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Committee on the Use of Limited Access Privilege Programs in Mixed-Use Fisheries; Ocean Studies Board; Division on Earth and Life Studies; National Academies of Sciences, Engineering, and Medicine

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The Use of Limited Access Privilege Programs in Mixed-Use Fisheries

Committee on the Use of Limited Access Privilege
Programs in Mixed-Use Fisheries

Ocean Studies Board

Division on Earth and Life Studies

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PRIVILEGE PROGRAMS IN MIXED-USE FISHERIES**

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Joshua K. Abbott, Arizona State University, Tempe
Lee G. Anderson, University of Delaware (ret.), Newark
Courtney Carothers, University of Alaska Fairbanks, Anchorage
James H. Cowan, Jr., Louisiana State University, Baton Rouge
Josh Eagle, University of South Carolina, Columbia
Timothy Essington, University of Washington, Seattle
Sherry L. Larkin, University of Florida, Gainesville
Steven A. Murawski, University of South Florida, Tampa
Sean P. Powers, University of South Alabama, Mobile
Martin D. Smith, Duke University, Durham, North Carolina
Tracy Yandle, Emory University, Atlanta, Georgia

Staff

Constance Karras, Senior Program Officer, Ocean Studies Board (on leave)
Vanessa Constant, Associate Program Officer, Ocean Studies Board
Kenza Sidi-Ali-Cherif, Program Assistant, Ocean Studies Board

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Elizabeth Costa, Program Assistant

Preface

In 1999, the National Research Council (now referred to as the National Academies of Sciences, Engineering, and Medicine [the National Academies]) published a report on an innovation in fisheries management called individual fishing quotas (IFQs). It was based on a study commissioned by Congress as part of the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (the MSA), which also imposed a moratorium on the further use of IFQs in managing commercial fisheries in federal waters. The findings and recommendations of that report, *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*, contributed to lifting of the moratorium and to Congress's redefinition of IFQs as Limited Access Privilege Programs (LAPPs) in the 2006 reauthorization of the MSA. Subsequently, most of the nation's regional fishery management councils worked with the National Marine Fisheries Service (NMFS) to create LAPPs for one or more of the fisheries under their jurisdictions.

The committee that produced *Sharing the Fish* was aware of the potential challenges involved in using IFQs in fisheries with large recreational participation, having in mind the Gulf of Mexico red snapper fishery, for which an IFQ plan had been approved by 1999 but not implemented because of the moratorium. However, the issue of IFQs in a mixed-use fishery was not addressed until the Modernizing Recreational Fisheries Management Act of 2018 called for this National Academies study of how fishing under a LAPP might interact with all sectors in a mixed-use fishery for the same species: commercial, recreational, and charter (i.e., for hire).

Recreational marine fishing, whether on one's own vessel or on a charter vessel or headboat, is a large and growing activity, with major effects on the intensity, timing, and magnitude of fishing effort as well as on coastal economies. It brings with it values and incentives that often differ from those of commercial fishing, and some of those differences are intensified by the focus on economic efficiency that LAPPs are designed to improve. The need for this study is therefore clear. Regional fishery management councils and the NMFS would benefit from cooperation among the sectors in striving to rebuild and sustain healthy fish stocks, while weighing and arbitrating competing claims for allocation. Knowing what difference a LAPP makes in this regard, based on an objective and independent review of available data, analyses, and testimonies, is important to considerations about reforming or strengthening existing programs and creating new ones.

Evaluating the effects of LAPPs in mixed-use fisheries requires multiple disciplines, with equal weight to fisheries ecology and the social sciences. Because LAPPs are mainly designed to address economic goals, economics looms large among the social sciences, but the social effects of matters such as the decision on how to initially allocate catch shares, the noncentralized trading markets, and rising costs of entry mean that other social sciences are equally important, including anthropology and political science.

The committee was aided by the staff of the fishery management councils and the NMFS, who gave generously of their expertise in those fields and their historical knowledge of the fisheries management regimes. The committee is also grateful to the many individuals who played a major role in the completion of this study. The committee met publicly six times, and it extends its gratitude to the individuals from the regional and science offices of the NMFS, regional councils, recreational and commercial fisheries organizations and businesses, and others who appeared before the full committee or otherwise provided background information and identified pertinent issues.

Finally, the committee sincerely thanks the National Academies' staff for their valuable support and efforts to facilitate the rapid completion of the report without compromising quality. Stacey Karras was the Study Director; she guided us through all of the major meetings and set the tone for an impartial and objective perspective on what can be contentious matters. Vanessa Constant came on late as Interim Study

Preface

Director and very ably helped the committee complete its report. We also thank Kenza Sidi-Ali-Cherif (Program Assistant), particularly for helping us navigate the world of web-based conferencing and cloud-based document storage.

Bonnie J. McCay, *Chair*
Committee on the Use of Limited Access
Privilege Programs in Mixed-Use Fisheries

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Reviewers

This Consensus Study Report was reviewed as a draft by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their review of this report:

Frank Asche, University of Florida
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Daniel Willard, Environmental Defense Fund
James A. Wilson, University of Maine (ret.)

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations of this report nor did they see the final draft before its release. The review of this report was overseen by **Eileen Hofmann**, Old Dominion University, and **Barbara Schaal**, Washington University in St. Louis. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the National Academies.

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Executive Summary

The Modernizing Recreational Fisheries Management Act of 2018 mandated a study that considers the use of limited access privilege programs (LAPPs) in mixed-use fisheries. Under a LAPP, individuals receive a permit to harvest a defined portion of the total allowable catch for a particular fish stock. The focus on mixed-use fisheries in this assessment of LAPPs reflects the difficulties of managing different sectors that target the same species (and stock) of fish. However, the question of how LAPPs impact the overall fishery, including fishing sectors that are not part of a LAPP, but target the same species, remains. Specifically, what are the impacts of LAPPs in “mixed-use fisheries,” where the same species or stocks are targeted by recreational, for-hire, and commercial sectors?

Consistent with the legislative request, the report considers the use of LAPPs in the Red Snapper and Grouper and Tilefish (managed by the Gulf of Mexico Fishery Management Council), Wreckfish (managed by the South Atlantic Fishery Management Council), Golden Tilefish (managed by the Mid-Atlantic Fishery Management Council), and Bluefin Tuna (a Highly Migratory Species managed by the Secretary of Commerce) mixed-use fisheries.

For each of the LAPPs in these mixed-use fisheries, the Committee examined available data and analyses on the fisheries and collected testimony from fishery participants, relevant Councils, and National Marine Fisheries Service regional experts through a series of public meetings. To provide context for the information provided, the Committee conducted literature reviews of peer-reviewed studies that have examined or predicted LAPP impacts in mixed-use fisheries.

Overall, the use of LAPPs in the mixed-use fisheries reviewed by the committee show little discernable impact on recreational and for-hire stakeholders; the outcomes of LAPPs in these mixed-use fisheries are similar to experiences in LAPPs that lack mixed-use components. The evidence base in the committee’s study of mixed-use LAPPs affirms a number of positive outcomes cataloged elsewhere in the literature while failing to provide a clear picture of many of the associated negative outcomes. Nevertheless, substantial data shortages limit the committee’s ability to robustly exclude the potential for some negative social and community effects. The committee’s recommendations for the knowledge base and other matters are aimed at improving a management system that in many respects appears to be working well.

The Committee makes a series of recommendations designed to address the economic, social and ecological impacts for the LAPPs reviewed in this report, as well as for any future use of LAPPs in mixed-use fisheries. While the recommendations pertain specifically to LAPPs in mixed-use fisheries, many of the recommendations are also applicable to LAPPs in single-sector fisheries. In addition to specific policy recommendations pertaining to best practices, the Committee also provides recommendations for how additional data, research, or syntheses of existing research could enhance the decision-making capacity of National Marine Fisheries Service and the Councils when designing, establishing, or maintaining a LAPP in a mixed-use fishery.

Summary

In 1976, Congress passed the Fishery Conservation and Management Act. That Act, now known as the Magnuson-Stevens Fishery Conservation and Management Act (referred to in this report as “the MSA”), establishes a system for regulating fisheries in U.S. federal waters while fostering their long-term biological and economic sustainability. Though the MSA gives the ultimate authority for managing federally regulated fisheries to the Secretary of Commerce and its subordinate agencies, the National Oceanic and Atmospheric Administration (NOAA) through the National Marine Fisheries Service (NMFS), the bulk of the responsibility falls to the eight Regional Fishery Management Councils (the Councils). Bluefin tuna and other highly migratory species are also managed through the NMFS but, ultimately, through the International Commission for the Conservation of Atlantic Tunas, to which the United States is a signatory.

In accordance with the MSA, the Councils are composed of officials from state, federal, and tribal governments and knowledgeable people with a stake in fisheries management. Their primary duties are the preparation, monitoring, and revision of Fishery Management Plans (FMPs) for fisheries within their respective geographic jurisdictions. The law gives the Councils flexibility to tailor rules that fit individual fisheries, but also mandates that FMPs and other management measures be consistent with 10 “national standards.” While these standards generally require that rules are fair to fishers,¹ promote fisher safety and efficiency, and ensure the long-term sustainability of fish populations and fishing communities, the first National Standard is specific and quantitative, commanding that policy makers “shall prevent overfishing while achieving ... the optimum yield” (FCMA, Pub. L. No. 94-265 § 3(7)(A)).

The first two decades of management under the MSA produced successes in ending overfishing and rebuilding some stocks. They also resulted in some failures. For example, by the early 1990s, a significant percentage of fish populations could be characterized as “overfished”—reduced to levels incapable of producing as high a yield as possible—and a number of fisheries could be considered severely overcapitalized such that the capital invested by fishers far exceeded the amount needed to catch the fish and maximize profits. From a societal perspective, these outcomes represent wasted resources and make fishing less sustainable and profitable than it otherwise could be.

In response to these and other issues, Congress and the administration made major revisions to the Act in 1996 and 2006. In 1996, the reauthorized MSA required overfishing to be ended and stocks rebuilt within a decade, if possible. It also imposed a moratorium on the use of Individual Fishing Quotas (IFQs) in fisheries management and commissioned a study of them, which led to a 1999 National Research Council report, *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*. In 2006, Congress added a section on Limited Access Privilege Programs (LAPPs) to the MSA that incorporated some of the recommendations of that report. Under a LAPP, individuals, corporations, and other entities receive exclusive use of a defined portion of the total allowable catch (TAC) for a particular fish stock. The addition of this section, which followed the lifting of the moratorium in 2002, represented the first time that Congress had directly authorized the use of IFQs. As discussed more fully throughout this report, LAPPs can alter the incentive structure of a fishery in pursuit of better conservation and greater efficiency if appropriately designed and accompanied by effective monitoring and accountability measures. However, the question of how this restructuring impacts the overall fishery, including fishing sectors that are not part of a LAPP but

¹ There is considerable debate on whether to use “fishermen” or “fishers” to indicate people who catch fish—for a living, for pleasure, or for subsistence. The term “fisher” is not universally accepted, particularly by women and men in North American fishing industries. However, in academic journals and many government documents, usage of “fishers” has increased in recent decades as a more gender-neutral term, even though in most usages, “fishermen” refers unambiguously to people of any gender who fish. Aware of this controversy, the committee opted to use “fishers” in this report.

target the same species, remains. Specifically, what are the impacts of LAPPs in “mixed-use fisheries,” where the same species or stocks are targeted by commercial and recreational fishers, more specifically recreational, for-hire, and commercial sectors?

An *ad hoc* committee was convened by the National Academies of Sciences, Engineering, and Medicine to consider the use of LAPPs in the following mixed-use fisheries: red snapper, and grouper and tilefish, managed by the Gulf of Mexico Fishery Management Council; wreckfish, managed by the South Atlantic Fishery Management Council; golden tilefish, managed by the Mid-Atlantic Fishery Management Council; and bluefin tuna, a highly migratory species managed by the Secretary of Commerce. The committee’s tasks for this report were to

1. Assess the progress in meeting the goals of each relevant LAPP and the goals of the MSA;
2. Assess the social, economic, and ecological effects of each relevant LAPP, considering each sector of the relevant fishery and related businesses, coastal fishing communities, and the environment;
3. Assess any impacts to stakeholders in the relevant mixed-use fishery caused by the LAPP;
4. Recommend policies to address any negative impacts identified in task 3;
5. Identify and recommend the different factors and information that the National Marine Fisheries Service and the Councils should consider when designing, establishing, or maintaining a LAPP in a mixed-use fishery to mitigate impacts to stakeholders to the extent practicable; and
6. Review best practices and challenges faced in the design and implementation of LAPPs in all Council regions.

This study was congressionally mandated in the Modernizing Recreational Fisheries Management Act of 2018 and funded by NOAA. The legislation specifically excludes examination of LAPPs under the jurisdiction of the Pacific and North Pacific Fishery Management Councils, except for the purpose of reviewing best practices and challenges in design and implementation of LAPPs.

For each of the LAPPs in mixed-use fisheries specified in the statement of task, the committee examined available data and analyses on the fisheries and collected testimony from fishery participants, relevant Councils, and NMFS regional experts through a series of public meetings. To provide context for the information provided, the committee conducted literature reviews, looking for peer-reviewed studies that have attempted to scientifically examine or predict IFQ or LAPP impacts in mixed-use fisheries.

Throughout the development of this report, the committee was alerted to the difficulty of establishing causation when evaluating the impacts of LAPPs in mixed-use fisheries. They recognize the scarcity of seminal data and studies that would enable a clearer picture of how the commercial, for-hire, and recreational fisheries for particular species, or species complexes, interact. The implementation of LAPPs in mixed-use fisheries has often coincided with stricter controls on overfishing, stock rebuilding programs, intensified monitoring, and other fishery management measures. In addition, conditions before and after implementation can be affected by other significant events, such as a major oil spill or natural disaster, trends in seafood markets, or general economic conditions. Accordingly, to assess the impacts of a LAPP on a particular fishery (stock or stock assemblage), it is not sufficient simply to point to changes in fisheries before and after the LAPP went into effect as instructed in the LAPP review guidelines. Instead, these changes can be compared to one or more plausible scenarios for what would have likely happened in the absence of the LAPP. Although not always possible given the data available, this was a methodological objective throughout this study.

Another methodological objective throughout this study was taking an interdisciplinary approach to addressing the causal questions about LAPPs in mixed-use fisheries wherever possible. These are questions which engage biological, ecological, economic, legal and administrative, anthropological, political, and other disciplines. Successful interdisciplinarity, a much-sought goal for integrated fisheries and marine research and policy, sometimes requires shared knowledge of and respect for divergent epistemologies and consideration of different standards of evidence. It also benefits from cooperation in

data analysis and interpretation where possible, and transparency in reporting the results. Interdisciplinarity is a critical tool to better understand and manage for the economic efficiency, social justice, and ecological resilience essential to the continued success of our nation's mixed-use fisheries.

Individual Quota Systems and LAPPs

LAPPs are fisheries management programs where shares of an overall quota, or allowable catch, are assigned to individuals or other entities for their exclusive use (see Figure S.1). Designated in the MSA, they are types of catch shares, and they are most often known as individual fishing quotas. IFQs were conceived of as a tool to address problems associated with wild fisheries and other common pool resources, where the combination of relative open access to participants and government regulations to protect the resource leads to inefficiencies, management complications, and possibly exacerbates threats to fisher safety (i.e., through the “race-to-fish,” also known as “derby fishing”). In marine fisheries, this “open access problem” is often expressed in costly processes whereby fishers seek to harvest as much as possible before quota limits are reached and the fishery is closed. IFQs provide fishery participants with individual shares of an overall quota (TAC), which gives them flexibility in timing the harvest. When the shares are transferable, the IFQs can help promote, through trading, a better alignment of fishing effort with the status of the resource, and thus increase profitability. The term individual transferable quota (ITQ) is a way to distinguish this type of IFQ; the cases in this study are all ITQs, but in the United States they are most often called IFQs. We use the terms IFQ and catch shares for the cases of this study, reserving the term individual bluefin quota (IBQ) for the bluefin tuna bycatch LAPP.

The initial allocation of shares and subsequent trading of IFQs can also lead to restructuring of ownership and participation. While this and other changes may enhance economic efficiency, they may also have disruptive social and economic effects on some sectors, such as Indigenous fisheries, small-scale fisheries, and fishery-dependent communities as documented in the United States, New Zealand, Iceland, and other places with experience in this form of management. For these and other reasons, Congress placed a moratorium on the adoption of new IFQs in U.S. fisheries that lasted from 1996 to 2002.

The LAPP provisions in Section 1853a of the 2006 reauthorization of the MSA represent Congress's attempt to design an IFQ program that maintains the economic advantages of IFQs while recognizing the need for equity and fairness in allocation of individual privileges, the importance of including social and cultural frameworks in their design and implementation, and the need to address questions regarding transferability and new entrants into fisheries. Briefly, the provisions clarified that LAPP permits are not “property” but rather “privileges” in the sense that the Councils or the NMFS may modify their terms, or even eliminate them, without having to compensate the owner. They can have property-like features, such as transferability; the Councils can make them transferable in order to facilitate trades that can result in greater efficiency. However, the Councils must establish caps, or maximum proportional shares, that a privilege holder can have and do whatever else is “necessary to prevent an inequitable concentration of limited access privilege.”

The initial allocation criteria are left up to the Councils as policy decisions. According to the MSA, the procedures for determining those criteria should, however, ensure that they are fair and equitable, and consider current and historic production; employment; investments in, and dependence on, the fishery; and the participation of fishing communities. To help mitigate impacts on fishery participants who might not qualify for LAPP allocations, there is a requirement “to consider the basic cultural and social framework of the fishery,” with attention to the needs of smaller owner-operated fishing vessels and fishery-dependent fishing communities. The MSA has provisions meant to facilitate participation in LAPPs by entry-level and small vessel owner-operators, captains, crew, and fishing communities. There is also a provision for an appeals process regarding initial allocation. Once implemented, the MSA requires permit holders to pay for costs related to the program up to 3% of the value of landings. Finally, the MSA requires periodic reviews and evaluations of LAPPs to assess progress toward addressing the goal(s) of the program. As the goals of each LAPP can differ, each review will necessarily differ.

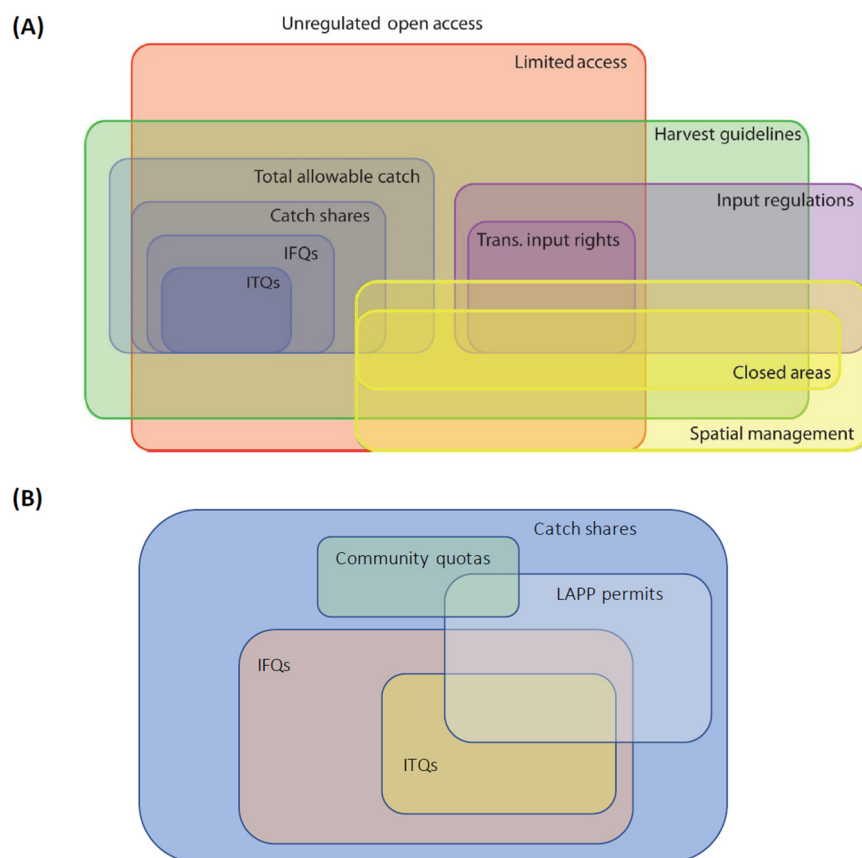


FIGURE S.1 (A) Venn diagram representing the relationships among common approaches to fishery management, with regions of greater overlap indicating additional restrictions. Beginning from unregulated open access, the diagram represents three pathways: (1) limiting catch, beginning with limited access and adding restrictions on total allowable catch, allocating harvest rights through catch shares, individual allocation through individual fishing quota (IFQ) and individual transferable quota (ITQ); (2) limiting effort through establishing non-binding harvest guidelines, imposing input restrictions and then transferable input rights; and (3) controlling spatial access by establishing regulated-take or closed no-take areas, with the range of effort or catch controls applying within regions where fishing is permitted. SOURCE: Anderson et al., 2019. (B) Venn diagram representing the relationship among LAPP permits and other commonly used allocation strategies. The LAPP forms of “community quotas” are LAPPs assigned to fishing communities or to regional fishery associations, as defined and under conditions outlined in the legislation 16 U.S. Code § 1853a(c)(3), (4).

Mixed-Use Fisheries

Mixed-use fisheries, as defined in the Modernizing Recreational Fisheries Management Act of 2018, are those where recreational, charter (i.e., for-hire), and commercial fishing sectors target the same species or stocks. The management systems in mixed-use fisheries usually differ. This is especially true between commercial and recreational fishing where the former is more tightly restricted to meet biological targets on fish mortality, including possible limits on access and on catches, and the latter is mainly open access with restrictions such as bag limits, size limits, and seasons only loosely linked to biological goals.

This study focuses on the effects of LAPPs on each sector that fishes in federal waters, even though they might also fish in state waters. The Councils provide mechanisms for interaction and coordination with state management through state representation on the Councils and through interactions with regional interstate marine fisheries commissions (MFCs; Gulf States MFC, Atlantic States MFC). While state-federal management is a major issue in the Gulf of Mexico, resulting in the recent shift of some federal-waters recreational fisheries management and monitoring of red snapper to the states, it was not seen by the

committee as within its purview, except in relation to possible innovations in recreational fisheries management. Neither of the Atlantic coast fisheries in this study (golden tilefish and wreckfish) are handled through the regional MFC, as these stocks are rarely found and fished in state waters.

The mixed-use fisheries of this study vary greatly in catch volume, degree of quota allocations by sector, geographic range, and nature of mixed use. As can be seen in Table S.1, the two Atlantic coast fisheries, golden tilefish and wreckfish, have low recreational participation and the commercial participants are very small in numbers. In contrast, the Gulf of Mexico reef fish fisheries, including the LAPPs for red snapper and the grouper-tilefish complex, are very large and have major recreational sectors with high recreational percentages of the allocation of total allowable catches, especially for red snapper and the shallow-water groupers. The bluefin tuna fishery, managed by the Highly Migratory Species division of the NMFS, is the most complex in terms of the variety and number of sectors, although the pelagic longline sector, which is managed through a LAPP for bycatch, is relatively small. It is one of the two cases in which there are multiple commercial fishing sectors besides the LAPP sector: for bluefin tuna, the pelagic longline IBQ sector plus purse seine, trap, harpoon, and general category (hook and line) sectors; for golden tilefish in the Mid-Atlantic, the ITQ vessels, primarily longliners, plus vessels with open access golden tilefish permits that are allowed a limited bycatch of the species.

Progress in Meeting Goals of LAPPs and Magnuson-Stevens Act as Determined by Program Reviews

A major task of the committee was to assess progress in meeting the goals of each relevant LAPP consistent with the goals of the MSA. Pursuant to the MSA, the Councils must periodically review LAPPs established after January 12, 2007. Although the Fishery Management Council responsible for managing the program conducts and writes the LAPP reviews, the responsible NMFS Regional Office and Regional Science Center also provide significant input. The LAPP reviews highlight the goals and objectives of the program, and evaluate whether and how they are being met. The MSA does not require that LAPP reviews address the impacts of LAPPs within mixed-use fisheries. Therefore, the reviews concentrate on the commercial sectors, and for the most part have little information about how LAPPs affect other sectors or the fisheries as a whole. Accordingly, the report provides background information on how LAPPs function in the commercial sectors in addition to information and analysis not ordinarily included in LAPP reviews.

The LAPP reviews indicate that where major objectives of the LAPPs were to reduce capacity and derby conditions, such reductions occurred, although it was not always possible to know whether the LAPP itself was the primary or sole cause of this change. Changes in fishery rebuilding and conservation, and the welfare of stakeholders and communities, can rarely be attributed to the LAPPs alone. LAPPs constitute just one component of larger fishery management programs. Their effectiveness and impacts are significantly dependent on other elements, including biologically appropriate total allowable catch limits and improvements in monitoring and enforcement within the management system, as well as external conditions and events.

The red snapper and grouper-tilefish ITQ programs sought to reduce overcapacity and to mitigate derby fishing conditions. The 5-year reviews concluded that the programs were moderately to highly successful in achieving those goals. Following the implementation of the IBQ program, bluefin tuna catch and discards declined as desired due to the bycatch focus of this LAPP, but the goal of maintaining the profitability of the longline fleet was not achieved (likely due to global market reasons unrelated to the bycatch program). The review of the golden tilefish ITQ found that, since program implementation, overcapacity was reduced, derby-style fishing subsided, and ex-vessel (i.e., wholesale) prices improved. The 2019 wreckfish review, the second for that ITQ program, found relative success in achieving its objectives; however, given the very small numbers of vessels and people involved, NMFS's rules on confidentiality limited the data available to assess economic and social objectives.

TABLE S.1 Characteristics of Limited Access Privilege Programs (LAPPs) in Five Mixed-Use Fisheries

First Year	Management Agency	Species	Type	Distribution of TAC			Number of Initial Shareholders	Number of Active Fishing Vessels
				LAPPs	Recreation	Other		
1991	South Atlantic	Wreckfish	ITQ	95%	5% ^a		6	8 permits (2018)
2007	Gulf of Mexico	Red snapper	ITQ	51%	49% ^b		554	362 (2011) ^c
2009	Mid Atlantic	Golden tilefish	ITQ	95%	0%	5% ^d	13	14 (2009-2013)
2010	Gulf of Mexico	Grouper-tilefish (G-T)			see below ^e		766	731 (2011-2015) ^f
		<i>G-T Shallow Water Grouper (SWG)</i>	ITQ	77%	23%			
		<i>SWG: Red grouper</i>		76%	24%			
		<i>SWG: Gag</i>		39%	61%			
		<i>G-T Deep water grouper</i>	ITQ	96.5%	3.5%			
		<i>G-T Tilefish</i>	ITQ	99.7%	0.3%			
2015	NOAA/HMS	Bluefin tuna	IBQ	8.1% ^g	19.7% ^h	72.9% ⁱ	136	76 (2018)

NOTES: IBQ = individual bluefin quota (to manage bycatch); ITQ = individual transferable quota. Allocations are percentages of the total allowable catch allocated to each sector: LAPP (commercial), recreational (usually includes for hire), and other. Shareholder refers to number of either individual entities or accounts, in most instances at time of initial allocation (exception is wreckfish, 2017). Estimates of active fishing vessels come from various sources and dates and are used as an indicator of relative differences in scale of the fisheries.

^a Although wreckfish has a recreational fishing allocation there are few reported recreational catches. SOURCE: Wreckfish LAPP review.

^b Red snapper recreational allocation is divided: 57.2% private angler, 42.3% for hire (charter). SOURCE: Jessica Stephen, NMFS, personal communication, 2021.

^c Red snapper and grouper-tilefish fishing vessels have significant overlap. SOURCE: Red snapper LAPP review.

^d Golden tilefish allocation for incidental catches from permitted commercial vessels. There is no allocation for recreational fishing, which is managed through bag limits at present. SOURCE: Golden tilefish LAPP review.

^e In some cases, there is no explicit recreational allocation; it comes from what remains after a commercial allocation is set. Fishing vessels in the grouper-tilefish ITQ program combined with those in the red snapper program (grouper-tilefish review). SOURCE: Mike Travis and Jessica Stephen, NMFS, personal communication, 2021.

^f Fishing vessels in the grouper-tilefish ITQ program combined with those in the red snapper program. SOURCE: Grouper-tilefish LAPP review.

^g The IBQ program is only for pelagic longliners. Their allocation is often increased by transfer from the Purse Seine sector or a Reserve category. There are limited entry permits for other categories.

^h Angling (recreational handgear); private anglers and for-hire vessels may also use the commercial General category in some conditions.

ⁱ 57% General (commercial handgear); 18.6% Purse Seine (not active in recent years); 4% Harpoon & Trap; 2.5% Reserve. SOURCE: Bluefin tuna LAPP review.

Regularly scheduled program reviews are vital to assessing program performance and thus building effective public policy. The systematic LAPP reviews provide important information about LAPPs and have resulted in programmatic changes and improvements. They also provide an opportunity to learn from a collection of LAPP reviews, especially with a focus on spillover² effects because the fisheries under consideration are quite diverse and any common themes will prove useful. However, in studying the five LAPP reviews, the committee found need for additional information and analysis that would help not only in future reviews of existing LAPPs but also in designing future LAPPs. In most cases the program reviews contained little empirical evidence that would enable evaluating social, cultural, and community aspects of the programs, reflecting the underdevelopment of data collection and analysis for social impact analysis. In addition, the committee concurred with the LAPP review guidelines that some LAPPs lacked key components including quantitative targets for specific major objectives, clear definitions of objectives such as “viability” or “overcapitalization,” and appropriate metrics and/or data for identifying progress toward achieving objectives. Building on the committee’s concern about evidence for causation, the program reviews could benefit from more explicit information on counterfactual scenarios in the absence of the LAPP and the impacts of concurrent and confounding events on outcomes. Finally, the reviews’ sole focus on LAPPs in commercial fisheries limits their value in assessing LAPPs in relation to other sectors in mixed-use fisheries.

Ecological Impacts of LAPPs in Mixed-Use Fisheries

The Councils primarily use LAPPs to meet economic or social objectives, but there are several ways LAPPs can alter the conservation status of a fishery and provide ecological benefits. Among the purported conservation benefits of a LAPP are that it may provide a stewardship incentive that is lacking in open- or limited-access fisheries. In theory, when individuals hold access rights that are secure, durable, and exclusive, they will have an incentive to support conservation actions that will provide future benefits to the fishery. Pursuant to the MSA, however, LAPP permits are not property in the sense that the Councils and the NMFS can modify or eliminate them without compensating the permit holder.³ LAPPs can, however, have property-like features. For example, they are exclusive to the privilege holder and can be transferable. These features may be sufficient to create the requisite incentives. A second pathway to ecological benefits is that LAPPs appear to increase the likelihood of keeping the catches close to the quota, enhanced by the fact that individual shareholders are liable for overages. A third pathway is that LAPPs tend to end or reduce the race to fish, and thereby reduce or eliminate the adverse ecological consequences that the race to fish can generate. For example, under restrictive trip limits there is an incentive to fish close to port with resultant local depletion as opposed to spreading fishing effort more broadly. The fourth pathway whereby LAPPs can exert ecological impacts is that the changes to the fishery monitoring, accountability, and quota-setting process itself that accompany a LAPP allow for increased control thereby reducing the probability of exceeding overfishing targets and thresholds. In effect, LAPPs convey fishing privileges in exchange for a higher standard of monitoring, data collection, and enforcement relative to the status quo.

The ecological consequences that might have resulted from the implementation of a LAPP in a mixed-use fishery are not fully addressed because only the LAPP component of the fishery has sufficient information to assess. Hence, the committee did not consider the ecological consequences that might result from individuals leaving one fishery and entering another or how the formation of a LAPP altered behavior in other non-LAPP fisheries targeting the same stocks.

Having a LAPP in the commercial sector of a mixed-use fishery may create leverage for improved conservation in other sectors. Overall, the committee found that sectoral discards in the mixed-use fisheries

² The various direct and indirect ways that actions in one sector of a fishery affect conditions and activities in another sector of a fishery.

³ Although Congress classified LAPP privileges as permits so that the Councils and the NMFS would have regulatory flexibility, LAPPs may be treated as property in other contexts, such as state court divorce proceedings.

studied have generally declined. Attributing those declines to the roles of LAPPs in modifying the behavior of fishers is generally not possible given the data available. Additional conservation measures that may be attributed to LAPPs include the improved conservation of bycatch species, which is also an outcome from some LAPPs but highly dependent on the circumstances of coincident fisheries. Further exploring this idea of “serial conservation” in mixed-use fisheries, which may include social and legal pressure for more accountability in other fisheries or sectors following strong performance of a LAPP, could improve overall understanding of these dynamics. Similarly, quota balancing in mixed-species fisheries may create a strong incentive to meet but not exceed fishery targets for complexes of stocks. Thus, while usually not the determining factor in the implementation of LAPPs for segments of mixed-use fisheries, LAPPs can have important ecological consequences for species, communities, and ecosystems.

Social and Economic Effects for Commercial Participants in Relevant Mixed-Use Fisheries

The committee evaluated the LAPPs included in this study in relation to expected or commonly observed economic and social impacts. The committee found no reason to expect that hypothesized mechanisms for the effects of LAPPs on the commercial fisheries would differ when used within mixed-use fisheries although it is possible that activity by sectors outside the LAPP, the for-hire and recreational sectors, could amplify problems that LAPPs are meant to address such as the race to fish. Empirical studies of LAPP fisheries have typically not distinguished between mixed-use and single-use fisheries.

The Race to Fish

A key objective of LAPPs, particularly those where trading is allowed—as is the case in all of the LAPPs covered in this study—is to create a system where fleet size, or other indicators of capital investment and fishing effort, can be adjusted to better fit the state of the resource through the decisions and market transactions of permit holders, albeit within the framework of administrative and government measures. As noted above, more traditional approaches to fishery management such as limited seasons or trip-by-trip quotas can result in a “race to fish” where fishers try to harvest as much as possible before a season has ended or a total allowable catch is reached. Racing behavior was a major source of overcapitalization in three of the five LAPPs in this study. According to the program reviews, all of the LAPPs coincided with significant declines in measures of overcapitalization (e.g., number of vessels), although some aspects of the declining numbers of vessels may be attributed to other causes.

To avoid possible misunderstanding, it should be acknowledged that there are regulatory and natural safeguards that will normally prevent the race to fish from damaging a fish stock. In the cases mentioned above where the race to fish is caused by incentives to get the fish before the season has ended or the TAC is taken, those limits are set with biological limits in mind. So while there may be a rapid increase in fishing effort, the effect of that increase will be limited. Even more important, one goal of fishing is to make a profit and the increase in effort will decrease the overall or localized stock size, which will reduce profits and slow down the race to fish.

The committee found strong evidence for a reduced race to fish in the red snapper LAPP—as assessed by the quality of evidence and rigor of experimental design or counterfactual, and supported in surveys of participants. Evidence is also strong in the related grouper-tilefish IFQ program, despite differences among the many species involved, that the race to fish was reduced. Evidence is weak for wreckfish, but strong for golden tilefish (in the Mid-Atlantic). The race to fish was not identified as a problem in the longline sector of the bluefin tuna fishery, where the LAPP applies only to bluefin tuna bycatch.

Safety at Sea

The conceptual argument for improved safety at sea as a consequence of LAPPs flows directly from mediating the race to fish. Because LAPPs allow fishers to decide when to catch fish rather than

forcing them into competitive and often short seasons, they can avoid bad weather and other potential safety hazards. Some evidence from risk-exposure and before-and-after comparisons show positive changes in fisher safety (i.e., reduction in the number of accidents) in LAPPs fisheries considered in this study. Inference and surveys of participants, where they exist, generally show perceptions of improved safety at sea as well.

Prices and Profitability

A number of studies indicate that LAPPs can increase prices by allowing fishers to time their catches with market demand and avoid market gluts, improving product quality by not racing to fish and fetching a premium by landing more fresh fish that otherwise would have to be frozen under derby conditions. Of the LAPPs that hoped to increase fish prices (i.e., red snapper, grouper-tilefish, and golden tilefish), all three had evidence for price increases. The IBQ for bluefin tuna was not designed to increase prices. The evidence for wreckfish was not publicly available due to confidentiality restrictions.

Avoiding market gluts by allowing landings to be more evenly dispersed throughout the year can also provide more stability in ex-vessel prices. In all four of the traditional LAPP ITQ programs examined in this study (exclusive of the bycatch-based bluefin tuna IBQ), ex-vessel fish prices were considered to have become more stable as a result of implementing the ITQ program. While none of the reviews provided quantitative evidence to support the conclusions, several referred to external studies including those that obtained information from stakeholder surveys.

Another indicator of overall profitability is an increase in quota or share price—the price to acquire a unit of quota in perpetuity or as a rental, respectively. As an indicator of the discounted future stream of expected profits, quota price is a measure of cost and revenue expectations from an operational perspective as well as anticipated stock health, regulation, and fleet structure. There was modest to strong evidence for profitability increases through share prices in three of the five study fisheries (i.e., red snapper, grouper-tilefish, and golden tilefish). Because of a very small number of participants in the wreckfish fishery, share prices are not consistently available due to the NMFS's policy on confidentiality. The configuration of the bluefin tuna LAPP is different from the others; share prices do not signal profitability.

An increase in average or median prices and reduced price volatility at the market level are both encouraging outcomes. However, there is potential for improvement in these markets from having transaction information released as soon as possible and in fostering the literacy of potential buyers and sellers on the factors that should be considered in their own decision making. Quota and allocation assets are unique, as are the decentralized markets in which they are traded. Without the conditions for a perfectly competitive transfer market, inefficiencies will remain and limit the full potential of transferability.

The impact of improved financial performance could also lead to modernization of vessels, processing equipment, and infrastructure (e.g., docks) as well as to investments in new markets and expanded product forms and in maintaining a highly skilled workforce. While the committee heard anecdotal evidence of this in some of the fisheries examined in this study, the reports available to the committee for this study did not address these outcomes.

Effort Reduction and Consolidation

LAPPs are expected to reduce total fishing effort and change industry structure. Consolidation refers to changes in industry structure where catch, boat ownership, and/or quota holdings become more concentrated among fewer vessels, individual owners, and/or fishing firms. In an overcapitalized fleet, LAPPs can impact fishery structure through consolidation of ownership of quota shares and/or fishing vessels through at least two mechanisms: (1) transferability of catch shares, usually from less efficient to more efficient operations whereby less efficient ones exit the fishery or are bought out and consolidated with the more efficient ones, and (2) possible economies of scale that attend larger business ventures. While increased concentration is expected in an overcapitalized fishery following the introduction of a LAPP, and in such cases consolidation is an indicator of program success, measures to prevent excessive consolidation

are required by MSA Section 303a(c)(5)(D). Share caps and lease accumulation caps prevent excessive consolidation where they exist (e.g., red snapper and grouper-tilefish). It is also possible that fisheries were more consolidated prior to the LAPP or would have been more consolidated today in the absence of the LAPP.

There was some evidence of consolidation in each of the four IFQ fisheries in this study. Consolidation was not considered an issue for the IBQ system. In most instances, evaluations lack statistical control of counterfactuals, and in some it is difficult to accurately identify the entities that participate in owning, leasing, and using quota shares. This is a perceived problem in the red snapper and grouper-tilefish ITQ programs in the Gulf of Mexico. The committee concluded that, even though there is a great deal of concern expressed by some participants, as revealed in ethnographic studies and in the mandated reviews about restructuring of ownership and access to quota shares, there is only modest evidence for consolidation in the grouper-tilefish ITQ program. For red snapper, the evidence shows moderate concentration but the causal effect of the LAPP on consolidation is weak. In neither fishery has consolidation been deemed to have resulted in subsequent market power. The wreckfish ITQ fishery and the Mid-Atlantic golden tilefish ITQ fishery have become highly and moderately concentrated, respectively, but in the latter case this is a continuation of the pre-LAPP trend.

Labor and Employment

If the LAPP creates conditions for reduction in the numbers of boats and/or trips and other changes linked to greater efficiency, one can expect effects on the number and character of jobs at sea and on land, the nature of work, and conditions of employment. Studies have shown both positive and negative outcomes for crew from fewer vessels participating over longer seasons and with possible increases in the unit value of catch, affecting wages and employment. However, these effects can be difficult to assess due to data deficiencies regarding individual identities and histories of participation.

No information was available on labor and employment shifts due to LAPPs for the wreckfish, golden tilefish, and Atlantic bluefin tuna programs. Data confidentiality may be a factor for the wreckfish and golden tilefish cases, given the very small number of vessels involved. A more general problem is the lack of records on hired captains and crew. However, special efforts were made for the two Gulf of Mexico LAPPs to survey shareholders, captains, and crew and to use ethnographic methods in selected fishing communities. There was evidence of some decline in crew sizes and the proportion of trip revenue afforded to crew in the traditional “lay” or share system of payment, but mixed data on income and job satisfaction. Ethnographic studies and social surveys found mainly a sense of unfairness in many aspects of the programs, particularly from those who did not benefit from initial allocations or were unable to afford leasing allocations. The committee recognized the importance of the findings but noted that these studies were constrained by lack of baseline data; underrepresentation of those who no longer participated in the LAPP fisheries; possible biases in participant selection that led to underrepresentation of the regional, ethnic, age, and racial diversity of the fisheries; and a lack of efforts to examine counterfactuals.

New Roles, Distributional Effects, and Barriers to Entry

The fairness or equity issues raised about employment are related to concern about the distribution effects of the LAPPs and the emergence of new roles as well as barriers to new entry. The initial allocation sets up the conditions and structure that may lead to realignment of social and economic positions within a fishery and within communities. In the existing IFQ and ITQ systems, the initial allocation is set up to guarantee entry for historical participants who meet qualification criteria (i.e., landings thresholds), and those criteria tend to reflect the status quo at the time decisions are made. The processes that follow (e.g., sales, lease exchanges, etc.) often result in a continuation or intensification of existing differences in capital, access, and status among participants.

The studies available to the committee frequently reflect the sentiment that shareholders should be active fishers rather than people profiting from the work and risks taken by fishers. The 5-year review of

the red snapper program identified an increase in quota owners that were not fishing as a significant social impact. The red snapper IFQ had begun with a requirement that shareholders also hold limited access reef fish permits, but this was scheduled to last only 5 years. After that, pursuant to the MSA, United States citizens, permanent resident aliens, and corporations, partnerships, or other entities established under the laws of the United States or any State, are allowed to purchase and use quota shares in LAPPs. That is the practice in all of the LAPPs in this study. Some shareholders and others have become brokers, buying and selling allocation, as might be expected given the transferability of the shares and annual allocations and their possible value as market clearing-houses. In the Gulf of Mexico, these issues were identified in the first review, and the Council has sought to address them through the amendment process since 2014. The alternatives have been discussed in terms of probable effects on different categories of participants based on share ownership, leasing behavior, and fishing behavior to highlight the effect that markets for shares and allocation have on whether a particular amendment will benefit each sector.

ITQ systems can lead to the consolidation of political power. The committee observed that the creation of the new class of shareholders, whether or not they actively continue to fish, has led to the creation of organizations representing shareholders that become active in Council matters and in the courts. As seen in the Gulf of Mexico IFQ programs and the Mid-Atlantic golden tilefish IFQ program, shareholders have formed associations to represent their interests, potentially changing the political dynamic of fisheries management. In some respects, the rise of formal associations representing commercial fishing shareholders is seen as a counterweight to large nongovernmental organizations representing environmental or recreational fishing interests, especially at the Council level. This may have important implications in mixed-use fisheries, affecting decisions about allocation among sectors (and particularly between commercial and recreational users) and it may be the strongest single way that LAPPs have affected the recreational sector in the mixed-use fisheries of this study.

Studies of IFQ programs in other regions show a clear pattern of loss of the ability to enter as owners in LAPPs fisheries on the part of young, small-scale, low-income, Indigenous, minority, and rural fishers. These populations can disproportionately be excluded from LAPPs at initial allocation or fare poorly under the trading that follows. The committee was unable to find information that allows assessment of what the actual impacts are on fishers across all of the cases the committee considered. The lack of basic demographic information for fishery participants was a serious barrier to assessing social impacts. Similarly, data were not available to the committee concerning social and cultural diversity dimensions of the fisheries assessed, beyond ethnographic appraisals of the grouper-tilefish IFQ program and the NOAA community studies.

The issue of the high barriers to access for new entrants and small-scale fishers is one that Congress recognized when delimiting LAPPs. The Councils are encouraged to develop measures to enable the participation of both new entrants to the fisheries and maintain access by existing small-scale fishers. In 2021 the Southeast Regional Office of the NMFS made loans through the federal Fisheries Finance Program available for purchase or refinancing of existing debt for ITQs in the Gulf of Mexico LAPPs. No information is yet available on the extent to which this has helped new entrants and small-scale fishers.

Other barriers to entry are the high costs of finding and negotiating with sellers, especially in fisheries with a broad geographic range. As LAPPs create a new structure, participants not only need to finance the transactions; they also need the skills that allow them to be able to determine an appropriate valuation of the asset and have the resources and capabilities to find trading partners. This is because there is usually no centralized market for shares or quotas. Information that is helpful to determining the appropriate asset valuation includes annual reports and peer-reviewed literature on prices and markets. However, for the transfer markets to realize their full potential, transaction information would both have to be accurate and publicly available in real time. However, none of the LAPPs in these studies provides such information. Other information that affects asset valuation includes, but is not limited to, changes in the TAC and an individual's cost to fish, risk preferences, access to local information sharing networks (such as through dealers), and implied discount rates.

Social and Economic Effects of LAPPs for Recreational Fishery Stakeholders in Mixed-Use Fisheries

The effects of LAPPs on recreational participants in mixed-use fisheries are most likely to arise as spillovers between the changing terms of fishery access on the commercial side of the LAPP and the availability, access, or quality of recreational experience available to recreational anglers. Spillovers and conflicts between recreational and commercial fishing sectors are longstanding and well known, although not always fully documented.

To assess the impacts of a LAPP on a particular fishery, one must establish how these changes differ from what would have likely happened in the absence of the LAPP (i.e., the “no-LAPP” counterfactual scenario). Unfortunately, the information required to evaluate these counterfactual scenarios is lacking, in large part due to very sparse longitudinal social and economic data of any kind on the recreational component of the fisheries in question. Given these deficiencies, the committee draws on theory and the empirical literature on recreational and commercial spillovers to establish plausible causal pathways and mechanisms for commercially focused LAPPs to create spillovers to the recreational sector (and vice versa).

Pathways of Impact

A potential source of conflict between recreational and commercial fishers is overlap of recreational and commercial fishing effort in space and time. The study distinguishes between within-season impacts (those that play out through mechanisms occurring within a fishing season) and between-season impacts (those requiring multiple seasons to show their full impact). Many of the spillovers between commercial fishing and recreational anglers are transmitted by variables that are relatively slow to change. As a result, the effects of LAPPs may take some time to unfold.

The overall evidence for policy-relevant spatial and temporal spillovers between commercial LAPPs and the recreational sector in existing U.S. mixed-use fisheries is weak. The committee found no evidence that LAPPs had an impact on the recreational sector in terms of within-season impacts, such as competitive exclusion of fishing grounds by one sector or the other. Regarding between-season impacts, it is conceivable that if the commercial LAPPs facilitated the rebuilding of target stocks or prevented overharvest of commercial allocations, more harvest could be available to recreational and for-hire sectors. In the case of golden tilefish in the Mid-Atlantic, the Council predicted that rebuilding the biomass of tilefish might encourage more recreational activity, and therefore included new restrictions for the recreational sector in a 2017 amendment to the Fishery Management Plan, going into effect in 2021. These restrictions are aimed at better understanding the magnitude of recreational effort and catch. Based on available data to date, it appears unlikely that the golden tilefish IFQ program has affected the level of activity in the recreational fishery.

One pathway of impact could be the conservation effect of LAPPs on the entire stock of fish, and hence the recreational and for-hire sectors’ fisheries. In the Gulf of Mexico cases, the rebuilding of red snapper is noteworthy; the individual accountability and extra monitoring provisions of the LAPPs have kept harvests below the allocation to the commercial sector, but the commercial harvest did not systematically exceed its allocation in the years immediately prior to the LAPPs, suggesting that the incremental effects of the LAPPs (which account for 51% of the red snapper allocation) on stock status are minor.

A second pathway of impact between LAPPs and other sectors is allocation. In the case of the IBQ program for Atlantic bluefin tuna, the scope for impacts to the private and charter sectors is very narrow. There is some potential that the IBQ creates conditions whereby recreational anglers could enjoy a larger total quota in the future, because incentives in the IBQ program may have contributed to the ability of the pelagic longline fleet to remain well under its overall IBQ allocation. This in turn has reduced the need to cover this fleet’s overages from other underused quota categories (i.e., purse seiners) and created the

possibility for reallocating that to other sectors, including private anglers and charter operations. This reallocation is currently under consideration.

Indirect spillovers through sectoral allocations are most evident with the Gulf of Mexico reef fish LAPPs. Because LAPPs enabled an essentially year-round commercial season for red snapper, while anglers continued to see the lengths of the federal recreational fishing seasons and bag limits reduced, the recreational sector pressured the Council for a greater allocation. The Council attempted to reallocate red snapper harvest to the recreational sector, but the presence of the LAPP and the commercial sector's greater accountability for staying within the quota strengthened the legal argument that led to a federal court decision to vacate the attempted reallocation. The committee also examined effort spillovers from the commercial to the recreational sector for the Gulf LAPPs and found that entry into the for-hire sector is blocked by limited licensing for charter and headboat vessels in the Gulf of Mexico. However, a limited spillover has occurred due to a small handful of vessels catering to recreational anglers on trips with commercial licenses.

In summary, the committee found minimal spillovers between commercial LAPPs and participants in the recreational sector, negative or positive. To the extent that there has been any negative effect on the recreational sector, it has occurred indirectly through enhancement of the legal validity and influence of the commercial sector's claim to its allocation as a consequence of the IFQ. Such allocation pathways of impact between LAPPs and other sectors are ambiguous and highly contingent on the political and legal context.

Broader Community Social and Economic Effects

Community concerns were important in the development of LAPP provisions by Congress. The NOAA social indicators database, as well as the National Ocean Economics Program database, indicate that in most of the coastal communities within which the fisheries of study are located, fishing is a small part of the local economy and society compared with tourism, retirement and second homes, and other sectors. This is true even for places with relatively high degrees of engagement in, and dependence on, fishing locations and well known to be important centers for commercial and/or recreational fishing.

The committee's main findings are that beyond these social indicator descriptions and limited ethnographic studies, the ability to assess the impacts of fishery management policies on communities in these mixed-use fisheries is underdeveloped because of the paucity of data and analytic tools for clearly linking policy changes to social variables. Hence it is not currently possible to fully examine these impacts. The effects of LAPPs on the commercial and recreational fisheries can ripple into larger communities. For example, any positive or negative effects of LAPPs on recreational and for-hire fisheries could affect ancillary businesses, such as marinas, bait shops, and fishing supply houses, as well as for-hire and boat-rental businesses. There could also be net effects from considering changes to the commercial sector. However, the committee found no data in this regard for the LAPPs and mixed-use fisheries of this study. With this in mind, the committee made an effort to use the NOAA social indicators database to see whether it could provide indicators of the effects of LAPPs on one dimension of community welfare, employment. The committee sees potential for the further refinement and use of the social indicators for such causal analysis.

Addressing the Impacts of LAPPs in Mixed-Use Fisheries

Synopsis of Committee Findings

Overall, the outcomes of LAPPs in these mixed-use fisheries are similar to experiences in LAPPs that lack mixed-use components. In terms of economic impacts, the committee finds very strong evidence showing that LAPPs mediate the race to fish and strong evidence for increased profitability of the LAPP fisheries. The committee finds some evidence that the LAPPs have modestly reduced economically wasteful overcapacity, but for most LAPPs they find no evidence that associated consolidation has contributed to market power in the quota market; however, stakeholder concerns about fairness and access

were central in several of the study fisheries. The committee finds strong evidence of ecological benefits of the tuna IBQ LAPP. Although they find only weak evidence of very modest ecological benefits of other LAPPs, the committee finds no evidence of ecological harms.

With respect to social impacts, the committee finds strong evidence that LAPPs have led to improvements in safety at sea. They find mixed and largely inconclusive effects of LAPPs on labor with indications that some participants are better off and others are worse off. The committee finds no direct evidence of negative or positive effects of the LAPPs in our study on communities; however, they note a significant lack of data to assess social and community impacts. Many of the potential negative effects of LAPPs on communities that they identify are rooted in studies of different geographies, regional economies, histories of coastal development, and cultures of fishing (e.g., Alaska, Iceland, New Zealand, Newfoundland, and Norway). The disruptiveness of LAPPs in these rural, resource-dependent, and sparsely populated areas could be quite different than in the U.S. Mid-Atlantic, South Atlantic, and Gulf of Mexico where complex coastal economies are often dominated by tourism and have substantial recreational fishing.

With respect to the mixed-use components of the fisheries in our study, the committee finds no evidence for direct effects of LAPPs on private recreational anglers or recreational for-hire providers. LAPPs plausibly increased the political power of the commercial sector in terms of its allocation claims. The greater accountability of the commercial sector, due to LAPPs, may be leading to pressures to attain greater accountability on the part of the recreational sector. While this is speculative, the greater political power of the commercial sector is a reasonable observation. However, given the particular history of power relations of the fisheries in our study, this change may result in greater parity in the political power of recreational versus commercial stakeholders in the Council process. The committee notes that studies of the political and power dimensions of fishery management systems, taking into account wide diversity within sectors, is necessary to properly assess these possible shifts. Taken as a whole, the evidence base in the committee's study of mixed-use LAPPs affirms a number of positive outcomes cataloged elsewhere in the literature while failing to provide a clear picture of many of the associated negative outcomes. Nevertheless, substantial data shortages limit the committee's ability to robustly exclude the potential for some negative social and community effects. The committee's recommendations for the knowledge base and other matters are aimed at improving a management system that in many respects appears to be working well.

The committee makes a series of recommendations designed to address the economic, social, and ecological impacts for the LAPPs reviewed in this report, as well as for any future use of LAPPs in mixed-use fisheries. While the recommendations pertain specifically to LAPPs in mixed-use fisheries (i.e., by addressing intersectoral spillovers), many of the recommendations are also applicable to LAPPs in single-sector fisheries. In addition to specific policy recommendations pertaining to best practices, the committee also provides recommendations for how additional data, research, or syntheses of existing research could enhance the decision-making capacity of the NMFS and the Councils when designing, establishing, or maintaining a LAPP in a mixed-use fishery.

The objectives of LAPPs are diverse and potentially conflicting (e.g., reducing overcapitalization to increase economic efficiency versus maintaining historic patterns of participation). The ultimate outcomes of LAPPs and the larger program thus require, and depend on, trade-offs. The efforts of the Councils and the NMFS to make such trade-offs would be enhanced by major improvements in the information available to them about economic and social matters. Finding ways to integrate qualitative and quantitative data more effectively through interdisciplinary approaches could lead to new insights and inform fruitful hypotheses about causes and the socioeconomic and ecological consequences of different management approaches.

Recommendations for Existing and Future LAPPs

Conflict over allocations is common in mixed-use fisheries, regardless of the presence of LAPPs. Nevertheless, the creation of a LAPP in the commercial component has the potential to alter the terms of this conflict: LAPPs create an additional class of stakeholders (i.e., shareholders) who are incentivized to

organize. This structural change in stakeholder representation potentially alters the political economy of decision making in ways that may be consequential to allocation outcomes as well as the contentiousness of the policy process.

Impacts to Recreational Stakeholders

Conclusion: A major finding of this study is that there is little if any direct impact of LAPPs in the commercial sectors on the recreational sector of the mixed-use fisheries. However, LAPPs may be viewed as problematic to efforts to expand recreational access to the total allowable catch for a fishery because of shifts in the power structure of decision making with the creation of a class of IFQ shareholders. Moreover, apparent increases in the accountability of the commercial sector due to incentives for higher compliance associated with LAPPs may highlight accountability problems in the recreational sector and increase pressure for management improvements.

There is evidence that creation of a LAPP can trigger spillovers of fishing effort into other commercial fisheries, and the general explanation is that the LAPP frees up fishing capital for other uses. Whether such spillovers occur across commercial and recreational sectors is not known, but the experience in commercial LAPPs suggests that additional tools are needed to improve accountability across all sectors. Along with the recommendation highlighted below, the committee made a related recommendation for devolved co-management institutions in the recreational sector, such as Angler Management Organizations, as an example of what might be done to improve angler accountability and facilitate the process of reallocation of harvest among sectors.

Recommendation: The Councils, or their state partners in the case of state-based management, should conduct reviews of their management of both private recreational and for-hire fisheries for species shared under LAPPs in mixed-use fisheries (or proposed LAPPs in mixed-use fisheries) and propose and implement reforms (including, but not limited to, IFQs or cooperatives for for-hire vessels and harvest tags or day passes for private anglers) that foster accountability while enhancing fishing experiences and opportunities to heterogeneous groups of anglers. To foster comparison between sectors, review guidelines like those that exist for the commercial sector should be established for each sector (e.g., including goals, objectives, and measurable outcomes).

Impacts to Commercial Participants

Conclusion: Once a LAPP is implemented, it becomes very difficult to make major changes. The program design features, such as initial allocation, have enduring effects. Therefore, in a series of committee recommendations, the Councils are advised to put more effort, via data collection, research, and deliberation, into the development and design of new LAPPs and reform of existing ones, building on known issues such programs have in achieving both efficiency and equity. Particular attention is given to the initial allocation, opportunities for hired captains and crew to more fully participate, the cost of new entry and effects on later generations, and the transparency and accessibility of markets for shares and allocations. One of those recommendations is on determining who is eligible in the initial allocation if such privileges are conferred without cost, which is critical to the subsequent performance of the LAPP fishery.

Recommendation: The Councils and the NMFS, in planning new LAPPs in mixed-use fisheries, should develop a broad range of options for the initial allocation of quota, including but going beyond the practice of limiting eligibility to existing vessel owners or permit holders with historic records (especially if overcapitalization is not a goal and shares are to be given for free). Where available, data on the contributions of hired captains and crew to the historic performance of vessels should be collected and used to assess the potential of awarding shares to them as well as vessel owners. If such

data are not available, the Councils should consider delaying the creation of a LAPP for a limited time to conduct a rapid assessment of crew contributions that would inform initial allocations.

Impacts to Fishing Communities

Conclusion: There is evidence from Alaska and other regions that LAPPs can have discernable and sometimes negative effects on communities through changes such as increased social conflict, diminished employment, or loss of product for processing plants. However, there is a paucity of data on the community dimensions of the fisheries studied, whether recreational, for hire, or commercial. This gap presents a major challenge to evaluating the effects of LAPPs on the broader community engaged in the mixed-use fisheries. The committee developed a set of recommendations that underscore the importance of ethnography, social indicators, and human dimensions research in NOAA Fisheries.

Recommendation: The NMFS and the Councils should develop explicit measures to associate LAPP fishing activity, as well as fishing activities of the for-hire and recreational sectors, with fishing communities represented in the NOAA Social Indicators data, both in the baseline (pre-LAPP) period and in subsequent periods. These measures should capture multiple community connections (e.g., residency, vessel homeport, landings, and support services for recreational and commercial fisheries).

Recommendations for Data Collection and Future Research

Conclusion: Because the committee encountered major gaps in the kinds of information needed to address its tasks, a large set of recommendations focused on data needs, some of which overlap with the sector-specific recommendations above. For fisheries where LAPPs may be contemplated, given the likelihood of having to make significant trade-offs, there is a pressing need for additional economic and social data, including pre-implementation baselines and concurrent examination of the LAPP in relation to other sectors of the fisheries. Committee recommendations emphasized introducing demographic data collection, expanding captain and crew data collection; improving the utility of social indicator data; making quota share and allocation data more transparent, comprehensive, and widely available; and developing data collection programs for mixed-use fisheries that enable assessment of the human dimensions of recreational and for-hire fisheries as well as commercial fisheries. The committee also advised that future review of LAPPs examine their relationships to other sectors of the fisheries.

Recommendation: For fisheries where LAPPs may be contemplated, the Councils and the NMFS should establish longitudinal data collection protocols for additional economic and social information, including pre-implementation baselines. These protocols should collect ongoing, and where possible, retrospective data prior to LAPP implementation and continue thereafter, with minimal disruptions to the survey protocols. At a minimum these data collection efforts should focus on social and economic data at the vessel level (e.g., revenues, input use, costs, ownership, community affiliation) including detailed demographic and economic data on crew, captains, vessel owners, and shareholders. Additionally, all data sets should cross reference each other to facilitate linking by including the appropriate identifiers.

Recommendations for Interdisciplinary Impact Assessment

Central to the committee's work has been the challenge of integrating qualitative and quantitative economic and social data that are based on distinct, discipline-driven methodologies and theories. Important examples are combining interview-based data with datasets like NOAA's Social Indicators for Coastal Communities project, and finding ways to meaningfully relate stakeholder perceptions of the fisheries system to what economic and biological data and models reveal about the system.

Conclusion: Fisheries policy issues with major economic, social, and ecological dimensions require interdisciplinary conceptualizations and methods for research. Finding ways to integrate divergent disciplinary perspectives and qualitative and quantitative data more effectively could lead to new insights, fruitful hypotheses, and more informed and improved decision making.

Recommendation: The NMFS and the Councils should encourage interdisciplinarity and better integrate qualitative and quantitative data to generate hypotheses and discern and test policy impacts. These activities and discussions can happen within the multidisciplinary Scientific and Statistical Committees of the regional councils as well as within the regional science centers of the NMFS.

This recommendation includes ways to assess the use of qualitative data on perceptions and values in social and economic impact analysis. Ideally, these assessments can be conducted in tandem with quantitative approaches like randomized sampling or taking a census of the population. To this end, the Councils and NOAA can expand the social and cultural methodologies used, including cultural models and cultural consensus analysis and network analysis among other adjuncts to in-depth interviews, participant observation, social surveys, and social indicators work that are well-known but not routinely applied to social and economic impact assessments within NOAA Fisheries.

Overall Conclusions

The use of LAPPs in the mixed-use cases reviewed has little discernible impact on recreational and for-hire stakeholders. However, fishers who are participants in the LAPP are held to higher monitoring, data collection, and enforcement standards relative to non-LAPP fishery counterparts and business-as-usual scenarios. To the extent that this eliminates overfishing and stocks are no longer overfished, it is possible that there will be more resiliency in the overall ecological system that benefits all fishery sectors. Moreover, the improved monitoring of the commercial sector with LAPPs may lead to pressure on other sectors to be more responsible, with the goal of staying within fishing mortality rate targets and reducing bycatch and discards. Thus, LAPPs may improve accountability, and hence conservation, in a mixed-use fishery in ways that deserve further scrutiny.

The committee's appraisal of the influence of LAPPs in mixed-use fisheries is constrained by the scarcity of data and studies that would enable a clearer picture of how the commercial, for-hire, and recreational fisheries for particular species or species complexes interact. The existence of LAPPs in the mixed-use fisheries of the Gulf and the Atlantic coasts is fairly new. Their creation often is accompanied by other measures, such as quota reduction and stronger monitoring that may account for variable outcomes. Moreover, beyond LAPPs, research on mixed-use fisheries as such appears to be limited to analyses done for purposes of allocating allowable catches among the sectors, with little attention to other possible relationships. Recognizing how potentially transformative LAPPs can be and the challenges of managing mixed-use fisheries, our conclusions and recommendations are aimed at improving a management system that in many respects appears to be working well.

1

Introduction

In 1976, Congress passed the Fishery Conservation and Management Act, now known as the Magnuson-Stevens Fishery Conservation and Management Act (the MSA).¹ The MSA establishes a system for regulating fisheries that operate between 3 and 200 nautical miles from U.S. shores. Although it nominally delegated management authority to the Secretary of Commerce and the National Oceanic and Atmospheric Administration (NOAA), the MSA gives the bulk of the responsibility for crafting and recommending fishing rules to eight Regional Fishery Management Councils (the Councils). Bluefin tuna and other highly migratory species are managed through the National Marine Fisheries Service (NMFS) of NOAA (also known as NOAA Fisheries) and, ultimately, through the International Commission for the Conservation of Atlantic Tunas (ICCAT), to which the United States is a signatory.

Pursuant to the MSA, the Councils are to be primarily composed of officials from state, federal, and tribal governments and citizens knowledgeable about fisheries management (16 U.S.C. § 1852(b)(2)(A)). The Councils' primary duties include the preparation, monitoring, and revision of Fishery Management Plans (FMPs) for fisheries within their respective geographic jurisdictions.² The law gives the Councils flexibility to tailor rules that fit individual fisheries, but also mandates that FMPs and other management measures be consistent with ten "national standards." While these standards generally require that rules are fair to fishers,³ promote safety and efficiency, and ensure the long-term sustainability of fish populations, the first National Standard is particularly specific and quantitative, commanding that policy makers "shall prevent overfishing while achieving ... the optimum yield" (FCMA, Pub. L. No. 94-265 § 3(7)(A)).

The first two decades of management under the MSA produced successes in ending overfishing and rebuilding some stocks. They also resulted in some failures. For example, by the early 1990s, a significant percentage of fish populations (or "stocks") could be characterized as "overfished," that is, reduced to levels incapable of producing as high a yield as possible over a sustained period of time. In addition, management under the MSA had produced a number of inefficient, "severely overcapitalized" fisheries in which the amount of capital invested by fishers far exceeded the amount needed to catch the fish and maximize profits. From a societal perspective, overcapitalization represents wasted resources; it also makes fishing less profitable for fishers than it otherwise could be.

In response to these and other issues, Congress has twice made major revisions to the MSA (1996 and 2006). In 1996, the reauthorized MSA required overfishing to be ended and stocks rebuilt within a decade, if possible. In 2006, Congress added Section 1853a, entitled Limited Access Privilege Programs. The addition of this section represented the first time that Congress had directly authorized the use of what are more generally known as Individual Fishing Quotas, or IFQs. As discussed more fully throughout this report, Limited Access Privilege Programs can dramatically alter the economic structure of a fishery,

¹ 16 U.S.C. § 1801, et seq.

² Defined by the MSA as "one or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics." FCMA, Pub. L. No. 94-265 § 3(7)(A).

³ There is considerable debate on whether to use "fishermen" or "fishers" to indicate people who catch fish—for a living, for pleasure, or for subsistence. The term "fisher" is not universally accepted, particularly by women and men in North American fishing industries. However, in academic journals and many government documents, usage of "fishers" has increased in recent decades as a more gender-neutral term, even though in most usages, "fishermen" refers unambiguously to people of any gender who fish (Branch and Kleiber, 2017). Aware of this controversy, the committee opted to use "fishers" in this report.

changing incentives in pursuit of better conservation and greater efficiency if appropriately designed and accompanied by effective monitoring and accountability measures.

Limited Access Privilege Programs (LAPPs) are systems of managing fisheries in federal waters whereby participation is limited to only those satisfying certain criteria (often referred to as eligibility criteria; 16 U.S.C. § 1802(27)). They are roughly synonymous with “catch shares” (see Figure 1.1), which represent a major contrast to traditional ways of managing fisheries.⁴ Permits are issued to harvest a quantity of fish as represented by a portion of the total allowable catch (TAC) that is held for exclusive use by a person in each fishing season or year. While the proportional quota shares held by any one individual do not change over time, any change in seasonal or annual TAC results in differing quantities of quota (often referred to as annual allocation as distinguished from share) that the holders can harvest.

These privileges are often referred to as individual fishing quotas (IFQs) when they are held by individual people, businesses, or other distinct entities, and more specifically individual transferable quotas (ITQs) when they are transferable through sale or lease (see Figure 1.1). The cases in this study are all ITQs, but in the United States they are most often called IFQs. We use the terms IFQ and catch shares throughout the report, reserving the term individual bluefin quota (IBQ) for the bluefin tuna bycatch LAPP.

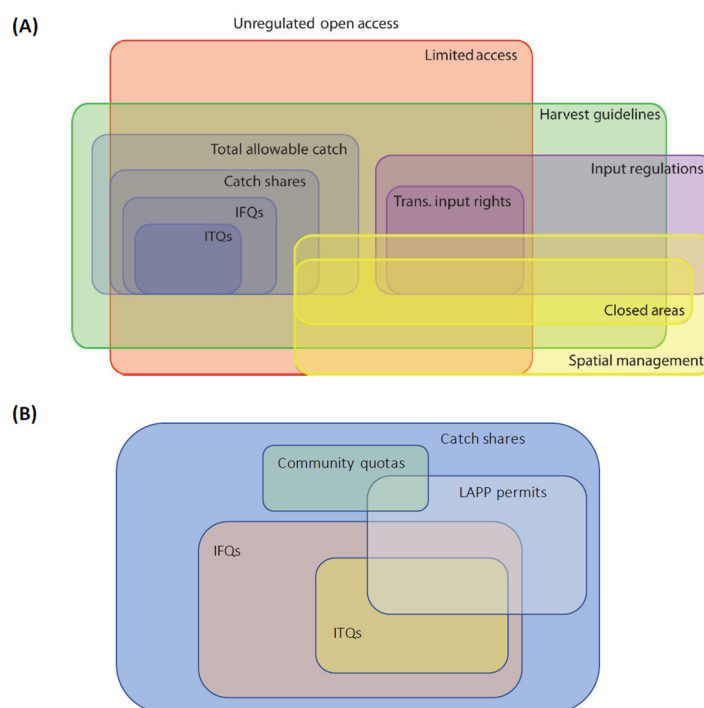


FIGURE 1.1 (A) Venn diagram representing the relationships among common approaches to fishery management, with regions of greater overlap indicating additional restrictions. Beginning from unregulated open access, the diagram represents three pathways: (1) limiting catch, beginning with limited access and adding restrictions on total allowable catch, allocating harvest rights through catch shares, individual allocation through individual fishing quota (IFQ) and individual transferable quota (ITQ); (2) limiting effort through establishing non-binding harvest guidelines, imposing input restrictions and then transferable input rights; and (3) controlling spatial access by establishing regulated-take or closed no-take areas, with the range of effort or catch controls applying within regions where fishing is permitted. SOURCE: Anderson et al., 2019. (B) Venn diagram representing the relationship among LAPP permits and other commonly used allocation strategies. The LAPP forms of “community quotas” are LAPPs assigned to fishing communities or to regional fishery associations, as defined and under conditions outlined in the legislation 16 U.S.C. § 1853a(c)(3), (4).

⁴ Excluded from LAPPs in the United States are Alaska’s Community Development Quota programs and New England’s Multispecies Groundfish Sector programs.

LAPPs represent major structural change, replacing fisheries management systems that are either open access or limited access, where individual fishers work within TAC quotas and other rules that apply to the entire group. LAPPs create a restricted kind of exclusive claim to ownership—not in fish per se, which remain public property, but in the right to take a proportion of a TAC, the size of which is determined by the NMFS and the Councils. Quota shares are fixed but annual allocations vary as the TAC changes. Under the MSA, LAPPs are “privileges” rather than property. They were specifically titled as such to emphasize the conditional nature of the program in general and, by extension, any “rights” granted as a component of the program (16 U.S.C. § 1853(b)). As such, a LAPP can be limited, modified, or revoked at any time. However, if a program has met or is meeting its stated objectives then it will likely remain (16 U.S.C. § 1853a(f)(1)). While the MSA classifies LAPP permits as “not property” for purposes of the Fifth Amendment to the U.S. Constitution, states can and do treat them as property for other purposes, such as divorce or probate proceedings.

The question of how restructuring actually impacts the fishery, including fishing sectors that are not part of a Limited Access Privilege Program, but pursue the same species, is the subject of this report. More specifically, the report focuses on impacts in what are known as mixed-use fisheries. As defined in the MSA, mixed-use fisheries are those federal fisheries that consist of two or more of the following sectors: recreational fishing; charter fishing; and commercial fishing (e.g., Figures 1.2 and 1.3).⁵ In the fisheries of this study, the LAPPs are only in the commercial sector although they have been explored for a for-hire sector. There can be other sectors in a mixed-use fishery. The bluefin tuna fishery has several commercial sectors, only some of which are LAPPs. Some mixed-use fisheries have important tribal and subsistence sectors that must be considered. To our knowledge, there are no tribal or subsistence sectors in the federal fisheries of this study.



FIGURE 1.2 Commercial reef fish longliner at Madeira Beach, FL. Photo credit: Steven Murawski.

⁵ Congress added this definition in 2018, as part of the Modernizing Recreational Fisheries Management Act (MFA). In addition to legally recognizing the differences between commercial and recreational fishing, the Act added management tools for decision makers to use in federal recreational fisheries and mandated the analysis of tools currently in place. Specifically, the MFA called for a study of Limited Access Privilege Programs (LAPPs) in mixed-use fisheries (Section 103(A) including the Red Snapper fishery of the Gulf of Mexico).



FIGURE 1.3 Reef fish headboat at Madeira Beach, FL. Photo credit: Steven Murawski.

The Statement of Task is as follows:

The National Academies of Sciences, Engineering, and Medicine (the National Academies) will convene an *ad hoc* committee to consider the use of Limited Access Privilege Programs (LAPPs) in the following mixed-use fisheries: red snapper, and grouper and tilefish, managed by the Gulf of Mexico Fishery Management Council; wreckfish, managed by the South Atlantic Fishery Management Council; golden tilefish, managed by the Mid-Atlantic Fishery Management Council; and bluefin tuna, a highly migratory species managed by the Secretary of Commerce. For each of the LAPPs, the committee will

1. Assess the progress in meeting the goals of each relevant LAPP and the goals of the Magnuson-Stevens Fishery Conservation and Management Act (the MSA).
2. Assess the social, economic, and ecological effects of each relevant LAPP, considering each sector of the relevant fishery and related businesses, coastal fishing communities, and the environment.
3. Assess any impacts (positive and negative) to stakeholders in the relevant mixed-use fishery caused by the LAPP.
4. Recommend policies to address any negative impacts identified in task 3, considering cost and/or feasibility.
5. Identify and recommend the different factors and information that the National Marine Fisheries Service and the Councils should consider when designing, establishing, or maintaining a LAPP in a mixed-use fishery to mitigate impacts to stakeholders to the extent practicable.
6. Review best practices and challenges faced in the design and implementation of LAPPs in all Council regions, including those not listed above.

The question is not whether to use LAPPs as a management tool. The questions are instead: What happens to fishers, fishing communities, and ecosystems when the Councils choose to employ LAPPs? And, if LAPPs do produce negative impacts, how might the Councils address those impacts by adjusting LAPP rules?

Study Methodology

This study examines U.S. mixed-use fisheries in which LAPPs have been implemented. LAPPs appear only in the commercial sector of the mixed-use fisheries. For each of these case studies, the committee examined available data on the fisheries and collected testimony from fishery participants, relevant Councils, and NMFS regional experts through a series of public meetings. To provide a context for the data and testimony collected, the committee conducted literature reviews, looking for peer-reviewed studies and reports that have attempted to document or to predict IFQ or LAPP impacts in mixed-use fisheries.

The Five Case Studies of the Mixed-Use Fisheries

The five fisheries in these case studies vary greatly in scope and scale and in the extent to which recreational and for-hire sectors are also involved in the fisheries (see Table 1.1).

The NMFS defines marine recreational fishing as “fishing primarily with hook and line for pleasure, amusement, relaxation, or home consumption. If part or all of the catch was sold, the monetary returns constituted an insignificant part of the person’s income.”⁶ There are three modes of recreational fishing: from shore, by headboat or charter boat, or by a privately owned or rental boat. For all of the species and fisheries covered in this study, only the latter two modes are applicable. Within the headboat and charter boat sectors, which differ by rental of space for one or rental of the whole boat, issues are similar such that these terms are used interchangeably in this study, or replaced by the more generic term “for hire.” Although private anglers and customers of for-hire boats come from just about anywhere, the recreational fishing sector also supports coastal communities through related business such as marinas and bait and tackle shops in addition to fuel, travel, and lodging for anglers to get to and from their residence to the fishing access site.

The commercial fishing sector for species that are federally managed includes individuals and businesses that harvest marine species for sale, primarily for human consumption. As a business, commercial fishers and their operations are subject to relatively large financial risks compared to businesses that are not similarly reliant on wild and variable natural resources. In addition, due to the historical use of output control measures (such as per trip and aggregate total allowable catches and bag limits) to protect stocks, many also faced heightened physical risks from safety issues at sea during poor weather. In many fisheries, commercial fishing also supports coastal communities through working waterfronts and provision of jobs (on boats or in shoreside processing facilities). However, although increasing coastal land values have reduced the number of fish houses located in waterfront locations and consolidated some land-based operations over the long term. Within the commercial sector, the financial and physical risks also vary by the assets owned, the portfolio of target species, the extent that the owner is dependent on a given fishery, and whether an operation is individual or corporate owned.

Typically, the recreational, charter, and commercial sectors in a particular fishery each function differently and have unique attributes. For example, recreational anglers may use a variety of both private and public access and landing sites, whereas commercial trips typically begin and end at designated locations. The main economic value inherent in commercial fisheries is the market price for the harvested

⁶ See <https://www.st.nmfs.noaa.gov/st1/recreational/overview/glossary.html> (accessed July 16, 2021). The committee notes that for some fisheries, subsistence and indigenous fishing are also important mixed-uses to consider; however, we have no information on the existence of those sectors for the fisheries of this study.

fish or shellfish. For charter fisheries, the value for the vessel owner is the willingness of customers to pay to fish for enjoyment and/or food; for private recreational anglers, the value lies in the experience and perhaps the food. As another example, commercial fisheries, and increasingly for-hire fisheries, may be subject to heightened reporting requirements as opposed to private recreational anglers.

Perhaps the most fundamental distinction between commercial and recreational sectors is that, for the most part, there are no limits in practice on the number of participants in recreational fisheries, other than purchasing a license to fish. Recreational fisheries are effectively open access. In contrast, many commercial fisheries have limited access, where participation depends on holding a permit, the number of which is limited and which can be very costly. Although for-hire recreational operations may be subject to limited licensing, both their customers and those pursuing marine species on private vessels operate under open access institutions. While legal participation may at times require a license or permit, these are unlimited in quantity and usually sold at a nominal price. In order to constrain recreational harvest, regulators typically rely on the use of seasonal and areal restrictions for targeted fishing as well as retention (bag) and size limits. However, commercial fisheries are increasingly subject to limitations on access that control the number of vessels or other units that may legally participate. These and other distinctions can have implications for management, such that the management strategies for recreational, charter, and commercial sectors vary. As stated in the MFA,

While both provide significant cultural and economic benefits to the Nation, recreational fishing and commercial fishing are different activities. Therefore, science-based conservation and management approaches should be adapted to the characteristics of each sector.⁷

In considering how to best conserve and manage the fisheries within their geographic regions, the Councils may consider a variety of mechanisms or techniques, including instituting size limits, fishing seasons, bag limits, gear restrictions, area closures, permitting requirements, access limitations, and others. In a mixed-use fishery, these management strategies can be applied to the individual sectors or to all sectors within the fishery to constrain annual removals to no greater than the TAC as allowed to each individual sector.

Table 1.1 shows each of the LAPPs in the mixed-use fisheries of this study, indicating the type of LAPP; when it was established; how the total allowable catch is allocated among the commercial, recreational, and other sectors; and, showing the large difference in the scale of these fisheries, the initial numbers of shareholders and estimates of the numbers of active fishing vessels.

Gulf of Mexico Red Snapper

The red snapper fishery in the Gulf of Mexico has very large commercial, recreational, and for-hire sectors. It is part of a complex set of fisheries for a number of reef fishes (e.g., snappers, groupers, porgy, triggerfishes, etc.). Its LAPP, like most others in this study, is only for the commercial sector. Also like most others, it is an IFQ program with transferability of both quota shares and annual allocations. It is thus technically an ITQ program, but is commonly described as an IFQ, and is so similarly described in this report.⁸ The program was implemented in 2007 under Amendment 26 of the Reef Fish FMP of the Gulf of Mexico Fishery Management Council. Participants live and work from a large number of ports around the Gulf of Mexico and are often also involved in the grouper-tilefish LAPP.

⁷ MFA, Pub. L. No. 115-405 § 2.

⁸ In theory, an ITQ is an IFQ with transferability. However, in the United States the federal fishery management system has adopted the practice of using IFQs as synonymous with ITQs. In this report we follow that practice except when a distinction is important. All cases in this study employ some degree of transferability.

TABLE 1.1 Characteristics of Limited Access Privilege Programs (LAPPs) in Five Mixed-Use Fisheries

First Year	Management Agency	Species	Type	Distribution of TAC			Number of Initial Shareholders	Number of Active Fishing Vessels
				LAPPs	Recreation	Other		
1991	South Atlantic	Wreckfish	ITQ	95%	5% ^a		6	8 permits (2018)
2007	Gulf of Mexico	Red snapper	ITQ	51%	49% ^b		554	362 (2011) ^c
2009	Mid Atlantic	Golden tilefish	ITQ	95%	0%	5% ^d	13	14 (2009-2013)
2010	Gulf of Mexico	Grouper-tilefish (G-T)			see below ^e		766	731 (2011-2015) ^f
		<i>G-T Shallow Water Grouper (SWG)</i>	ITQ	77%	23%			
		<i>SWG: Red grouper</i>		76%	24%			
		<i>SWG: Gag</i>		39%	61%			
		<i>G-T Deep water grouper</i>	ITQ	96.5%	3.5%			
		<i>G-T Tilefish</i>	ITQ	99.7%	0.3%			
2015	NOAA/HMS	Bluefin tuna	IBQ	8.1% ^g	19.7% ^h	72.9% ⁱ	136	76 (2018)

NOTES: IBQ = individual bluefin quota (to manage bycatch); ITQ = individual transferable quota. Allocations are percentages of the total allowable catch allocated to each sector: LAPP (commercial), recreational (usually includes for hire), and other. Shareholder refers to number of either individual entities or accounts, in most instances at time of initial allocation (exception is wreckfish, 2017). Estimates of active fishing vessels come from various sources and dates and are used as an indicator of relative differences in scale of the fisheries.

^a Although wreckfish has a recreational fishing allocation there are few reported recreational catches. SOURCE: Wreckfish LAPP review.

^b Red snapper recreational allocation is divided: 57.2% private angler, 42.3% for hire (charter). SOURCE: Jessica Stephen, NMFS, personal communication, 2021.

^c Red snapper and grouper-tilefish fishing vessels have significant overlap. SOURCE: Red snapper LAPP review.

^d Golden tilefish allocation for incidental catches from permitted commercial vessels. There is no allocation for recreational fishing, which is managed through bag limits at present. SOURCE: Golden tilefish LAPP review.

^e In some cases, there is no explicit recreational allocation; it comes from what remains after a commercial allocation is set. Fishing vessels in the grouper-tilefish ITQ program combined with those in the red snapper program (grouper-tilefish review). SOURCE: Mike Travis and Jessica Stephen, NMFS, personal communication, 2021.

^f Fishing vessels in the grouper-tilefish ITQ program combined with those in the red snapper program. SOURCE: Grouper-tilefish LAPP review.

^g The IBQ program is only for pelagic longliners. Their allocation is often increased by transfer from the Purse Seine sector or a Reserve category. There are limited entry permits for other categories.

^h Angling (recreational handgear); private anglers and for-hire vessels may also use the commercial General category in some conditions.

ⁱ 57% General (commercial handgear); 18.6% Purse Seine (not active in recent years); 4% Harpoon & Trap; 2.5% Reserve. SOURCE: Bluefin tuna LAPP review.

Gulf of Mexico Grouper-Tilefish

The fishery for a complex of groupers and tilefishes in the Gulf of Mexico also has very large commercial, recreational, and for-hire sectors which overlap extensively with those for the red snapper fishery. Its IFQ program in the commercial fishery began in 2010, under Amendment 29 of the Reef Fish FMP of the Gulf of Mexico Fishery Management Council. Participants live and work from a large number of ports around the Gulf of Mexico.

South Atlantic Wreckfish

The wreckfish commercial fishery IFQ program was one of the first to be created in U.S. federal waters. The program began in 1992, under Amendment 5 of the FMP for the snapper grouper fishery of the South Atlantic region. It takes place offshore and is highly specialized, with very few participants, working out of a small number of ports. The recreational and for-hire sectors appear to be negligible, although there is a five percent recreational allocation.

Mid-Atlantic Golden Tilefish

The IFQ program for the golden tilefish of the northeast region was created through the Mid-Atlantic Fishery Management Council in 2009, as Amendment 1 of the Tilefish Fishery Management Plan. The fishery is offshore and quite specialized, mainly using longlines. The IFQ program has few participants, 13-14 vessels in recent years, although very large numbers of commercial vessels may be permitted to take a small incidental catch of golden tilefish, for which five percent of the TAC is allocated. While the LAPP vessels primarily work from only two ports in New York and New Jersey, the large incidental catch fishery is more widely spread along the coast. Recreational and for-hire sectors are occasionally involved, most often as part of offshore large pelagic fishing (e.g., for tuna). There is no recreational allocation.

Highly Migratory Species: Bluefin Tuna

The LAPP for bluefin tuna differs in being a bycatch program, the IBQ program. The Atlantic bluefin tuna are managed by the Highly Migratory Species Division of the NMFS, within the U.S. commitment to the ICCAT. The IBQ program was created in 2015 as Amendment 7 to the 2006 Consolidated Highly Migratory Species Fishery Management Plan (79 Fed. Reg. 71510; December 2, 2014) to create greater incentives and tools for longline fishers to minimize regulatory discards of bluefin tuna within fisheries for other large pelagics, such as swordfish. The pelagic longline fishery is not allowed to directly harvest bluefin tuna. Direct harvesting is instead done by a very large recreational fishery, both private and for hire, and by other commercial fisheries (the “general category” for hook and line, purse seine, harpoon, and trap). The pelagic longline sector gets a small percentage (8.1% plus annual adjustments) to account for its bycatch, which is allowed to be sold. The purse seine sector is allocated a much larger percentage (18.6%). The purse seine fleet has become inactive since 2005; consequently, about 75% is put into a reserve which can be reallocated to other sectors, and that which is held by individual permit holders can be leased to pelagic longliners.⁹

⁹ The purse seine fishery, which was very small and concentrated in New England, was assigned an allocation in a way that could be seen as a LAPP. The annual allocation to shareholders is transferable, in a limited sense, to the pelagic longline fleet. It has limited duration (1 year), and the size of a share is dependent on the previous year’s activity. When the current system that includes IBQs was created, IFQs to the purse seine fleet were intended to last only for the tenure of the grandfathered permit holders, expiring upon the sale of the vessels (Walter Golet, personal communication, 2021).

Data and Information Challenges

To assess the social, economic, and ecological impacts of LAPPs in mixed-use fisheries we must address a number of data and evaluative challenges. Many of these challenges stem from significant gaps or biases in data collection. For example, data on social or economic indicators are often only available after the implementation of a LAPP, whereas impact analysis inherently requires longitudinal comparisons before and after policy implementation. In other cases, significant biases or blind spots may exist in otherwise robust data collection efforts. For example, for reasons of cost and feasibility, many economic and social science data series focus on vessels or vessel owners but fail to capture the outcomes and perceptions of other participants with less consistent or well-documented participation (e.g., crew) or individuals who once participated but have now exited the fishery.

Another fundamental evaluative challenge relates to the complex and dynamic nature of mixed-used fisheries. They are complex social-ecological systems, and therefore we expect the ecological, social, and economic state variables affecting commercial and recreational fishery stakeholders to change over time in ways that may be quite difficult to predict—even in the absence of the implementation of a LAPP. For example, external drivers such as coastal population growth, regional economic transformation and gentrification, globally integrated seafood markets and associated competition with farmed seafood, disasters (e.g., harmful algal blooms, hurricanes, and oil spills), and the effects of climate change on ecosystems all influence the trajectory of fishing livelihoods and the welfare of fishery-dependent communities.

Failing to account for these underlying dynamics may lead to a biased assessment of a particular LAPP's impacts. The attribution of a particular trend to the effect of LAPP implementation is often confounded by the other simultaneous effects. Furthermore, large policy measures such as LAPPs often are naturally combined with other policy changes in ways that may make it difficult to separate the effects of the LAPP from other aspects of the policy “bundle.” For example, LAPPs may be implemented as part of a stock rebuilding program—so the total quota of commercial harvest may decline at the same time LAPPs are implemented, thus making it difficult to separate the effect of LAPPs from the quota reduction.

These examples illustrate a general principle of impact evaluation: to assess the impacts of a LAPP on a particular fishery, it is not sufficient simply to point to changes in these variables before and after the LAPP went into effect as recommended in the guidelines for periodic reviews (Morrison, 2017b). Instead, one must establish how these changes differ from one or more plausible scenarios for what would have likely happened in the absence of the LAPP (Ferraro et al., 2019). In other words, any judgment about the impact of the LAPP is predicated on an implicit or explicit assumption about the “no-LAPP” counterfactual scenario (i.e., relating to or expressing what has not happened or is not the case). This scenario can be developed using a wide array of quantitative or qualitative approaches—from comparison of trends of paired “control” fisheries or communities not affected by the policy change, expert elicitation, qualitative scenario construction, or bioeconomic modeling. The most credible and practicable approach in a given scenario will depend on the nature of the impacts being considered, the complexity and extent of knowledge about the relevant causal feedbacks, and the availability of data.

Our evaluation of the impacts of LAPPs in mixed-use fisheries is ultimately dependent on our consensus assessment of the published literature, Council and NMFS analyses, as well as insights provided to the committee by stakeholders participating in committee meetings and/or providing written input. These sources are distinct in their data types (e.g., qualitative versus quantitative), hypotheses being investigated, breadth and depth of data coverage (e.g., cross sectional versus longitudinal), and analytical approach. They also diverge in their approach to the challenge posed by the counterfactual no-LAPP scenario. In many cases this counterfactual is left unstated, or implicitly imagined as a static “no-change” scenario relative to a measured, recalled, or reconstructed pre-LAPP data point. This static reasoning, as argued above, is often lacking justification. The objective throughout this report is to place these distinct lines of evidence in conversation with one another, forming an assessment of each LAPP's impacts relative to the most likely baseline scenarios, while being clear about the relative strength of evidence for distinct effects and gradations of uncertainty.

In many cases—due to sparse data, an absence of evaluative studies, or poor consideration of counterfactual scenarios in existing studies—it is difficult to provide straightforward evidence of certain impacts in the particular LAPPs being evaluated. In such cases the committee proceeds by drawing on a combination of theory from natural sciences, economics, and other social sciences. In synthesis with the broader empirical literature on LAPPs, we use these theories to hypothesize plausible causal pathways for LAPPs to affect commercial and recreational stakeholders or broader communities as well as the qualitative nature of these impacts (e.g., positive versus negative impacts). The committee then draws on the peer-reviewed literature, Council and NMFS analyses, as well as insights provided to the committee by stakeholders to assess the evidence for or against these hypothesized impacts. The committee concludes by summarizing the overall weight of the evidence and providing suggestions for data collection and research to more rigorously evaluate these questions in the future.

Successful interdisciplinarity, a much-sought goal for integrated fisheries and marine research and policy, sometimes requires shared knowledge of and respect for divergent epistemologies (Moon et al., 2021) and consideration of different standards of evidence (Charnley et al., 2017). It also benefits from cooperation in data analysis and interpretation where possible, and transparency in reporting the results. The committee's approach is consistent with the charge of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Section 301(a)(2)) to employ the “best available science” in its assessment. Beyond addressing the challenges of sparse data and causality noted above, the committee must also address the often distinct assumptions about methods and ways of knowing among the natural sciences, economics, and other social sciences (Charnley et al., 2017). The hypotheses investigated as well as data sources may differ by field, influencing what aspects of the system and outcomes are investigated. In addition, ethnographic data gathered by cultural anthropologists or human geographers may be less concerned with recovering an objective accounting of a single reality than in describing the heterogeneous lived experiences and perceptions of fishers and other stakeholders. Given this distinct goal, these data may be challenging to compare with data gathered by economists or other social scientists. Nevertheless, the committee views the lived experiences of those in fishery systems managed by LAPPs as vital to the assessment of these programs, and endeavors to integrate ethnographic data into this assessment along with other qualitative and quantitative data without unduly privileging one over the other. In cases where ethnographic data appear to conflict or contradict other evidence, the committee critically examines the overall preponderance of evidence. In some cases, apparent divergences may be indicative of important differences in sample (e.g., active fishers versus those that have exited a fishery) or in the variables that are measured, such that seemingly divergent results are instead complementary when viewed in totality. In other cases, there may be significant “daylight” between the perceptions and lived experiences of individuals versus the best available objective metrics of the same phenomena (e.g., subjective perceptions of safety at sea versus objective risk exposure). In the case where the conflicting metrics are of comparable credibility (i.e., in terms of following best practices of research design and analysis), the committee's presumption is that ethnographic data represent the best available assessment of the perceptions and lived experiences of the sampled individuals in the time period in question, whereas measured outcomes with quantifiable counterfactuals represent the best available assessment of causal impacts. Exploring the reasons for the divergence can be important for better understanding a policy's differential impacts and the political economy of LAPPs in a particular system.

Report Outline

Chapter 2 of this report provides background on the history of and rationale for IFQs in general. While the economic theory of IFQs predicts multiple benefits from their use, there is evidence that they might also have negative impacts on some participants in the fishery. After summarizing these concerns, the committee examines the specific language of Section 1853a, focusing on the ways Congress gave or did not give the Councils power to mitigate the predicted and observed negative impacts of LAPPs. Chapter 3 reviews the progress that has been made in meeting the individual goals for each LAPP as well as the broader goals set forth in the MSA. The committee analyzes the ecological effects of LAPPs on the study

of mixed-use fisheries (Chapter 4). The committee then considers the social and economic effects of LAPPs on participants in the commercial sector (Chapter 5), recreational sector (Chapter 6), and broader community (Chapter 7). Finally, in the concluding chapter the committee assesses the effects of LAPPs in mixed-use fisheries. It recommends potential changes that could be implemented to mitigate negative impacts, while promoting the positive functioning of the LAPPs considered in this study as well as any future LAPPs that may be considered in mixed-use fisheries.

2

Individual Quota Systems and LAPPs

What are LAPPs? As noted in Chapter 1, the term Limited Access Privilege Program (LAPP) describes a set of programs that includes IFQs, or individual fishing quotas, as defined by Congress in Section 1853 of the Magnuson-Stevens Fishery Conservation and Management Act (the MSA) Reauthorization of 2006.

This chapter builds on the earlier study of IFQs commissioned by Congress (NRC, 1999b). The first part explains what IFQs are, and why the economists who developed the theory of IFQs believed they would improve fisheries management. In short, the economists' prediction was that by giving fishers individual quota shares, they would have greater incentive to invest more efficiently in fishing equipment and labor, to fish in a deliberate manner likely to improve quality and safety, and to support conservation measures that produced benefits over the long term.

The next part of the chapter provides different perspectives on IFQs. Some fisheries anthropologists, geographers, and sociologists have questioned whether the predicted benefits of IFQs, if they materialized, would outweigh potential harm to fishing enterprises and fishing communities. For example, economists might see a reduction of labor costs as a positive result because it makes fishing more efficient; cultural anthropologists, on the other hand, might find evidence that the reduction of labor costs was also the loss of valued livelihoods and businesses within a community. The differences are mainly disciplinary, with economists being more likely to focus on costs and benefits to businesses and individual fishers, with sociologists and anthropologists being more likely to also focus on other social units, including families and communities.

Finally, the chapter explains how Congress, in drafting the LAPP provisions, answered key questions in designing its own IFQ program guidelines. The answer to each of these key questions is an exercise in maximizing the hoped-for positive outcomes while minimizing negative outcomes, such as those identified by social scientists. Key questions Congress answered include the following:

- Should the quota shares take the form of property or of a license to fish?
- How should the government allocate quota shares at the outset of the program?
- Should all fishers in the relevant fishery be required to hold shares before fishing, or should some kinds of fishers, for example, those who fish for recreation or subsistence, be exempt?
- Should shareholders be permitted to buy and sell shares?
- If shares can be bought and sold, should there be limits on how many shares an individual fisher can acquire?
- Should the government facilitate the purchase of shares by fishers who are unable to otherwise afford them?
- And, should shareholders be required to contribute financially to the management of the fishery?

In drafting LAPP provisions, Congress not only had to take into account the pros and cons of various forms of IFQ programs, but also it had to ensure that whatever form it ultimately chose was consistent with the broader MSA. For example, National Standard One is that “conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.” National Standard Five underscores the importance of efficiency, but also provides that it cannot be the sole objective of any management measure.

National Standard Eight requires that the choice of management measures should, where possible, provide the sustained participation of fishing communities and minimize any adverse economic impacts (16 U.S. Code § 1851).

Individual Quotas: The Economists' Rationale

"In the sea fisheries the natural resource is not private property; hence the rent it may yield is not capable of being appropriated by anyone" (Gordon, 1954).

The historical path of fishery regulation that led to LAPPs began with the application of economic theories to the study and management of fishery systems. Fish stocks are classic examples of common-pool resource (CPR) systems, resources for which it is difficult to exclude users, and where the use of the CPR by one user can decrease the resource benefits for all users. CPRs may be managed via a variety of property relations (e.g., no property, government or state property, common property, and private property). A CPR with little to no effective restrictions on the right to participate is known as "open access." In an open access fishery, the immediate benefits of catching a fish go to the individual and, in deciding whether or not to catch that fish, the individual will take into account their own costs. The problem is that individual fishers often have very little incentive to consider the impacts of their decision on the entire stock of fish and on other resource reliant individuals. To understand the practical impacts of this theoretical problem, assume an open access fishery that has, at present, 100 fishers. If catching a fish is worth net \$1.00 to our fishers, but also reduces the long-term value of the fishery by \$90.00 by impairing stock productivity, fishers will rationally choose to catch the fish because they will make a ten-cent profit on it. ($\$1.00 - (\$90.00/100.00) = \$0.10$). In other words, participants in an open access fishery will rationally make individual decisions contrary to the collective long-term health of the fishery, jeopardizing conservation efforts as mandated and primary in the national standards for the MSA.

Open access fisheries can also lead to inefficient use of labor and capital. Although the term "open access" suggests a free-for-all, many fisheries are actually "regulated commons," in which government managers set an overall annual limit on catch, then open fishing to all willing participants (see Box 2.1). In this form of open access, fishers have a strong incentive to catch fish as quickly as possible because the government will close the fishery once the overall annual limit has been reached. This form of management is also known as the source of "derby fishing" or the "race to fish." It leads competitive firms to invest in labor and capital to catch fish as quickly as possible. Investments made in fishing speed represent a waste of resources if the same amount of fish could be caught at a slower pace. Invariably, the quality of the fish caught (and thus their value) in derby fisheries deteriorates because of gluts to the processing and distribution parts of the supply chain. Rushing to catch fish can also create safety problems, because fishers are motivated to fish quickly, discounting risks associated with bad weather or the condition of their vessels.

The proposal to use IFQs as part of fisheries management was a way to solve the excludability problem while maximizing the aggregate producer surplus generated from the resource. Christy (1973) suggested that the limited licenses be issued in terms of units of harvest (which could be effectively controlled by a TAC) rather than in terms of vessels. Because the secure "privilege" to harvest a specified amount of catch each year would eliminate the race to fish, the owner of the license could focus on arranging fishing activity in time, place, and method to maximize the value of the harvest. As noted above, slower, deliberate fishing can eliminate unnecessary costs and promote safety as well. It can also improve the quality of fish landed, because fishers can take their time both catching fish and unloading catches at the dock.

In the economic view, IFQ programs, depending on how they are structured, could have other benefits as well. If the privilege to harvest a specific amount is indefinite in duration and the amount allowed under each share is based on a percentage of the TAC, fishers would have more reasons to care about the long-term sustainability of the fishery.

BOX 2.1 Examples of Problems in Regulated Commons

The pre-IFQ Pacific halibut fishery is a classic example of what has been called “the tragedy of the regulated commons.” The fishery was regulated by a total allowable catch (TAC) that was controlled with a season closure; when the aggregate recorded catch approached the TAC a closure date was announced after which vessels could not leave port. This created an incentive to change fishing behavior (i.e., move closer to shore as the closure date approached, begin a final trip the day before the closure, and remain at sea longer than optimal). This behavioral change had additional implications throughout the value chain as end-of-season product quality was compromised (e.g., product was “deck-loaded” without ice), processing speed had to increase, and cold storage space had to increase to accommodate the last landings of the season. The additional landings may have added revenue to the trip, but economic gains were tempered by lower product price. In sum, while an aggregate TAC with close monitoring can theoretically protect stocks from overexploitation (e.g., if the close-to-shore fishing areas are not spawning grounds), the behavioral responses to that approach have indirect effects (inefficiencies and costs).

In this case, in the short run, the closures were generally effective at keeping catches close to the desired levels. As a result, stock size increased and halibut fishing remained profitable; however, without controls on entry this provided incentives for further entry, and of boats designed to maximize profits under the conditions of this fishery (i.e., larger and more powerful boats that could catch fish faster). As a result, fishing seasons grew shorter over time. This exacerbated the problem. Additionally, processors were motivated to build plants in remote ports closer to the fishing grounds so as to increase their share of the catch even though the new plants were more expensive to operate than plants on the mainland.

In some regions the halibut fishery ended up with a season of one or two days with far too many large boats and processing plants and an inferior product because most of the catch had to be frozen during the short fishing season then stored for sale throughout the year. It would have been more cost effective to use fewer boats and to spread the catch over a longer season (and hence store the fish in the water until they were needed), process it closer to the major markets, and produce a high-quality fresh product (Homans and Wilen, 2005).

The story is similar for the pre-IFQ Gulf snapper and grouper fisheries with some differences in the regulatory histories. There was a TAC limit on catch put in place in 1990 after a period of only input controls in the 1980s, and landing fish was directly prohibited when the TAC was taken. There was no indirect control through a season closure. However, given the race to fish, the fleet grew and became more powerful, and the period over which the limited amount of fish was landed was reduced. Eventually, a two-tiered licensing system was created that limited red snapper landings, and red snapper seasons were separated from the rest of the reef fish complex (Solis et al., 2015). The effects on the industry were generally the same as in the halibut fishery. The race to fish encouraged the entry of larger and more powerful vessels able to catch the TAC very quickly. However, in this case there was another problem caused by the existence of similar fisheries elsewhere in the United States and Latin America. The reduced fishing period caused the domestic fishers to lose market access because they could not guarantee a steady stream of harvest throughout the year. Restaurants and markets developed marketing strategies to try to keep people coming back for the same product. Suppliers found that retailers would rather have a steady stream of imported fish than a stream of local fish that was truncated when the quota was met. Once the names of the imported fish were printed on the menus, it was often difficult to reintroduce domestic fish.

Individual *transferable* quota (ITQ) programs theoretically represent another twist on IFQs, even though the terms IFQ and ITQ are often used interchangeably in the United States (see Figure 1.1). Transferability means that the program allows holders of quota shares and/or the corresponding annual allocations to sell or lease them to other fishers. By creating a market for the long-run privilege (i.e., shares) or the corresponding short-run annual harvest (i.e., allocation), transferability can generate additional efficiency gains. In the share market, buyers are those who assign a higher net value to the fish than sellers. Net value is the difference between marginal cost of catching a fish and the price for which the fish (or the opportunity to catch the fish) can be sold. If we assume that price is constant across the fishery (such as if the market were to reach equilibrium), then shares and/or allocations should end up in the hands of those participants who have lower marginal costs of catching fish. The total variable costs of fishing, integrated under marginal cost curves and summed across the fishery, are minimized.

The extent to which transferability can enhance efficiency gains, such as through markets reaching equilibrium, will ultimately depend on the extent to which the markets have the characteristics to support a perfectly competitive equilibrium (i.e., homogeneous good, many buyers and sellers, full information, and no barriers to entry and exit). For at least some fisheries, these conditions will not be met. Transferability also creates opportunities to address catch and management uncertainty in multispecies fisheries in which vessels cannot perfectly target species under individual quota management and can use trading to quota balance (i.e., fill their individual allocations of species without exceeding regulated limits).

In brief, fisheries economists predict that moving from a regulated commons (derby with a TAC), or a regulated, open-access fishery, to an IFQ will eliminate the race to fish, thus reducing fishing costs, improving safety, and giving fishers a greater incentive to care about the long-term health of the fishery. If transferability is allowed, the resulting ITQ program can produce the benefits of IFQs while adding additional efficiency gains. All of the cases in this study are ITQs, but we follow the standard practice in the United States of using the term IFQ for them in the rest of this report.

Other Consequences of LAPPs

Our statement of task asks us to examine the positive and negative effects of the LAPPs that have been implemented pursuant to the MSA. We focus on the ways features of LAPPs generate positive and negative impacts within mixed-use fisheries.

For example, IFQ programs allow fishing enterprises to reduce costs because they can have more control over when and how they fish. If they reduce capital and labor costs and increase profits, this can benefit the shareholders, vessel owners, and fishing crews and may generate more wealth for the community, depending on how the income is used. But there can be other consequences that are negative for some. For example, some former hired captains and crew will no longer be employed, and some equipment dealers or vessel maintenance companies might lose revenue. Both of these changes can affect not only the individuals and companies that are directly affected, but the communities around them.

The use of transferable IFQs can create additional problems. In an IFQ fishery with no or limited transferability, the government distributes the shares to fishers without charge; when fishers retire, for example, they return their shares to the government, which then redistributes them. In an ITQ fishery, where the quota shares are transferable, the retiring fishers can sell their shares on the market. The market for shares created by ITQ programs raises important questions. For example, should one fisher be allowed to purchase all of the shares in a fishery, thus potentially consolidating benefits to one community? And, what if there are fishers who want to fish—because they have been trained to fish or because it is culturally important to them—but who cannot afford to buy shares in the quota market? With respect to the former question, LAPPs implemented in the United States are directed to consider restrictions to prevent excessive consolidation. With respect to the latter question, there are several potential solutions such as improving access to market information and sellers, establishing a grant or loan program, and providing job retraining.

Real-World Experience Informing the 2006 Amendments

The first major IFQ program was instituted in New Zealand in 1986 and served as an important source of ideas for IFQs in the United States (Anderson, 1989). The first program in the United States was the surf clam and ocean quahog fishery in 1990. The wreckfish fishery in this study was close behind, in 1991. These early experiments with IFQs came shortly after experiments with cap-and-trade programs in the 1970s as a means to address other market failures in environmental management (Fowle and Perloff, 2013; Tietenberg, 2002). The North Pacific halibut and sablefish IFQ system began in 1995. But in 1996 the U.S. Congress imposed a moratorium on new IFQ-like programs that lasted until 2002. In 2006 Congress reauthorized the MSA, Section 303A, with provisions for LAPPs (see Box 2.2). The concepts of “catch shares” and LAPPs became widely used. In 2007, the Gulf of Mexico red snapper IFQ LAPP was implemented, having been stalled by the moratorium. In 2009, the golden tilefish IFQ LAPP came into effect, soon followed by an IFQ LAPP for New England Atlantic sea scallops and for Gulf of Mexico

grouper and tilefish in 2010. All of these programs involved transferable individual quotas and are thus technically ITQs. New England's multispecies groundfish sectors, similar to LAPPs but managed on a cooperative basis, began in 2010 as well. Between 1999 and 2011, the West Coast and North Pacific saw a variety of programs with different structures, including cooperatives, permit stacking, and "rationalization," as well as the unique Western Alaska Community Development Quota Program (1992).¹ Finally, the individual bluefin quota (IBQ) program was created for managing bycatch of Atlantic bluefin tuna in 2015.²

As described above, IFQs were initially conceived of as policy tools used to address the open access problem and promote the economic goal of efficiency by reducing overcapitalization. They have been called "one of the great institutional changes of our time: the enclosure and privatization of the common resources of the ocean" (Neher et al., 1989), and they continue to be praised as a practical solution to the excludability problem for a common-pool resource and as a means to promote economic efficiency. However, the major IFQ programs in New Zealand, Iceland, and the United States gained many critics. In Iceland, one of the first countries to utilize IFQs on a broad scale, the programs have been described as "one of the most contentious and tumultuous issues in Icelandic political history" (Helgason and Pálsson, 1998).

Social scientists studying the human dimensions of fisheries and fishing communities have critique conceptualizations of IFQ systems that center on the goal of efficiency as leaving out or minimizing considerations such as livelihood and community sustainability, social justice, and distributional equity, among other goals that fisheries management policy could explicitly address. Numerous studies suggested that IFQs, particularly those with transferability (i.e., the ITQs), fundamentally transform fishery systems (e.g., Carothers and Chambers, 2012; McCay, 2004; McCormack, 2017; NRC, 1999b; Olson, 2011; Pinkerton, 2015b; Pinkerton and Davis, 2015; Young et al., 2018).

For those and other reasons, including struggles between harvesters and processors over control of quota (see Matulich and Clark, 2003), there was considerable resistance to IFQs in U.S. fisheries. Congress placed a moratorium on them in U.S. fisheries in its 1996 reauthorization of the MSA and called for a study, which was published as *Sharing the Fish* (NRC, 1999). Issues highlighted in *Sharing the Fish* and other studies (e.g., GAO, 2004), as well as concerns of fishers, fishing communities, crew, processors, and councils, fed into Congress's next reauthorization, which went into effect in 2007 and included specification of LAPPs (Iudicello and Lueders, 2016). Support for IFQs also expanded as environmental nongovernmental organizations (NGOs) shifted position to become more in favor of them (e.g., Environmental Defense Fund, 2009; Pew Environment Group, 2009). A review of the NGO literature showed that the term "catch share" was increasingly used along with the thesis that private ownership promotes stewardship and conservation (Carothers and Chambers, 2012).³

After the 1996-2002 moratorium on IFQs, National Oceanic and Atmospheric Administration (NOAA) policy shifted to promoting catch shares not only for efficiency but also "to help rebuild and

¹ In the North Pacific region, some LAPPs are assigned to cooperatives; certain limited access fisheries allow permit holders to use more than one permit on a vessel, which is called permit stacking; and the word "rationalization" has been used to refer to particular cases of assigning individual quotas.

² See <https://www.fisheries.noaa.gov/national/sustainable-fisheries/catch-share-programs-council-region> (accessed December 28, 2020).

³ The committee was not tasked to examine the complex issue of the property status of IFQs and other LAPPs in relation to conservation and has chosen not to do so given the priority of other questions. Macinko and Bromley (2003) have criticized property claims for ITQs, but most scholars accept that they constitute quasi-property. Court cases and legal scholarship show that they are best viewed as property for some purposes but not others (Iudicello and Lueders, 2016). They may be viewed as property in bankruptcy or divorce proceedings, and the privileges are considered property for purposes of the Due Process Clause of the Fifth Amendment. Status as "property" in these regards may help fishing groups intervene in court cases based on having property at stake. However, the MSA is clear that they are revocable privileges assigned by government, and not private property with regard to the Takings Clause of the Fifth Amendment. As a result, they are not subject to a takings claim against the government if the government revokes the privileges.

sustain fisheries and support fishers, communities and vibrant working waterfronts” (NOAA Fisheries, 2010). Furthermore, concerns about livelihood, social justice, and other social matters, highlighted in the National Research Council (1999b) study, were reflected in the design of LAPPs (Stoll and Holliday, 2014). The 2006 reauthorization of the MSA highlights the need for equity and fairness in allocation of individual privileges, the importance of the social and cultural framework in their design and implementation, and the need to address questions about transferability and new entrants.

Just as the initial evolution of IFQs was due to a process of adapting to limited entry programs, the more recent evolution has involved learning and adapting to circumstances that influenced today’s programs (McCay, 2004). For instance, early Canadian experiments in the Bay of Fundy underscored the critical role of monitoring and enforcement, which delimits the use of IFQs (Burke and Macgillivray, 1990). The New Zealand experience revealed risks of treating the allocations as complete property rather than privileges and not fully understanding the full range of claimants to rights or privileges (De Alessi, 2012; Guth, 2001; Stewart and Callagher, 2011). The initial New Zealand program for orange roughy showed the wisdom of allocating percentages of an annual quota rather than specific amounts of fish, a practice now widely followed (Boyd and Dewees, 1992). The first U.S. IFQ program, for surf clams and ocean quahogs, dramatized how rapidly extreme consolidation of holdings might occur and the critical importance of the initial distribution (Adelaja et al., 1998; McCay and Brandt, 2001), information about which fueled fisher resistance to IFQs along the Atlantic seaboard. A British Columbia program raised questions about fairness to crew members and potential new entrants in the manner in which the cost of leasing or buying shares is allocated (Pinkerton and Edwards, 2009).

The IFQ program for crab in the Bering Sea and Aleutian Islands included a number of features to address distributional concerns and support fishing communities: including allocating some quota share to captains, vesting processing quota share in processors to preserve historic landings patterns (which required special legislation), and an arbitration mechanism for ex-vessel harvesters designed to preserve the historic division of rents between processors and harvesters. Still other programs have design features intended to protect small-scale and owner-operator fishing enterprises and, by implication, fishing communities. For example, the North Pacific halibut and sablefish IFQ program adopted in 1995 has provisions designed to maintain the owner-operator structure of parts of the industry such as quota caps, transfer limitations, and rules on quota leasing (Szymkowiak and Himes-Cornell, 2015). However, there have been dramatic shifts in access to the halibut fishery as a result of the IFQ program, particularly the loss of access rights in rural and Indigenous communities (Carothers, 2010; Carothers et al., 2010; NPFMC, 2016). For example, in the Gulf of Alaska region communities are excluded from the Community Development Quota program in western Alaska (see Haapala, 2019; NRC, 1999a; Pinkerton and Langdon, 2019). In 2004, a new community quota purchase program began for the Gulf of Alaska to address these inequities, but has been largely unsuccessful in returning fishing rights to longstanding halibut-dependent communities in the Gulf region (Carothers, 2011; Langdon, 2008; Langdon and Springer, 2007; NPFMC, 2010; Richmond, 2013; Sea Grant Alaska, 2009; Soliman, 2015).

Congress Creates Its Own Brand of IFQs: LAPPs

The LAPP provisions in Section 1853a of the MSA represent Congress’s attempt to balance the potential benefits and costs of catch share programs, particularly IFQs, including ITQs.

Issues in Designing an Individual Fishery Quota Program

Transferability

A major choice that law and policy makers need to make when implementing an IFQ program is whether to make the privileges transferable, that is, to allow permit holders to buy and sell or lease privileges as an ITQ. A program allowing managers to grant fishers nontransferable rights can produce many benefits; however, adding transferability to the picture creates other kinds of potential benefits, including the

possibility of making fishing more efficient and profitable for fishers through trading. Transferability also creates opportunities to address catch and management uncertainty in multispecies fisheries in which vessels cannot perfectly target a menu of individual species allocations under individual quota management and can thus use trading to quota balance. These potential benefits, though, could come at a cost, including reduced access and lost employment if excess downsizing occurs, and with it excess consolidation of ownership and control. A decision to allow transferability in part reflects law and policy makers' judgment of the relative importance of efficiency, access, and employment opportunities in the fisheries within their respective jurisdictions.

The question of whether shareholders can buy, sell, or lease individual shares is of enormous significance. If the shares are transferable, there may be efficiency gains but they also may be accumulated and consolidated into fewer entities. In addition, the use of shares can be effectively consolidated by collaboration within families (and extended families), companies, communities, and fish houses although consolidation is to be addressed by accumulation caps. The standard characterization in the fishery management plans implies that shareholders are distinct individuals with a single investment making independent decisions. However, often "shareholders" can often be individuals, firms, or partnerships, and the link between shareholding entities and actual fishing enterprises is not clear and can be complicated by intractable relationships (e.g., families).

Although it can generate efficiency gains, creating a market for IFQs and making them the prerequisite for participation in a fishery can result in social costs in the form of loss of access for certain groups of fishers and communities, reduced employment, the creation of political power due to enhanced profitability for those holding the privileges and loss of power for those without, and high barriers to new entrants to the fishery.

Scope of Program: To Whom Should the Rights Be Allocated?

From a long-run economic efficiency point of view, if the rights are transferable, it should not matter how the rights are initially allocated. With a perfectly competitive market there will be incentives for the more efficient producers to purchase or lease rights from the less efficient producers. The incentives for these trades will continue until the allowable harvest is landed by the entities that can do so at the highest net present value of the quota shares.

Although in theory LAPP systems could allocate quota to a wide array of interest groups, in practice, there are no individual quota programs that include this wide a range of users to date. In fact, almost all quota programs are limited to the commercial fishing sector, exceptions being a few for the for-hire sector (e.g., for Alaska halibut) and some collaborative arrangements with environmental organizations. For example, The Nature Conservancy worked with fishers to establish a risk pool for bycatch of low-quota species in the West Coast groundfish LAPP (Kauer et al., 2018).⁴ There would seem to be several reasons that quota programs are mostly limited to the commercial sector. First, it will often be the case that net value per fish varies more between sectors than within sectors. For example, while the commercial sector, under the assumption of constant price, tries to minimize costs of catching fish to maximize profits, recreational fishers are seeking to maximize their net utility from the fishing experience. Because users value quota for different purposes, a transferable quota system that included both recreational and commercial fishers could lead to large shifts in holdings between traditional commercial versus recreational sectors, especially if less commonly measured and considered values (particularly in the long run) were discounted. Ideally the transferrable market system would fully incorporate the social values generated by the existence of each sector, including the provision of food to sustain a local community and community stability, through employment and ancillary businesses in many aspects of the commercial fishery. However, existing transaction markets only capture private benefits and costs (although social factors could be explicitly incorporated through resource rents). Second, the market for shares can only

⁴ See <https://www.nature.org/en-us/about-us/where-we-work/united-states/california/stories-in-california/california-groundfish-project> (accessed July 16, 2021).

function where potential buyers believe that shares represent the only lawful (or practically lawful) way to catch fish. Enforcement is easiest in commercial fisheries because of the relatively small numbers of participants and the ease of tracking commercial catches. Other sources of fish mortality, such as recreational fishing or pollution, are much harder to monitor and regulate effectively. Recreational fishing involves large numbers of participants who are very heterogeneous, highly dispersed, do not have to use marinas, and are somewhat unpredictable in behavior, adding to enforcement challenges.

The economic perspective is dominant in the design of LAPPs. However, equity and environmental justice considerations could support giving rights to those who are highly dependent, were historically and remain deeply engaged in the fishery, have cultural ties to fishing, and so forth. For example, the LAPP provision in the MSA requires an effort to “promote the sustained participation of small owner-operated fishing vessels and fishing communities that depend on the fisheries.” Sustained participation is also at the heart of grandfathering people into such systems; historical participants have invested in their operations, in their vessels, in training crew, and (in some cases) in developing their markets. A more open definition of who is eligible to participate can disadvantage smaller operators and those supporting fishing communities as larger operations and outside investors compete to be shareholders.

Initial Allocation

In order for an individual quota system to work, the government must at the outset create shares and then distribute those to vessel owners or other stakeholders. The manner of initial allocation has tremendous implications for the distribution of benefits from IFQs, and hence the political acceptability of the program itself given entrenched power structures. It may also, under certain conditions, influence the final outcome of who holds rights and harvests the quota—thereby influencing efficiency as well. In principle, with well-functioning markets for quota and free transferability, the initial allocation formula may be irrelevant to the final ownership since quota can easily find its way to those who can harvest it most efficiently. This “independence property” has some empirical support from cap-and-trade pollution markets (Fowlie and Perloff, 2013), but has not been extensively studied in fisheries. In practice, relatively small numbers of fishers, potential market power, and information failures may all serve as transaction costs in IFQ markets, causing the initial allocation to matter for the realized efficiency.

The economists’ preferred method for the initial distribution of shares would likely be some form of auction, again helping to ensure that shares move to their highest and best use, and reduce the problem of windfall profits, whereby the initial recipients of shares have an advantage in subsequent trading. Auctions also have the beneficial effect of taking government officials out of allocation decision making (at least at the firm level), thereby limiting the potential for both actual bias and complaints about bias. Because they generate revenue, auctions ensure that the public receives some compensation for the fish it is handing over for private profit, making fishery management more in line with other publicly managed extractive resources, such as mineral and oil leases.

Despite these benefits, there are legitimate concerns about the impact of auctions on the demographics of a fishery. To start, the potential effects of an auction on the fishery resemble the effects of transferability: the winning bidders will be, all other things being equal, those with the highest net present value and the greatest access to capital. Risk preferences are also an issue as there is no guarantee that the programs will continue in the future. Auctions would also favor fishers who have been in the fishery longest and whose cost structure (e.g., absence of boat payments, supports higher bids through their access to capital). While this could be efficient, it would also lock in the status quo, as defined by some measure of historical participation and, perhaps, investment concerns about the impacts of consolidation on fishing communities. However, the use of auctions implies that the historical participants, which perhaps advantaged some in many ways, would be paying for their shares and those funds could be used to provide subsidies or loans to those seeking entry in subsequent years in order to address socioeconomic priorities of the fishery.

The most commonly used approach to the initial allocation of shares is to base the distribution formula on each individual’s historical catches. While this approach is simple and fair in concept because

it is grounded in a form of reliance interest, it is controversial because it requires managers to define “history.” Specifically, managers must determine which (and whose) history counts. It is typical, for example, to exclude several years of recent fishing history in calculating share allocations. The purpose of excluding this history is to remove fishers’ incentive to increase catches while the individual quota plan is being developed. While this makes sense, it may also unfairly punish fishers who simply happened to do well during that time period or are new to the fishery. It is also the case that extending the time period for eligibility to allow fishers to each pick their best years over a long time horizon means that, on average, the associated/implied annual TAC would need to be higher and, as a result, the shares each receive will be less than what could be optimal.

A politically determined approach to allocation, as opposed to a market-driven approach such as auctions, opens the door to favoritism or, at least, the perception of favoritism on the part of government decision makers. At the same time, a political approach does not guarantee but allows for the possibility that decision makers can structure the initial demographics of the fishery in a way that fairly takes into account the social benefits of certain distribution patterns. Because assessments of efficiency and fairness inevitably include subjective judgments, there is no objectively optimal approach to allocation.

Management Costs

Fisheries management costs money. Proper management requires good science about all of the dimensions of fishery systems. Moreover, no management scheme can be effective without some level of enforcement. In most U.S. fisheries management, the government bears the costs of science and enforcement. IFQ programs, specifically those in which shares are marketable, create private wealth by permitting costs to be rationalized. Given enhanced profitability (and the public nature of the underlying resource), it is reasonable to suggest that the fishing industry should pay some or all management costs.

While there are obvious benefits to the public from shifting costs to private parties, the arrangement can be viewed as leading to shareholder “ownership” of science and enforcement. Nonshareholders, such as recreational fishers in many cases, could be concerned that science and enforcement efforts would be focused on ensuring shareholder success instead of the success of the fishery more generally.

Accessibility (for future entry into program)

By imposing a new cost on potential entrants into the fishery—the cost of purchasing shares from an existing shareholder—IFQ programs may increase barriers to entry, even when there are existing entry costs such as limited entry permits. A barrier to entry, whether it be a formal right or an informal sanction, is necessary to solve the exclusion problem. Higher barriers will have the greatest effect on younger and less experienced fishers, who in a more traditionally managed fishery would have the opportunity to learn and earn their way to success. In many communities, fisheries have long offered economic opportunities to people without much formal education and training, to those without resources, as well as to immigrants and other disadvantaged groups. In some areas, there are few other occupations available. However, in places where absence of exclusion led to overfishing, these opportunities with low costs of entry may become less economically viable over time.

How Congress Addressed the Issues in Section 1853a

Transferability and Limits on Transfer

Although Section 1853a(b)(4) establishes that LAPP permits do not constitute property, Section 1853a(c)(7) expressly allows councils to make LAPP permits transferable. Consistent with the general theory of ITQs, transferability will reduce capacity by facilitating trades between more- and less-efficient fishers, making it possible for the more efficient to buy out the less efficient.

Due to other policy goals, including food security and job protection, the MSA limits potential efficiency gains by limiting transferability. In Section 1853a(c)(1)(D), Congress artificially limited the size of markets for LAPP permits by prohibiting them from being transferred to “any person other than a United States citizen, a corporation, partnership, or other entity established under the laws of the United States or any State, or a permanent resident alien.” Section 1853a(c)(5)(D) requires the Councils or the Secretary, depending on which is developing the LAPP, to “ensure that limited access privilege holders do not acquire an excessive share of the total limited access privileges in the program.” Pursuant to that section, all LAPPs must “establish a maximum share, expressed as a percentage of the total limited access privileges, that a limited access privilege holder is permitted to hold, acquire, or use” and can “establish any other limitations or measures necessary to prevent an inequitable concentration of limited access privileges.”

Scope of Program: To Whom Should Rights Be Allocated?

The MSA does not require the inclusion of all fishery users in any LAPP. The MSA does provide for two types of LAPPs—for “fishing communities” and “regional fishery associations”—that allow for the inclusion of a wide range of direct and indirect users, including “residents who conduct commercial or recreational fishing, processing, or fishery-dependent support businesses within the Council’s management area.”⁵

The scope of any LAPP is likely to be closely correlated to the specific fishing sectors that drove its creation in the first place. The MSA, in Section 1853a(c)(6) (“Program Initiation”), lays out the process by which LAPPs are generally to be created. The process of establishing a LAPP can be initiated either by one of the Councils or by a petition submitted by fishers. The MSA does not define the term “fishermen” or “fishers.” Section 1853a(c)(6)(B) does, however, state that petitions can be submitted only by “group[s] of fishers constituting more than 50 percent of the permit holders, or holding more than 50 percent of the allocation, in the fishery.”

The MSA creates special process requirements, in the form of referenda, for certain fisheries in the Gulf of Mexico and New England.⁶ The Gulf of Mexico provision requires a majority vote of those who “substantially fished” the species in question. The New England provisions require a two-thirds vote among a stakeholder group that includes not just fishers who hold allocation or permits but also “crew members who derive a significant percentage of their total income from the fishery.”

Initial Allocation

As noted, the initial allocation of shares in an individual quota fishery will often be hotly contested because the distribution of shares is the distribution of wealth (rent). Congress chose to make initial allocation decisions political rather than market driven. In Section 1853a(c), the MSA mandates that the Councils “establish procedures to ensure fair and equitable initial allocations, including consideration of current and historical harvests; employment in the harvesting and processing sectors; investments in, and dependence upon, the fishery; and, the current and historical participation of fishing communities.” While meeting these criteria would require the input of quantitative information (such as data on historical catches), the final decision is a policy one. In choosing which years to include as relevant history, for example, the Councils must make subjective judgments. It should be noted that while the MSA allows the Councils to use auctions for initial (or subsequent) allocation, those auctions must be structured to meet the above-listed requirements relating to “fair and equitable allocation.”⁷

⁵ 16 U.S.C. § 1853a(c)(3)(A)(III).

⁶ 16 U.S.C. § 1853a(c)(6)(D).

⁷ 16 U.S.C. § 1853a(d)(1).

In order to help mitigate impacts on fishery participants who end up on the outside of the LAPP, the allocation provisions in the MSA require that the Councils “consider the basic cultural and social framework of the fishery,” with attention to the needs of smaller owner-operated fishing vessels and fisheries dependent fishing communities. This includes (i) the development of policies to promote the sustained participation of small owner-operated fishing vessels and fishing communities that depend on the fisheries, including regional or port-specific landing or delivery requirements; and (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery. In addition, there is a requirement that a LAPP develop an appeals process.

Accessibility (for future entry into program)

The MSA contains various provisions meant to facilitate entry into LAPPs, both from the outset and after the program and the market for permits have begun to operate. Section 1853a(c)(5)(C) (“Allocation”) requires the Councils to “include measures to assist, when necessary and appropriate, entry-level and small vessel owner-operators, captains, crew, and fishing communities through set-asides of harvesting allocations, including providing privileges, which may include set-asides or allocations of harvesting privileges, or economic assistance in the purchase of limited access privileges.”

Section 1853a(g) gives the Councils the option of creating a fund in order to facilitate entry:

- (1) IN GENERAL.—A Council may submit, and the Secretary may approve and implement, a program which reserves up to 25 percent of any fees collected from a fishery under section 304(d)(2) to be used, pursuant to section 53706(a)(7) of title 46, United States Code, to issue obligations that aid in financing—
 - (A) the purchase of limited access privileges in that fishery by fishermen who fish from small vessels; and
 - (B) the first-time purchase of limited access privileges in that fishery by entry level fishermen.
- (1) ELIGIBILITY CRITERIA.—A Council making a submission under paragraph (1) shall recommend criteria, consistent with the provisions of this Act, that a fisherman must meet to qualify for guarantees under subparagraphs (A) and (B) of paragraph (1) and the portion of funds to be allocated for guarantees under each subparagraph.

Management Costs

The MSA requires LAPP permit holders to pay for costs related to the program:

In establishing a limited access privilege program, a Council shall—

- (2) develop a methodology and the means to identify and assess the management, data collection and analysis, and enforcement programs that are directly related to and in support of the program; and
- (3) provide, under section 304(d)(2), for a program of fees paid by limited access privilege holders that will cover the costs of management, data collection and analysis, and enforcement activities. Cost recovery fees may not exceed three percent of the annual ex-vessel value of fish harvested by a program subject to a cost recovery fee.⁸

⁸ The NMFS has determined that only incremental costs attributable to the LAPP are subject to cost recovery.

BOX 2.2 Select Provisions of Section 303A: Limited Access Privilege Programs

(a) **IN GENERAL.**—After the date of enactment of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, a Council may submit, and the Secretary may approve, for a fishery that is managed under a limited access system, a limited access privilege program to harvest fish if the program meets the requirements of this section.

(b) **NO CREATION OF RIGHT, TITLE, OR INTEREST.**—Limited access privilege, quota share, or other limited access system authorization established, implemented, or managed under this Act—

- (1) shall be considered a permit for the purposes of sections 307, 308, and 309;
- (2) may be revoked, limited, or modified at any time in accordance with this Act, including revocation if the system is found to have jeopardized the sustainability of the stock or the safety of fishermen;
- (3) shall not confer any right of compensation to the holder of such limited access privilege, quota share, or other such limited access system authorization if it is revoked, limited, or modified;
- (4) shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested by the holder; and
- (5) shall be considered a grant of permission to the holder of the limited access privilege or quota share to engage in activities permitted by such limited access privilege or quota share.”

(c) **REQUIREMENTS FOR LIMITED ACCESS PRIVILEGES.**—

(1) **IN GENERAL.**—Any limited access privilege program to harvest fish submitted by a Council or approved by the Secretary under this section shall—

...

(G) include provisions for the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and this Act, and any necessary modification of the program to meet those goals, with a formal and detailed review 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every 7 years);

...

(5) **ALLOCATION.**—In developing a limited access privilege program to harvest fish a Council or the Secretary shall—

(A) establish procedures to ensure fair and equitable initial allocations, including consideration of—

- (i) current and historical harvests;
- (ii) employment in the harvesting and processing sectors;
- (iii) investments in, and dependence upon, the fishery; and
- (iv) the current and historical participation of fishing communities;

(B) consider the basic cultural and social framework of the fishery, especially through—

- (i) the development of policies to promote the sustained participation of small owner-operated fishing vessels and fishing communities that depend on the fisheries, including regional or port-specific landing or delivery requirements; and
- (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery;

(C) include measures to assist, when necessary and appropriate, entry-level and small vessel owner-operators, captains, crew, and fishing communities through set-asides of harvesting allocations, including providing privileges, which may include set-asides or allocations of harvesting privileges, or economic assistance in the purchase of limited access privileges;

...

(7) **TRANSFERABILITY.**—In establishing a limited access privilege program, a Council shall—

- (A) establish a policy and criteria for the transferability of limited access privileges (through sale or lease), that is consistent with the policies adopted by the Council for the fishery under paragraph (5); and
- (B) establish, in coordination with the Secretary, a process for monitoring of transfers (including sales and leases) of limited access privileges.

SOURCE: 16 U.S.C. § 1853a.

3

Progress in Meeting Goals of LAPPs and Magnuson-Stevens Fishery Conservation and Management Act as Determined by Program Reviews

Limited Access Privilege Programs (LAPPs) are systems of managing federal fisheries. Participation in these programs is limited to only those satisfying certain criteria (often referred to as eligibility criteria; 16 U.S.C. § 1802 (27)) and federal permits are issued to harvest a quantity of fish as represented by a portion of the total allowable catch (TAC) that is held for exclusive use by a person in each fishing season or year. These privileges are often referred to as individual fishing quotas (IFQs) since they are held by individual people, businesses, or other distinct entities such as cooperatives or fishing communities. However, the law excludes Alaska's community development quotas and New England's multispecies groundfish sectoral allocations from designation as LAPPs, although they too are acknowledged as catch shares that assign exclusive shares of a quota to entities. While the proportional IFQ shares held by any one individual do not change over time unless they have been subject to sale, each change in seasonal or annual TAC results in differing quantities of quota (often referred to as annual allocation) that the holders can harvest.

The implementation of a LAPP begins with the specification of eligibility conditions that determine what types of stakeholders a LAPP includes and which ones are ultimately issued federal permits (e.g., if catch histories are required). LAPPs are always implemented with stated goals and intended outcomes. As such, the programs are often characterized by additional rules and regulations designed to help track the progress of the program and increase the probability that stated goals and outcomes are met. Some of the more common components of LAPPs include enhanced monitoring systems to track landings, whether quota shares and/or the associated allocations are transferable (and between whom), and whether they only apply in certain sectors of a fishery (i.e., not to all participants).

This chapter first summarizes a set of overarching criteria that LAPPs must address as specified in the Magnuson-Stevens Fishery Conservation and Management Act (the MSA). For each LAPP, this chapter then provides brief background information on the fishery or fisheries and summarizes progress toward meeting the overall goal and objectives of their unique LAPP as concluded in the most recent program review. As the program reviews include recommendations, those are summarized as well. Although each of the LAPPs reviewed occurs in a mixed-use fishery, neither the specific LAPP objectives nor the reviews address this feature of the programs nor do they address distinctions and relationships between federal and state management of the species involved.

Overall MSA and LAPP Goals

As noted, the MSA, 16 U.S.C. § 1801 *et seq.*, contains Section 1853a, entitled "Limited Access Privilege Programs." Specifically, Section 1853a(c) includes requirements that every LAPP shall

- assist in rebuilding a stock if it is overfished;
- contribute to reducing overcapacity if the fishery is overcapitalized;
- promote safety, fishery conservation, and management, and social and economic benefits;
- prohibit any person other than a U.S. citizen, corporation, partnership or other entity, or a permanent resident alien from acquiring a privilege to harvest fish;
- require that all fish harvested be processed on vessels of the United States or on U.S. soil;

- specify the goals of the program;
- include provisions for regular monitoring and review by the Council and the Secretary of the operations of the program;
- include an effective system for enforcement, monitoring, and management; and
- include an appeals process for administrative review of decisions regarding initial allocation of limited access privileges.

Under the MSA, LAPPs are “privileges” and were specifically titled as such to emphasize the conditional nature of the program in general and, by extension, any “rights” granted as a component of the program.¹ As such, any LAPP can be limited, modified, or revoked at any time; however, if a program has met or is meeting its stated objectives then it will likely remain.²

LAPPs established after January 12, 2007, including those reviewed in this study, must be reviewed periodically.³ The National Marine Fisheries Service (NMFS) guidance for these “formal and detailed” reviews dictates that they evaluate (1) “whether or not the catch share program objectives were met”; and (2) “various components of the catch share program” (Morrison, 2017a,b).

With regard to the reviews, the MSA states that the first review will be 5 years after implementation and thereafter reviews will coincide with the review of the umbrella Fishery Management Plan (FMP) but no longer than every 7 years. It also states that they include progress in meeting program goals and goals of the MSA and that they be “formal and detailed”; however, there is no language that specifies what information should be included or how success in addressing the program goals or objectives should be assessed. Guidelines for the review process were formalized in NMFS Procedure 01-121-01 (Morrison, 2017b) and will undergo review in December 2023. The Guidelines call for the establishment of a review team and the inclusion of external input, in addition to eight elements that must be addressed in each that are intended to produce a document that is fairly comprehensive in scope. While the development of the catch share program will have included an analysis of the program’s expected benefits in the Fishery Management Plan, the LAPP reviews are to be “a retrospective evaluation of an established program,” which “is to describe and analyse the effects that have actually taken place since the ‘baseline’ time period” (Morrison, 2017b).

Progress by Fishery

This section provides background information on each LAPP addressed in this document, then summarizes the findings of the most recent progress review. These reviews are produced by the Fishery Management Council responsible for managing the program, with significant input from the responsible National Oceanic and Atmospheric Administration (NOAA) regional office and regional science center. The LAPPs are solely for the commercial sectors in these mixed-use fisheries. There are separate and parallel management systems, primarily with “output” controls (such as bag limits, size limits, and season specification) for recreational and for-hire sectors, which are usually open access. Only rarely, as is the case of bluefin tuna, do these sectors require limited access permits. Moreover, some commercial fishing and the majority of recreational fishing take place in state waters, particularly in the cases of Gulf reef fish. These dimensions of the overall fishery systems and the fishers and fishing activity associated with them are not included in the mandatory LAPP reviews, limiting the utility of the reviews for assessing the impacts of the LAPPs on noncommercial sectors of the mixed-use fisheries. But they are major sources of information for their impacts on commercial fisheries.

This chapter summarizes the findings of the last official periodic review that assess progress at meeting LAPP-specific goals and anticipated benefits, and the associated conclusions of the review (i.e., impacts to date and recommended changes or issues that remain). It does not delve into suggestions for

¹ 16 U.S.C. § 1853(b).

² 16 U.S.C. § 1853a(f)(1).

³ 16 U.S.C. § 1853a(c)(1)(G).

further improvements, but does highlight the final recommendations of each review that could prove helpful in providing guidance for the tracking and evaluation of LAPPs in mixed-use fisheries.

Red Snapper (Gulf of Mexico)



FIGURE 3.1 Scientist and two red snapper collected in the Northern Gulf of Mexico.

The Fishery and Its LAPP

Red snapper (*Lutjanus campechanus*) are distributed from North Carolina to Brazil, with major fisheries occurring in the Gulf of Mexico (off the United States and Mexico) and in the South Atlantic regions of the United States (Patterson et al., 2007). Red snapper are early maturing (by age 2) but can live in excess of 40 years and obtain lengths of 1 m and weights of up to 23 kg (see Figure 3.1). Adult fish generally move only short distances although juvenile fish migrate from nursery areas on sand bottom habitats to hard structures including both naturally occurring rock and coral outcroppings, and constructed habitats including oil and gas infrastructure and artificial fishing reefs. The species supports valuable commercial and recreational fisheries in U.S. waters, including in the Gulf of Mexico, where the stock is regulated by the Gulf of Mexico Fishery Management Council (GMFMC).

Over most of the recent history of red snapper fisheries in the Southeast United States, stocks have been determined to be overfished (stock sizes below biomass thresholds) and overfishing (harvest rates in excess of limit reference points) was occurring. Commercial and recreational fisheries in the Gulf of Mexico have separate target catch allocations, with 51% allocated to commercial fisheries and 49% to recreational sectors (Patterson et al., 2007). Two major gear types are used in the commercial fishery: vertical longlines (“bandit” gear) and demersal longlines, which consist of a series of baited hooks targeting relatively large

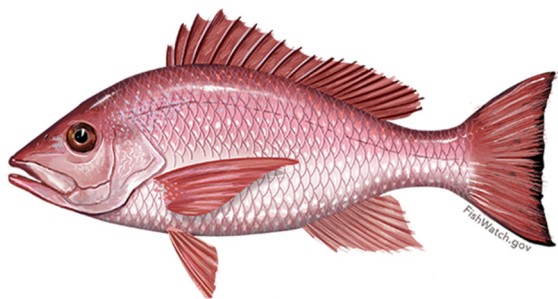


Image of red snapper (*Lutjanus campechanus*).

SOURCE: NOAA Fisheries.

fish (Scott-Denton et al., 2011). Small quantities of red snapper are landed via rod and reel and spearguns. There is also some bycatch of mostly juvenile red snapper from shrimp fisheries in the Gulf. Recreational fisheries for red snapper in the Gulf are primarily by hook and line.

Prior to the introduction of the IFQ program for red snapper in the Gulf of Mexico in 2007, the commercial fishery was regulated through a series of ever more restrictive commercial trip limits, closed seasons, gear restrictions, size limits, and

closed areas both as conservation restrictions for red snapper (SEDAR, 2018) and associated fish species, and to protect sea turtles accidentally caught in the fishery. The first fishery management plan for this fishery was implemented by the NMFS in 1984, with no bag limits on recreational fishing, and a 13-inch minimum size. The only restrictions on the commercial fishery in 1984 were prohibitions on pot and trap fisheries. The first recreational bag limit was implemented in 1990 (seven fish), which was reduced successively to two fish beginning in 2007, which endures today.

The red snapper stock is periodically assessed through the Southeast Data Assessment and Review (SEDAR) process and the annual catch limits and distributions to each sector (commercial and recreational) are determined by the Science and Statistical Committee and recommended to the GMFMC (Council).

The red snapper stock in the Gulf of Mexico is assessed as two components (east and west of the Mississippi River Delta). The overall stock biomass has increased substantially in the past decade, although the western component is larger and continues to grow, whereas the eastern component has leveled off in recent years (SEDAR, 2018). Most red snapper catch is derived from the eastern component (Alabama, Florida, and Mississippi). In 2020 an effort to estimate the total number of red snapper in the Gulf of Mexico was referred to as the “Great Red Snapper Count,” which resulted in a number that was larger than recent SEDAR assessments (Stunz et al., 2021). The Council is currently considering how this new scientific information can be incorporated into the setting of the annual catch limit given that the data, modeling, and results did not go through the standard SEDAR peer-review process.

In the Gulf of Mexico commercial red snapper fishery, which is the sector now managed by a LAPP, red snapper is part of a broader reef fish fishery that consists of numerous other species (i.e., amberjacks, triggerfish, porgies, tilefish, and a number of other species including other snappers and groupers). Weighted vertical lines or longlines are the main harvesting techniques. As mentioned previously, the fishing grounds are located throughout the Gulf of Mexico near reef structures, often more than 100 miles offshore, and fishers typically visit multiple locations on a single trip (Weninger and Waters, 2003). Red snapper, vermilion snapper, red grouper, and shallow water grouper species are the most intensively harvested by weight.

The original FMP simply banned certain fishing techniques deemed harmful to the marine environment. Prior to the 2007 implementation of the IFQ program, the main management tools for the commercial sectors of the fishery were overall fishery quotas, closed seasons, area and gear restrictions, and trip limits. From 1990 to 2006 the FMP used a TAC, distributing 51% and 49% to commercial and recreational harvesters, respectively (a distribution that continues today), as the primary management tool. During these years, the commercial quota ranged from 2.04 million pounds to 4.65 million pounds and once

the quota was landed, the season ended. This type of control led commercial participants to race to harvest as they tried to maximize their share of the catch before the season closed. As a result, the season averaged a relatively short 77 days from 1996 to 2003 (NMFS, 2008).

In addition to shorter seasons, compressed markets, and lower prices and revenue (Ropicki, 2013), the race to fish led fishers to ignore inclement weather. In April 2001 the fishing vessel *Wayne's Payne* sank off Marsh Island, Louisiana, and the captain cited the open red snapper season as the reason for fishing under hazardous conditions (Weninger and Waters, 2003).

In 2007, the GMFMC implemented Amendment 27 to the Reef Fish Fishery Management Plan that created an IFQ system for the commercial sector of the red snapper fishery (Ropicki, 2013). The program distributed total allowable catch based on catch history. Each fisher's individual quota share could be transferred to, or purchased by, anyone, although the amendment limited quota share trading to reef fish permit holders for the first 5 years of the program. Harvesting of quota still requires a reef fish permit (NMFS, 2012). Reef fish permit holders can harvest either the quota allocation resulting from shares they own, or they can lease in pounds of quota allocation each year (i.e., there are two transfer markets, one for share ownership and another to lease allocation in pounds). As a result, there are at least six distinct types of commercial participants based on whether the participant fishes, whether they own shares, and whether they participate in the allocation market. Due to these differing behaviors, post-LAPP operation of the fishery varies among categories of fishers (Ropicki et al., 2018).

The most dramatic change in fishery regulations with respect to the commercial fisheries was an increase from 100 days per year or less throughout most of the 1990s and early 2000s to a fish-on-demand system under the IFQ (NOAA Fisheries, 2021). This new system eliminated the race to fish and the necessity to fish during very restrictive seasons even when conditions were adverse.

In 2007 the reef fish regulations for recreational fishing of red snapper included a two-fish-per-person bag limit (down from five fish in 2000-2006), a recreational size limit of 16 inches, and a reduction in the total recreational quota to 3.18 million pounds from the previous year's quota of 4.47 million pounds (SEDAR, 2018). Additionally, there were a number of seasonal and permanent area restrictions in force, but these did not change in 2007.

Assessment of Meeting Goals and Objectives

The red snapper IFQ program was implemented via Amendment 26 to the Reef Fish FMP. Box 3.1 summarizes the goals and anticipated benefits of this program, which was implemented on January 1, 2007.

The red snapper IFQ program, which accompanies a major decline in total allowable catch, sought to achieve a reduction in overcapacity and to mitigate derby fishing conditions. The 5-year review published in April 2013, the most recent available, concluded "that progress in addressing these objectives have been made" (p. 58). The conclusions by type of impact and any needed or potential changes that should be considered as noted in the 2013 review are summarized in Table 3.1.

BOX 3.1 Goal and Anticipated Benefits of the Red Snapper IFQ Program

Program Goal

"... reducing overcapacity and eliminating the problems associated with derby fishing." (Gulf of Mexico Fishery Management Council, 2013)

Anticipated Benefits

"increased market stability, elimination of fishing season closures, increased flexibility for fishing operations, cost-effective and enforceable management of the red snapper commercial sector, improved safety at sea (balance of social, economic, and biological benefits from the red snapper commercial sector). Additionally, ... provide direct and indirect biological benefits to the red snapper population and other marine resources by eliminating quota overages and reducing bycatch and discard mortality." (Amendment 26)

TABLE 3.1 Red Snapper IFQ 5-Year Review Conclusions by Type

Type of Impact	Impacts to Date (April 2013)	Recommended Changes or Issues That Remain
Participant Consolidation and Overcapacity	<ul style="list-style-type: none"> Moderate success reducing overcapacity 	CHANGE: continue to reduce fleet capacity
Achievement (or Harvesting) of Optimum Yield (OY)	<ul style="list-style-type: none"> Success in reducing quota overages, consistent with the achievement of OY 	CHANGE: address inactive accounts that account for as much as 1.5% of the commercial quota ISSUE: the success had little to do with the LAPP itself, but rather the quota reductions
Biological Outcomes	<ul style="list-style-type: none"> Contributed to lower commercial fishing mortality rates and discards (with revisions to the rebuilding plan, quota reductions, and commercial size limit) Prevented commercial quota overruns 	ISSUE: fishers in the eastern Gulf have opted to discard legal-sized fish instead of purchasing sufficient allocation
Social Impacts	<ul style="list-style-type: none"> Program is supported most by large shareholders and those in the western Gulf Entry and participation are more difficult due to the costs of shares and allocation Consolidation has reduced competition for harvest and increased trip revenues Crew sizes are smaller, but the ability to hire and keep stable crews has improved 	ISSUE: the increase in the number of shareholders without landings has led to perceptions that many are profiting at the expense of working fishers
Mitigating the Race to Fish and Safety at Sea	<ul style="list-style-type: none"> Mitigated the race to fish by enabling year-round harvests that increased inflation-adjusted share, allocation, and ex-vessel prices Increased confidence in the program Reduced annual mortalities Medium and large shareholders believe the program has improved safety at sea 	None stated
Enforcement and Program Administration	<ul style="list-style-type: none"> Compliance has improved Program expenses currently exceed the 3% cost recovery collected for program administration, research, and enforcement 	CHANGE: a variety of enforcement violations have been identified; additional enforcement efforts may be necessary to deter violations

NOTES: Subsequent studies include “allocation caps” as a type of impact and, although not included in the summary in Section 6.0, a cap on share holdings has been in effect since the program was implemented. The cap is 6.0203% and is only binding in the share market, not the annual allocation market. According to a study by Agar et al. (2014), concentration of harvest has declined.

SOURCES: Adapted from Section 6.0 of the red snapper IFQ program 5-year review (Gulf of Mexico Fishery Management Council, 2013).

The next 5-year review of this program will cover the years 2012-2018 and be conducted in conjunction with the grouper-tilefish IFQ program. However, the NMFS Southeast Regional Office (SERO) conducts an annual report on the program in a living document. The most recent evaluation was released on July 2, 2020. The summary concludes:

In the thirteenth year of the RS-IFQ program, the program has shown continued progress in achieving its main objectives of reducing overcapacity and mitigating the derby fishing conditions and auxiliary objectives such as increased market stability, fishing flexibility, and balancing social, economic, and biological benefits. During the 13 years of the program, there have been changes in participation and activity in the program. (NMFS-SERO, 2020)

Grouper-Tilefish (Gulf of Mexico)

The regulated grouper-tilefish complex in the Gulf of Mexico consists of multiple species of groupers and tilefishes. For the purposes of management, the grouper species were divided into a deepwater group (misty grouper, *Hyporthodus mystacinus*; snowy grouper, *Epinephelus niveatus*; yellowedge grouper, *Mycteroperca interstitialis*; Warsaw grouper, *Epinephelus nigritus* (see Figure 3.2), and speckled hind, *Epinephelus drummondhayi*) and a shallow-water group (black grouper, *Mycteroperca bonaci*; gag, *Mycteroperca microlepis*; red grouper (see Figure 3.3), *Epinephelus morio*; Nassau grouper, *Epinephelus striatus*; yellowfin grouper, *Mycteroperca venenosa*; yellowmouth grouper, *Mycteroperca interstitialis*; rock hind, *Epinephelus adscensionis*; red hind, *Epinephelus guttatus*; and scamp, *Mycteroperca phenax*. In 2012, rock hind, red hind, and misty grouper were deleted from the IFQ program, as were anchor tilefish and blackline tilefish. The grouper complexes demonstrate a wide range of life histories, with some being slow growing and long lived (over 70 years, e.g., Warsaw, snowy, and yellowedge groupers), while some shallow-water species are fast growing and mature early in life (e.g., red grouper and gag). All species of the Gulf of Mexico groupers begin their adult lives as females, and eventually change sex to males as larger (older) animals (termed protogynous hermaphrodites). The factors that dictate when the sex change occurs are poorly understood but are partially related to larger size and include social factors such as the presence of other males in the vicinity. This unique life history complicates understanding of the effects of size limits and fishing rates on the fecundity and spawning success of the species.

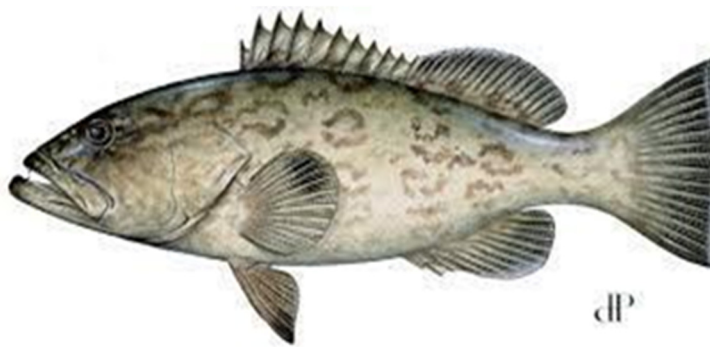


Image of red grouper (*Epinephelus morio*). SOURCE: NOAA.

Golden tilefish (*Lopholatilus chamaeleonticeps*), the major species in the tilefishes complex, are distributed from the southern portion of Georges Bank (off New England) to Brazil. In the United States, the Gulf Council and the Mid-Atlantic Councils manage Gulf and Atlantic golden tilefish populations separately. The species is moderately long lived, relatively slow growing, and lives its entire juvenile and adult lives in a single burrow which it excavates. It is a benthic species caught primarily with demersal longlines and by the recreational fishery using hook and line. Fishers catch golden tilefish in relatively deep water (in a narrow temperature band averaging 12°C) throughout their range. Populations are subject to local depletion if burrow areas are too heavily targeted. Two additional tilefish species, blueline tilefish (*Caulolatilus microps*) and goldface tilefish (*Caulolatilus chrysops*), are included in the IFQ program.

The most abundant and important grouper species to the Gulf of Mexico fisheries are red grouper, gag grouper, and yellowedge groupers (Scott-Denton et al., 2011). Fishers catch red grouper almost exclusively in the eastern Gulf (east of the Mississippi River Delta and mostly off Florida), whereas the other two species are ubiquitous. Fishers primarily use demersal longline gear, although they also use vertical longlines and handlines (Scott-Denton et al., 2011). While the Gulf Council assesses all species periodically, it assesses red grouper most frequently and, perhaps as a result, changes management regulations for the species most frequently (SEDAR, 2019).



FIGURE 3.2 Scientist pictured with warsaw grouper from the northern Gulf of Mexico, 2017.

The Fishery and Its LAPP

The Gulf Council included most grouper species in the initial Reef Fish Fishery Management Plan (1984) but species-specific regulations date to the early 1990s. Bag limits for recreationally caught groupers have usually included an aggregate number (three to five) with a maximum number of some species (e.g., two of the aggregate four can be red grouper, 2015-present). Because many of these species occur in mixed-species aggregations, bycatch mortality of regulatory discards (due to biotrauma) is problematic, especially for species in the deep-water complex (Runde and Buckle, 2018).

The grouper-tilefish FMP includes a number of categories for the IFQ, as listed in Table 3.2.

TABLE 3.2 Grouper-Tilefish IFQ Species by Share Category

IFQ Category	Species
Gag	Gag (<i>Mycteroperca microlepis</i>)
Red grouper	Red grouper (<i>Epinephelus morio</i>)
Deepwater grouper	Snowy grouper (<i>Epinephelus niveatus</i>) Speckled hind (<i>Epinephelus drummondhayi</i>) Warsaw grouper (<i>Epinephelus nigrilus</i>) Yellowedge grouper (<i>Mycteroperca interstitialis</i>)
Other shallow-water grouper	Black grouper (<i>Mycteroperca bonaci</i>) Scamp (<i>Mycteroperca phenax</i>) Yellowfin grouper (<i>Mycteroperca venenosa</i>) Yellowmouth grouper (<i>Mycteroperca interstitialis</i>)
Tilefishes	Blueline tilefish (grey) (<i>Caulolatilus microps</i>) Golden tilefish (<i>Lopholatilus chamaeleonticeps</i>) Goldface tilefish (<i>Caulolatilus chrysops</i>)

SOURCES: Adapted from Table 1.3.2.1 of the grouper-tilefish IFQ program 5-year review (Gulf of Mexico Fishery Management Council, 2018a).



FIGURE 3.3 Red Grouper associated with a carbonate rock outcropping in the Eastern Gulf of Mexico. SOURCE: NOAA.

The grouper-tilefish IFQ program was implemented in 2010 (3 years after the red snapper IFQ), with similar program goals (e.g., reducing capacity of the commercial fleet, and mitigating or preventing the race to fish) but also including the goals of increasing harvest efficiency and profitability (Stephen, 2020). The anticipated benefits of the grouper-tilefish IFQ were to increase market stability, eliminate fishing season closures (for commercially caught groupers and tilefish), improve safety at sea, reduce bycatch and associated bycatch mortality, and balance social, economic, and biological benefits (Stephen, 2020).

Because of the large number of grouper species often caught together, additional flexibility was incorporated into the IFQ program. For example, three share categories—shallow-water grouper, deepwater grouper, and tilefishes—are multispecies, and some species are found in both shallow and deepwater habitats. Under some conditions, species in one category may be accounted for in another. The principal objective of these measures was to minimize bycatch-associated mortality particularly when deepwater species were caught. Overall, the effects of the program have been to decrease the number of shareholders in the grouper-tilefish IFQ program (by about 30%) and the number of allocation holders (by about 7-12%). Ex-vessel prices for most species have increased substantially, even when adjusted for inflation (Stephen, 2020).

Most importantly, implementation of the IFQ program for groupers and tilefishes has eliminated costly and inefficient trip limits, which changed frequently (SEDAR, 2019). For example, in 2005 the Gulf Council made three separate trip limit changes for the shallow- and deepwater grouper complexes. While there remain many spatial closures and some gear restrictions (e.g., relating to numbers of hooks, hook size, and hook materials), these restrictions are not as volatile and have been more-or-less in place for a decade or more (SEDAR, 2019).

Assessment of Meeting Goals and Objectives

The grouper-tilefish LAPP was implemented on January 1, 2010. The main goal was associated with reducing effort, as measured in numbers of vessels, and reaping the benefits that are hypothesized when annual landings are known in advance and can be planned independently of other fisheries. Box 3.2 summarizes the overall program goals and associated high-level benefits that were anticipated.

BOX 3.2 Goal and Anticipated Benefits of the Grouper-Tilefish IFQ Program

Program Goal

“... to rationalize effort and reduce overcapacity of the grouper-tilefish fishing fleet to achieve and maintain optimum yield in these multi-species fisheries.” (Gulf of Mexico Fishery Management Council, 2018a)

Anticipated Benefits

“... mitigate some of the problems resulting from derby fishing conditions or at least to prevent the condition from becoming more severe ... [and] improve profitability of commercial fishermen who target grouper and tilefish.” (Gulf of Mexico Fishery Management Council, 2018a)

The anticipated benefits of the program as they relate to eliminating the race to harvest and improving profitability included “increased market stability, elimination of quota closures, increased flexibility for fishing operations, cost effective and enforceable management, improved safety at sea; reduction in bycatch; and balancing of economic, social and environmental benefits” (Gulf of Mexico Fishery Management Council, 2018a). The 5-year review included a number of conclusions and recommendations that are summarized in Table 3.3.

In general, the program has been moderately to highly successful in achieving its stated goals, although there is still room for further achievement, particularly with respect the overcapacity, discard mortality, price reporting, and social and community impacts. (Gulf of Mexico Fishery Management Council, 2013)

The social impacts of this program, which were assessed relative to intended objectives and benefits to the commercial sector, noted that although crew sizes are smaller, the ability to hire and keep stable crews has improved.

Bluefin Tuna (highly migratory species)*The Fishery and Its LAPP*

Atlantic bluefin tuna (*Thunnus thynnus*) are the largest of the tuna species, up to 13 feet in length and 2,000 pounds. Slow growing and long lived, to 20 years or more, they range widely through the Atlantic Ocean, the Gulf of Mexico, and the Mediterranean Sea. In the western Atlantic, bluefin tuna (BFT) are found off the waters of Newfoundland down to the Gulf of Mexico. The only known spawning area for the western stock of Atlantic BFT is the Gulf of Mexico.

TABLE 3.3 Grouper-Tilefish IFQ 5-Year Review Conclusions by Type

Type of Impact	Impacts to Date (April 2018)	Recommended Changes or Issues That Remain
Data Collection and Reporting	<ul style="list-style-type: none"> Improved collection of share and allocation price data 	<p>CHANGE: may need mandatory price reporting and limits on the range</p> <p>CHANGE: harmonize the IFQ, coastal logbooks, and trip ticket data collection programs</p>
Participation and Operational Changes	<ul style="list-style-type: none"> Reduced fishing capacity and overcapacity such that technical efficiency and capacity utilization increased Contributed to consolidation and efficiency gains within the vertical line and bottom longline subsectors 	<p>ISSUE: further consolidation is possible as fishing capacity remains large relative to the quotas</p>
Share and Allocation Caps	<ul style="list-style-type: none"> The distributions of shares and landings by share category have barely changed Market power does not exist in any of the markets (i.e., landings, shares, or annual allocation) Economies of scale are not being exhausted (i.e., average costs of production are not minimized) Existing share and annual allocation caps are not constraining landings 	<p>ISSUE: retaining the current share and annual allocation caps would continue to prevent participants from exercising market power</p> <p>CHANGE: providing flexibility by increasing some caps would not create additional risk of market power but would allow for further cost efficiencies</p>
Share, Allocation, and Ex-Vessel Prices	<ul style="list-style-type: none"> Grouper ex-vessel prices increased minimally Profitability of fishing operations improved due to the reduced operating costs 	<p>ISSUE: the collection of accurate share and allocation prices continue to be a challenge</p>
Catch and Sustainability	<ul style="list-style-type: none"> Year-round fishing opportunities have been provided Gag and red grouper multiuse shares were not as effective as anticipated Discards of species in program were reduced, especially red grouper and all gear types 	<p>CHANGE: consider replacing gag and red grouper multiuse shares with shares specifically for red and gag groupers</p>
Safety at Sea	<ul style="list-style-type: none"> Improved safety at sea of participating commercial fishers 	None stated
New Entrants	<ul style="list-style-type: none"> Crew and hired captains who do not own shares have become disenfranchised 	<p>CHANGE: foster access by considering loan programs, share redistributions, and quota banks</p> <p>ISSUE: promoting new entrants is inconsistent with the program goal of reducing overcapacity</p>
Monitoring and Enforcement	<ul style="list-style-type: none"> Violations of regulations can result in a seizure of annual allocation 	<p>ISSUE: seizures are not deducted from shareholders' account until the case settles; lengthy delays undermine effectiveness</p> <p>CHANGE: consider improved enforcement like in red snapper</p>
Administration and Cost Recovery	<ul style="list-style-type: none"> Administrative changes include reporting improvements for share and allocation transfer prices Cost recovery fees have fully funded the program 	None stated
Program Duration	<ul style="list-style-type: none"> Shares are issued for 10 years and will be renewed if not rescinded, limited, or modified Shares from nonactivated accounts were revoked to promote the full utilization 	<p>ISSUE: longer duration is more conducive to longer-term planning and conservation</p>

SOURCES: Adapted from Section 13.0 of the grouper-tilefish IFQ 5-year review (Gulf of Mexico Fishery Management Council, 2018a).

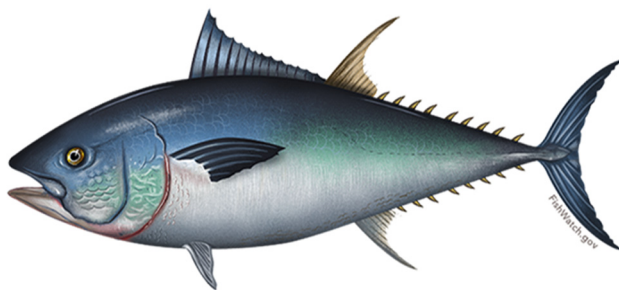


Image of bluefin tuna (*Thunnus thynnus*).
SOURCE: NOAA Fisheries.

Atlantic BFT are managed in the United States under Secretarial authority, through the Highly Migratory Species Division of the NMFS, rather than through the regional Council system. Ultimately, management takes place through the International Commission for the Conservation of Atlantic Tunas (ICCAT), where scientific information is used in a complex negotiation process to establish national quotas. NOAA Fisheries then administers the national quota for the United States. Although BFT populations are a small percentage of what they are estimated to have been before the industrial era, and have been

proposed as an endangered species (The Pew Charitable Trusts, 2017), the western stock of Atlantic BFT, the focus of U.S. fisheries, is now considered to not be subject to overfishing, although its overfished status is unknown (NOAA Fisheries, 2021).

In U.S. waters, permits are required for all BFT fisheries, whether commercial, for hire, or recreational. There are seven permit categories, of which four can target bluefin: general (commercial handgear), angling (recreational), harpoon, and purse seine. Longline and trap categories can only catch BFT as incidental to other targeted species. In recent years, allocation of the quota among the major sectors was 57% to general, 19.7% to anglers; and 18.6% to purse seine. Pelagic longline received 8.1% (plus a special deduction), and harpoon received 3.9%, trap received 0.1%, and reserve received the final 2.5%. Recreational fishing for BFT, whether private or for hire, can take place using angler or general permits and is a major component of the fishery.

The individual bluefin quota (IBQ) LAPP, implemented January 1, 2015, applies only to the pelagic longline fishery and concerns incidental catches of BFT. (The purse seine fleet has a separate allocation for targeting BFT, which is allotted to individuals annually and thus similar to a LAPP.) Most of its allocation goes to the reserve sector or is leased to the pelagic longline fishery (see Figure 3.4). There was a separate ICCAT allowance for dead discards until 2006, when they had to be accounted for within the U.S. annual quota (NMFS, 2019). Between 2006 and 2015, an allocation of 8.1% of total U.S. landings was given to the longline category to cover BFT bycatch when targeting swordfish and other tunas. Vessels could retain one, two, or three BFT if they had 2,000, 6,000, or 30,000 pounds of targeted catch on board, respectively. Bluefin tuna caught in excess of this limit were required to be discarded. Catches were routinely greater than the quota, requiring adjustments among categories, mainly by transferring from the purse seine allocation, which was underharvested. It was seen as a situation in which individual vessels had little incentive to keep within the limits. The industry advisory panel and various data analyses suggested the need for more individual accountability to keep catches within the category's quota (NMFS, 2019).

The catch share program for BFT—known as the IBQ program—was established on January 1, 2015, with Amendment 7 to the 2006 Consolidated Highly Migratory Species Fishery Management Plan. The 8.1% share of the overall quota for longliners was divided into exclusive individual quotas assigned to owners of individual vessels to cover bycatch. The LAPP was part of a larger complex of measures to improve accountability and thus reduce problems that the United States had in accounting for and reducing dead discards of bluefin tuna, while maintaining viable fisheries for other large pelagic species. Central was an electronic monitoring program, combined with a requirement to have a functioning Vessel Monitoring System aboard participating fishing vessels. To further support more individual accountability and reduce interactions with BFT, other measures were adopted. These included two gear-restricted areas; required closure of the pelagic longline fishery upon reaching annual BFT quota; termination of target catch requirements associated with the retention of incidentally caught BFT in the pelagic longline fishery; and

required retention of any dead, legal-sized BFT unintentionally harvested as bycatch (NMFS, 2019). Amendment 7 also included an increase to the longline category quota and increased management flexibility for transfers among quota categories through the reserve category quota (NMFS, 2019).

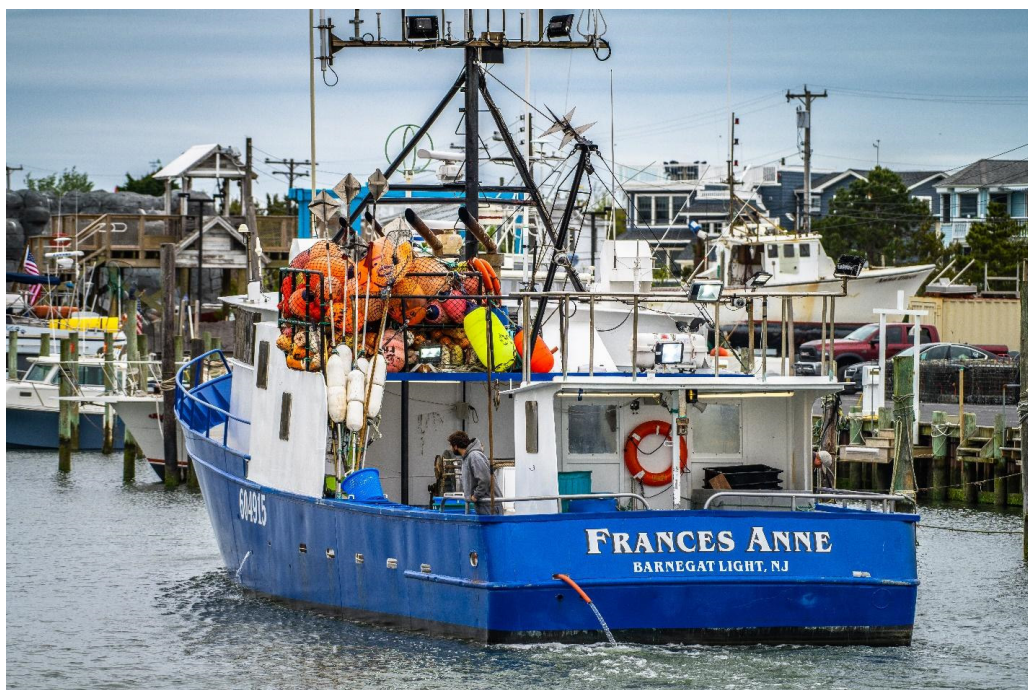


FIGURE 3.4 Pelagic Longliner F/V Frances Anne, Viking Village, Barnegat Light, New Jersey. SOURCE: Britton Spark.

Assessment of Meeting Goals and Objectives

The LAPP was part of a larger complex of measures to improve accountability and thus reduce problems that the United States had in accounting for and reducing dead discards of BFT, while maintaining viable fisheries for other large pelagic species. Since the Electronic Monitoring Program was implemented to support the LAPP, the effects of both can be attributed to the LAPP. The program goal and anticipated benefits are summarized in Box 3.3, and the 3-year review conclusions are summarized in Table 3.4.

BOX 3.3 Goal and Anticipated Benefits of the Bluefin Tuna IBQ Program

Program Goal

“... to introduce individual accountability to permitted pelagic longline vessels for bluefin bycatch and incentivize those participating ... to minimize interactions with bluefin as a conservation and management measure for the stock.” (NMFS, 2019)

Anticipated Benefits

The five objectives are expected to reduce bluefin tuna landings and dead discards by providing incentives and flexibility for the pelagic longline fleet that allows for optimization of fishing opportunities to maintain profitability, and balancing these expected outcomes with impacts on the directed permit categories and the broader objectives of the 2006 Consolidated HMS FMP and MSA.

TABLE 3.4 Bluefin Tuna IBQ 3-Year Review Conclusions by Type

Type of Impacts	Impacts to Date (September 2019)	Recommended Changes or Issues That Remain
Allocations and Accountability Rules	<ul style="list-style-type: none"> The current distribution of allocation may not align with the needs of commercial vessels Three approaches have been used for accountability and all were successful 	CHANGE: consider a different method of share allocation, and/or distribution of allocation among permit holders CHANGE: consider quarterly accountability
Eligibility	<ul style="list-style-type: none"> Eligibility criteria were not excessively restrictive; shares were awarded to inactive vessels 	None stated
Catch and Sustainability	<ul style="list-style-type: none"> Catch did not exceed the quota and dead discards were reduced 	None stated
Accumulation Caps	<ul style="list-style-type: none"> There are data to consider accumulation caps 	CHANGE: caps on allocation used or shares distributed to one entity warrant consideration
Data Collection, Reporting, Monitoring, and Enforcement	<ul style="list-style-type: none"> Compliance with Vessel Monitoring System reporting requirement increased over time Electronic monitoring program verified the counts and identification of bluefin reported by the vessel operator 	None stated
Duration	<ul style="list-style-type: none"> No duration was specified; hence, per the MSA, it is not to exceed 10 years 	None stated
New Entrants	<ul style="list-style-type: none"> No unreasonable barriers; despite new entrants to the fishery, there was a decline in the number of vessels allocated IBQ 	None stated
Cost Recovery	<ul style="list-style-type: none"> None 	CHANGE: will be considered in Amendment 13 ISSUE: will create social impact that could undermine support for the program

SOURCE: Adapted from the bluefin tuna IBQ 3-year review (NMFS, 2019).

According to the interim review in September 2019, total pelagic longline (PLL) and BFT catch and dead discards have declined, as have the number of vessels and percentage of active vessels landing BFT. The incentives for landing BFT have succeeded as BFT retention rates increased. Thus, objectives 1 and 2 have been met. However, it was noted that the decline in vessels in the fishery was also likely part of a longer-term process of decline in the U.S. pelagic longline fishery due to their positions in the global market for swordfish, tunas, and other large pelagic fishes. Flexibility (objective 3) was provided to the PLL fleet through in-season IBQ allocations, as well as transfers or leasing from the purse seine sector, that

- helped account for BFT landings and dead discards,
- reduced quota debt,
- fostered leasing of IBQ allocation, and
- reduced uncertainty in the fishery.

The program sought to optimize fishing opportunities and maintain profitability in spite of an intended reduction in BFT mortality from the PLL fleet. To date, and in a continuation of a trend observed before the program was implemented, revenues from the top three revenue-generating species—swordfish, yellowfin, and bigeye—decreased.

The IBQ Program contributed to reduced revenue and fishing effort during the IBQ period. The reduction in fishing effort during 2015 compared to 2014 may have been due to uncertainty regarding the new IBQ Program, as well as the factors driving the long-term reduction in fishing effort. The increasing pattern in average annual operating income supports the contention that the economic situation has stabilized for many of the vessels that fished during the IBQ period, although there is high annual variability in the data. There are conflicting patterns in the data, such as increasing average annual operating income, but declining numbers of active vessels. (NMFS, 2019)

It is difficult to separate out the influence of the IBQ program from other factors that affected this fishery such as swordfish imports, closed areas, and availability of target species. In addition, several social factors were noted in the review:

- A positive social impact associated with the IBQ program was the reduction in the frustration for fishery participants associated with regulatory dead discarding of bluefin.
- As the average cost of leased IBQ allocation fell over time, the financial stress associated with that cost was reduced, but was not eliminated.
- Recommendations to help foster the leasing of IBQ corroborates the findings of Ropicki and Larkin (2014) whereby the role of social networks affects search costs that can hamper the development of an autonomous market. With the IBQ program, entrants are hampered by lack of experience with the transfer market that is recognized by managers.

Wreckfish (South Atlantic)

The Fishery and Its LAPP

Wreckfish (*Polyprion americanus*) in the South Atlantic is a predominantly commercial fishery with a nominal recreational catch (i.e., 5% of annual catch limit) that often goes uncaught. Furthermore, this is an extremely small fishery. There are currently six active shareholders spread across the South Atlantic management region. Commercial harvest is permitted under a LAPP (ITQ) system, with an additional limited access snapper-grouper permit required. No trip limit or minimum size restrictions have been established. Recreational fishing is allowed in July and August, with a bag limit of one per vessel per day and no minimum size limit. Commercial fishing is year round except for an annual spawning season closure (January 15 to April 15) (see Figure 3.5).

Wreckfish are widely distributed throughout the Atlantic. However, as the species matures, it moves from a pelagic to benthic habitat and also appears to migrate in a clockwise pattern. This behavior generally results in geographically distinct locations for different age groups (Ball et al., 2000).

For example, wreckfish found off the southeastern U.S. coast tend to be large and mature and may have migrated from the Mid-Atlantic Ridge or from areas further east (Sedberry et al., 1996, 1999). Within U.S. waters, wreckfish management is solely under the jurisdiction of the South Atlantic Fisheries Management Council (SAFMC).

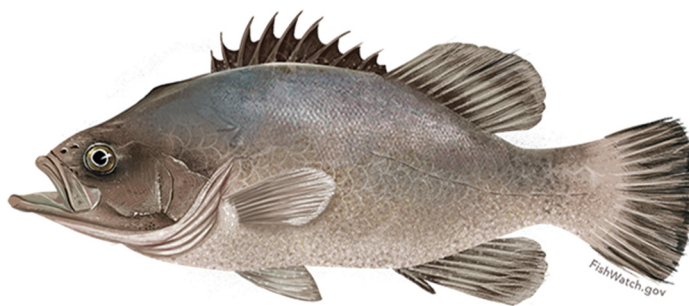


Image of wreckfish (*Polyprion americanus*).
SOURCE: NOAA Fisheries.

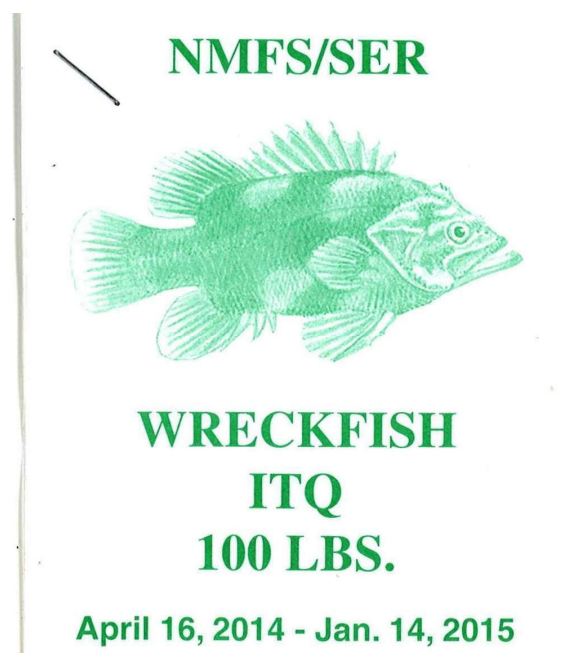


FIGURE 3.5 Coupon used for allocation of wreckfish ITQ in 2014-2015. SOURCE: NOAA.

The North American wreckfish population was discovered in the mid-1980s off of the Charleston Bump, nearly 100 miles southeast of Charleston, South Carolina. The accidental discovery was made by swordfish fishers seeking lost longline gear (Gauvin et al., 1994; Yandle and Crosson, 2015).

Wreckfish are mostly caught on underwater ridge systems (Sedberry et al., 1999) at depths between 1,500 and 2,000 feet. Fishing primarily occurs out of Charleston, South Carolina, and the east coast of Florida, with some more recent activity out of Townsend, Georgia (SAFMC, 2019). Initial harvesters came from a mix of boats that had long histories of working in deepwater fisheries and shrimpers who saw the new fishery as an opportunity to diversify their catch (Richardson, 1994; Vaughan et al., 1993; Yandle and Crosson, 2015). While nominally a mixed-use fishery (SAFMC, 2019), *de facto* it is a commercial fishery due to both the distance traveled and the specialized gear required. Recreational fishers occasionally land wreckfish, but it appears to be a novelty rather than a targeted fishery.

Wreckfish harvest rapidly expanded from 30,000 pounds in 1987 to four million pounds in 1990. Driven by concern over biological sustainability, the SAFMC introduced a permit system in 1990 and implemented a new catch limit on the fleet. The 2 million pound limit was caught within 4 months (Gauvin et al., 1994), spurring the introduction of trip limits and gear restrictions in 1991. The most significant gear restriction was the ban on bottom longlines, an essential tool for the shrimper conversion vessels (SAFMC, 1992a). At the same time, both wreckfish and market-competing grouper prices declined (SAFMC, 1992b). These events resulted in fishery participation declines even before the ITQ program introduction (Richardson, 1994).

Assessment of Meeting Goals and Objectives

The IFQ program was implemented in 1992, prior to LAPP legislation, and first reviewed in 2009. The second official review was in 2019. Since the 2009 review, the allocation between sectors was established (95% commercial, 5% recreational), the total allowable catch was reduced significantly (by 88%), the number of shareholders declined, and a cap on shareholdings was established. The 2019 review assesses the success of the program in meeting its objectives by comparing the 3-year period after the 2009 review with the 5 years that followed since they would have been impacted by the changes to the fishery mentioned above. As such, this is not a comprehensive review of the effects of the IFQ program since

inception; it focuses on changes since the previous review that was conducted a decade earlier. Moreover, it is not a review of the entire management system but instead focuses on changes to the IFQ program in particular.

BOX 3.4 Goal and Anticipated Benefits of the Wreckfish IFQ Program

Program Goal

“... to manage the wreckfish sector of the snapper-grouper fishery so that its long-term economic viability will be preserved.” (Federal Register, 1992)

Anticipated Benefits

The initial establishment of the program in 1992 sought to limit access to the fishery, and thereby reduce the risk of “overcapitalization in the harvesting and processing/distribution sectors,” through an ITQ system in order to achieve six objectives that focused on expected outcomes associated with creating long-run conservation, compliance and profit incentives among fishers with a management system that would allow for new entrants, providing stability and the opportunity for participants to plan for the long term (and use a marketplace to adjust harvest strategies), and would reduce gear and area conflicts. (SAFMC, 2019)

The 2019 review revisited the overall goal along with other program-specific objectives and offered other insights regarding program management and success. By 2019, there were notable documented improvements in the performance of the fishery. More stringent management measures had not been needed and the program appears to have stabilized the harvester sector, but management costs were concluded to be “higher than necessary.” It is still not possible to measure investment, and stability in the dealer sector will likely not be possible as dealers are not as primarily dependent on wreckfish as are the harvesters (see Table 3.5).

The program-specific objective to “[d]evelop a mechanism that allows the marketplace to drive harvest strategies and product forms in order to maintain product continuity and increase total producer and consumer benefits from the fishery” contains several potential measures to evaluate. They were deemed to have been achieved overall, with the caveat that uncertainty remains (see Box 3.4).

Using the utilization rate of catch to quota and other indicators, it was concluded that by 2019 the objective of minimizing overcapitalization was partially achieved. Finally, the objective of providing opportunity for new fishers’ entry was deemed to have been achieved with the caveat that uncertainty remains.

In general, the program has been relatively successful in achieving its stated objectives, although there is still room for further improvement, particularly with respect to confidentiality and related constraints; moving away from a coupon-based program to an electronic one; cost recovery; wreckfish permit requirement; allocation issues; offloading sites and times; and economic data collection. (SAFMC, 2020)

Finally, the most recent review called for a revision of the overall goals and objectives of this program to distinguish between goals and objectives that would also facilitate their evaluation and collapse related objectives. This is a unique issue in this fishery as data are limited both on the social science side by confidentiality (due to the small number of participants and NOAA’s policy against reporting data on fewer than four entities) and on the natural science side by being a bottom-tier stock for stock assessment priorities that limits the availability of data and analysis needed to guide managers in the pursuit of the IFQ goal and objectives.

TABLE 3.5 Wreckfish IFQ 2019 Review Conclusions by Topic

Type of Impacts (pp. 65-71)	Conclusion	Recommended Changes or Issues That Remain
Allocations and Accountability Rules	<ul style="list-style-type: none"> Recreational demand for wreckfish is weak so the 5% quota goes unused 	CHANGE: consider revisiting sector allocations to either remove sectors or reduce the recreational allocation to improve utilization and help meet the MSA objectives
Eligibility	<ul style="list-style-type: none"> The commercial wreckfish permit is redundant to the commercial snapper-grouper permit and adds complexity to the analysis The commercial wreckfish permit has more stringent requirements than in other fisheries and increases the likelihood that fisheries data will remain confidential and unavailable for management Under Amendment 20(A) inactive shares reverted back to the management 	CHANGE: consider eliminating the permit requirement ISSUE: the pulling back of shares eliminated participants from the fishery
Catch and Sustainability ^a	<ul style="list-style-type: none"> Catch has been extremely variable, in part due to economic reasons, not stock constraints 	None stated
Accumulation Caps ^a	<ul style="list-style-type: none"> Amendment 20(A) established a cap of 49% 	None stated
Data Collection, Reporting, Monitoring, and Enforcement	<ul style="list-style-type: none"> The current paper system is inefficient, compromises data quality, and causes redundancies The designation of offloading sites and times is burdensome and inefficient 	CHANGE: suggest migrating to an electronic system to benefit harvesters, reduce management costs and aid monitoring ISSUE: would require startup expenses and learning curve CHANGE: consider changing or eliminating ISSUE: a new system would have costs
New Entrants ^a	<ul style="list-style-type: none"> Requires shares and permits 	CHANGE: consider loan programs to facilitate entry ISSUE: loan programs are counter to limiting access that is often a goal of LAPPs
Cost Recovery	<ul style="list-style-type: none"> No fee currently collected 	CHANGE: none recommended ISSUE: it takes resources to assess and collect fees
Safety at Sea	<ul style="list-style-type: none"> No evidence of safety concerns 	None stated

^a Not discussed explicitly in 2019 review since not considered to have changed since last review.

SOURCES: Adapted from pp. 65-71 of the wreckfish IFQ 2019 review (SAFMC, 2019).

Golden Tilefish (Mid-Atlantic)

The Fishery and Its LAPP

Golden tilefish (*Lopholatilus chamaeleonticeps*) are found along the outer continental shelf and upper continental slope along the Atlantic coast and into the Gulf of Mexico and as far south as Brazil. The Mid-Atlantic stock extends from the Canadian border to the Virginia/North Carolina border, which distinguishes this stock from the South Atlantic stock for management purposes. Tilefish grow slowly, have long lifespans, and are most abundant in the Mid-Atlantic region from Nantucket Island, Massachusetts, south to Cape May, New Jersey



Image of golden tilefish (*Lopholatilus chamaeleonticeps*). SOURCE: NOAA. Fisheries.

(NOAA Fisheries, 2021). This region also hosts other tilefish, particularly blueline tilefish (*Caulolatilus microps*), for which a recreational and for-hire fishery has developed in recent years as well as a mainly incidental catch commercial fishery (Mid-Atlantic Fishery Management Council, 2021). It is currently managed within an open access regime.

Commercial fishing for golden tilefish (hereafter “tilefish”) north of the North Carolina border is under the management jurisdiction of the Mid-Atlantic Fishery Management Council (MAFMC). Fishers developed a fishery for this species in the early 20th century, but it was very limited and sporadic. In the early 1970s a longline fishery emerged, mainly from the port of Barnegat Light, New Jersey. A recreational fishery also emerged for a few years. Peak catches occurred in the late 1970s and early 1980s; they have since declined. In the meantime, fishing effort shifted to ports in New York (Montauk, Hampton Bays). Today the bulk of landings are in Montauk, New York, and to a lesser extent from Barnegat Light. Participation in the fishery has declined greatly, a process accelerated by limited access measures. In 2001, there were 50 fishing vessels; the 2009 IFQ program identified only 13 eligible vessels.

The commercial fishery is very small, with only six or seven boats actively targeting golden tilefish as of 2021, and they are concentrated in two small tight-knit fishing communities, Montauk, New York, and Barnegat Light, New Jersey (see Figure 3.6), although incidental catches of tilefish occur up and down the coast. The fishing gear used is a highly specialized deepwater, baited longline. The major market is the New York wholesale seafood market, and the fishing grounds, on the edge of the continental shelf, are highly localized.



FIGURE 3.6 Captain and Crew of F/V Sea Farmer with golden tilefish, Viking Village, Barnegat Light, New Jersey. SOURCE: Britton Spark.

Because of the deepwater habitat and behavior of tilefish, the NOAA bottom trawl surveys rarely catch them, and management depends on catch per unit effort data collected from the fleet (Nitschke et al., 1999). Efforts to address observed decline in size and abundance of tilefish led to discussion of an IFQ approach based on historical landings in the 1980s, but nothing was done to manage tilefish even though it was declared overfished. Meanwhile, many of the Barnegat Light fishers moved into other fisheries, including longlining for swordfish and other large pelagics and scalloping, whereas the Montauk fishers continued to specialize in tilefish.

Required by the 1996 reauthorization of the MSA to address overfishing for all stocks, the MAFMC once again took up the matter in 1999. It was prevented from using IFQs because of the congressional moratorium, and instead created a tiered limited entry system, which began in November 2001. Based on historical catch, “tiers” of the fishing industry received proportionate allocations of the total allowable level (TAL) of catch: 66% of the TAL went to full-time Tier 1, 15% to full-time Tier 2, and 19% to the part-time tier. An additional 5% of the TAL went to boats with incidental catches. Fifty vessels were eligible for this

limited entry program (Mid-Atlantic Fishery Management Council, 2017), a considerable reduction from the number of boats historically in the fishery.

The tiered limited access period, 2001-2009, saw the creation of cooperative management on the part of the leading full-time fishers and problems with catch overages and closures for others that eventually led to the creation of IFQs. The full-time Tier 1 members created a nonprofit association through which members collectively organized to manage the tier quota allocation, as well as provide various marketing benefits and protections (Kitts et al., 2007; Pinto da Silva and Kitts, 2006). However, in some years the other tiers had early closures (Mid-Atlantic Fishery Management Council, 2017). Meanwhile, the stock began to recover. As of 2017, the Mid-Atlantic stock is not currently overfished and is not subject to overfishing (NOAA Fisheries, 2017).

The IFQ system began in November 2009, whereby each group or tier received roughly the same percentage of the overall quota as before but specific allocations were awarded to individual vessels, based on their performance during a qualification period, 2001-2005. A total of 31 vessels in the limited-access fishery were eligible to participate in the IFQ system, but only 13 of these met the minimal criteria required to be issued a quota allocation (Mid-Atlantic Fishery Management Council, 2017). The 13 owners of the qualifying vessels became IFQ shareholders. Most of the vessels based in Barnegat Light did not qualify for, or received very small, IFQ allotments and were thus excluded. Although involved in tilefish fishing in the 1970s to the 1990s, they had mainly switched to other species by the eligibility period, despite the fact that some had started the fishery in 1971 and done much to develop the markets (Moore, 2020). The choice of 2001-2009 as the qualifying period was a point of contention for many years (Degener, 2009). Subsequent quota share trading activity has led to increased participation of vessels hailing from Barnegat Light.

The number of shareholders has remained much the same, but the number of active fishing vessels in the IFQ fishery has declined to about six or seven per year. However, there is a very large incidental catch sector, fishing under open access conditions with a small trip limit (500 pounds whole weight per voyage). The pre-IFQ baseline was 2,334 permits; in the IFQ period 2010-2015 there was an average of 2,068 vessels with permits for incidental catches of tilefish. The incidental sector is allotted 5% of the overall TAL. Because of allegations that some fishers are targeting golden tilefish through this permit, the MAFMC recently developed a rule requiring that it be no more than 50% by weight of the total landings.

The recreational sector has no allocation. It remains open access; the Council manages it with bag limits. At times there has been considerable for-hire activity, often associated with offshore tuna fishing trips. The extent of private angling is unknown. To address questions about the scale and needs of recreational fishing and the lack of data for both for-hire and private angling, in August 2020 the Greater Atlantic Regional Fisheries Office began requiring a private recreational tilefish permit and electronic Vessel Trip Report catch reporting for all vessels fishing for or retaining both golden tilefish and blueline tilefish from Virginia to Maine. The committee heard some concern from commercial fishers that the recreational reporting is solely on the honor system, there being no checks comparable to the dealer reporting that ensures high accountability of commercial fishing.

Assessment of Meeting Goals and Objectives

Prior to the IFQ program for golden tilefish (tilefish), the fishery was managed with a constant harvest strategy in order to rebuild the stock. During that time, two sectors of the fishery (i.e., full-time Tier 2 and part time) operated with derby-style fishing pressures that shortened seasons and weakened the market for tilefish.

With respect to the stated goals of the program:

In general terms, it was found that overcapacity has been reduced since the program was implemented, and it appears that derby-style fishing has subsided and that ex-vessel prices have improved under the Individual Fishing Quota system. (Mid-Atlantic Fishery Management Council, 2017)

Box 3.5 summarizes the program goal and anticipated benefits and Table 3.6 summarizes additional conclusions and recommendations.

BOX 3.5 Goal and Anticipated Benefits of the Golden Tilefish IFQ Program	
Program Goal	
“... to reduce overcapacity in the commercial fishery, and to eliminate, to the extent possible, problems associated with a derby-style fishery.” (Federal Register, 2009)	
Anticipated Benefits	
“... reduce discards and waste for sectors experiencing early closures in the commercial fishery, ... [eliminate incentive for] vessel operators ... to go to sea during unsafe winter weather conditions in order to compete with someone else for a share of the quota, ... [and] to provide vessel operators more flexibility in deciding when, where, and how to fish.” (Mid-Atlantic Fishery Management Council, 2017)	

TABLE 3.6 Golden Tilefish IFQ 5-Year Review Conclusions by Type

Type of Impacts (Sections 7 and 8)	Conclusion from 5-Year Review (September 2017)	Recommended Changes or Issues That Remain
Participant Consolidation and Overcapacity	<ul style="list-style-type: none"> Moderate reduction of overcapacity (active vessels declined 25% but allocation holders and dealers remained steady) 	None stated
Mitigating Race to Fish	<ul style="list-style-type: none"> Successful at fostering year-round landings, especially for old full-time Tier 2 and part-time categories 	ISSUE: cannot trace price increases directly to IFQ
Improved Safety at Sea	<ul style="list-style-type: none"> Apparent reduction of marine casualty incidents 	ISSUE: reductions cannot be tied to the IFQ program
Cost Recovery	<ul style="list-style-type: none"> Initial allocation holders pay, which means subleasing is prohibited to facilitate tracking 	CHANGE: consider increasing flexibility by assessing fee on landings
Fishing Year	<ul style="list-style-type: none"> The fishing year differs from the period used for stock assessments and cost recovery (i.e., calendar year), so the latter covers two periods and complicates administration 	CHANGE: consider using the calendar year for both
Framework 2 (modify incidental limit, clarify recreational gear, eliminate interactive voice response (IVR) requirement, prohibit fishing multiple IFQ allocations, requiring landing with head on)	<ul style="list-style-type: none"> Vessels are authorized to land during a specific time period, which means all landings are attributable to that allocation (i.e., harvesting multiple allocations cannot overlap in time) Interactive voice response reporting is redundant Landings and dealer reporting are with head on so there is an inconsistency that also complicates monitoring the catch limits 	CHANGE: consider requiring vessels to only fish one allocation at a time CHANGE: consider eliminating IVR reporting CHANGE: consider requiring golden tilefish to be landed with the head attached
Industry Concerns	<ul style="list-style-type: none"> Desire flexibility to carry over IFQ to next year Highgrading by small allocation holders Variable cost recovery owed at end of year and prevents planning Increased recreational landings will negatively impact stock size and IFQ allocations 	CHANGE: consider allowing unused IFQ to carry over across fishing years ISSUE: increases risk of overfishing ISSUE: analysis showed no irregularities with group ISSUE: managers attempt to estimate cost figures early CHANGE: if monitoring indicates removals “substantially larger,” will need to be considered in stock assessment

SOURCES: Adapted from the golden tilefish IFQ 5-year review (Mid-Atlantic Fishery Management Council, 2017).

In summary, the tilefish IFQ program “has resulted in a moderate reduction of overcapacity” and “was successful at mitigating the race to fish” as tilefish can be landed year round (Mid-Atlantic Fishery Management Council, 2017). As a result, “fleet-wide economic trends have been positive since the implementation of the IFQ program” (Mid-Atlantic Fishery Management Council, 2017).

Issues to Consider During Future LAPP Reviews

Regularly scheduled program reviews are vital to assessing program performance and thus building effective public policy (Newcomer et al., 2015; Vedung, 2017). As illustrated above, these systematic LAPP reviews provide important information about LAPPs and are resulting in changes and improvements. They also provide an opportunity to learn from a collection of LAPP reviews, especially with a focus on spillover effects, as the fisheries under consideration are quite diverse and any common themes will prove useful. However, during the process of recapping the program reviews themselves, several themes emerged for improving future program reviews.

The MSA mandated reviews but provided no details about the extent or subject materials to be included in such reviews. As a result, there is not necessarily consistency across reviews despite a call for such in the guidelines (Morrison, 2017b). This has resulted in different metrics and different types of data that can be used for different programs thereby hampering comparisons. Measures of fishing industry or quota market concentration are examples. Standard metrics of fishery concentration (e.g., Herfindahl-Hirschman index [HHI] and Gini coefficients) were used where data allowed but might not be comparable as there are many nuances to applying these approaches (e.g., Yitzhaki, 1998). One such nuance with the HHI is that geographic submarkets would affect the measure, which could be an issue for programs in the Gulf of Mexico. For the Gini coefficient, a complication is that the units be identical. For fisheries with both individuals and companies as owners, it might be insightful to add measures of entropy (e.g., Theil indices).

Specified goals and objectives often simply assign directional effects (e.g., “reduce fleet size”), not quantitative targets. As a result, while improvements are documented, improvements alone are insufficient to assess the benefits of future changes or how close we are to the “optimum.” This was noted in the guidelines as well (Morrison, 2017b). Quantifiable, specific objectives with targets for such metrics as fleet size would allow future evaluators to determine the program designers’ intentions, for example, with respect to addressing overcapitalization and evaluating related measures of concentration, and according to the guidance should be included in the Fishery Management Plan.

Often it is difficult to determine causation between LAPPs and their intended outcomes. In many fisheries, but specifically in the Gulf of Mexico, several notable events occurred during the time period of review that certainly affected the data used in the analysis such that caution should be taken with respect to ascribing the impacts to the implementation of LAPPs. These changes include the *Deepwater Horizon* oil spill in 2010 that resulted in extensive fishing closures in space and time and adverse effects on the market and demand for product, including the imposition of annual catch limits and imposed penalties for overages. Program reviews need to be explicit about the impacts of such events in evaluating causation.

The program reviews were tasked with evaluating the goals and objectives of the program, the underlying Fishery Management Plan, and the MSA. Because reviews can simply summarize information in other publications, in most cases it was challenging to ascertain the extent to which the non-LAPP measures of fishery performance were addressed. In some cases, the goals and objectives were not clearly defined, which hampered analysis (e.g., wreckfish). Terms such as “viability” and “overcapitalization” can be complex to evaluate when there are different metrics and different indicators of capital. These issues are exacerbated when the industry is too small to analyze statistically or when data confidentiality precludes data analysis.

Ecological Impacts of LAPPs in Mixed-Use Fisheries

Conceptual and Theoretical Basis

Limited Access Privilege Programs (LAPPs) are primarily introduced to meet economic or social objectives, but economists and ecologists recognize several ways by which LAPPs can alter the conservation status of fisheries and provide ecological benefits. As elsewhere in this report, we use the term LAPP and individual fishing quota (IFQ; a common term for similar programs throughout the world) interchangeably. The literature also focuses on individual transferable quotas (ITQs), but tradable quotas are a subset of individual fishing quotas. Not all programs with individual quotas allow trading, and programs that do allow trading often restrict trading in various ways. For example, the bluefin tuna LAPP, a bycatch program, allows only annual leasing of allocations, not the sale of shares.

One pathway to the ecological benefits of LAPPs is that they may provide a stewardship incentive that is lacking in open or limited access fisheries (Costello et al., 2010; Fujita et al., 1998; Grafton et al., 2006). When the access right is secure, durable, and exclusive (Arnason, 2005), individuals stand to benefit in the future from conservation actions taken today. This incentive might be manifested in investments in more sophisticated stock assessment and forecasts, removal of derelict gear, research and development of lower impact gears for avoiding habitat damage or bycatch, or advocating for lower annual catch quotas in the face of uncertainty (Branch, 2009). Removal of derelict gear and reduction of bycatch may have positive impacts on populations of nontargeted species as well (Scheld et al., 2016). Furthermore, the disincentive structure against overfishing is also changed. In LAPPs, the benefits and penalties for catch overages apply to the individual vessel or sector, in contrast to open or limited access fisheries where the benefits of catch overages accrue to those responsible for the violation but the penalty (in terms of reduced fishing opportunities in the following year) is incurred by all members of the fishery.

We should note that a range of scientists offer critical assessments of this theoretical link between LAPPs and stewardship (e.g., Acheson et al., 2015; Donkersloot and Carothers, 2017; Foley et al., 2015; Macinko and Bromley, 2004; McCormack 2017; Pinkerton, 2014, 2015; Sumaila, 2010; Van Putten et al., 2014), and in that light it is important to note that by law the LAPP quota shares are revocable privileges with limited duration (16 U.S.C. § 1853a(b)) although the committee uses “rights” and “privileges” interchangeably (primarily because the former is used in theoretical discussions and the latter is a result of U.S. law). Nonetheless, the greater liability of individual privilege holders in LAPPs, especially when combined with concurrent accountability measures, is likely to increase incentives to adhere to science-based limits on catch.

A second pathway to ecological benefits is that LAPPs allow for catch:quota balancing when the IFQ is transferable, especially in multispecies fisheries (Branch, 2009; Branch and Hilborn, 2008; Melnychuk et al., 2012; Sanchirico et al., 2006; Squires et al., 1998). Catch:quota balancing refers to the ability of the fleet to fully utilize the quota of abundant or productive stocks without exceeding the quota on depleted or unproductive stocks. This is often challenging in mixed-species fisheries because of the limited ability to target specific species. When quota transfer markets are working effectively, operators can lease quotas as needed to account for imbalances between their quota and catches (Sanchirico et al., 2006). Keeping within the quota is essential to the success of catch limits as major tools for sustainable fisheries.

A third pathway is that LAPPs tend to end or reduce the race to fish (Birkenbach et al., 2017) and thereby reduce or eliminate the adverse ecological consequences that the race to fish can generate. In derby fisheries, the ability to target species is reduced, the likelihood of catch overages is high, and monitoring

catch and catch overages might be too slow to allow for responsive management action. As a result, derby fisheries are characterized by overcapitalization, high bycatch rates, damage to vulnerable habitats, and overfishing caused by annual quota overages.

A fourth pathway for ecological effects is that the changes to the fishery monitoring, accountability, and quota-setting processes that often accompany the creation of an IFQ program allow for reduced overfishing. Many LAPPs require robust catch-accounting systems, onboard observers, and an annual catch quota based on a stock assessment. All of these can produce conservation benefits in the form of maintained catches within biological limits, improved stock assessment by enhanced catch monitoring (Rudd and Branch, 2017), and enhanced accounting of incidental catch of vulnerable or protected species. Thus, the limited access privilege itself may not play a direct role in producing ecological benefits, but the regulatory instruments needed to enact the LAPP may nevertheless do so.

All of the above pathways rely on sound design of LAPPs (Bonzon et al., 2013). Improperly designed and implemented LAPPs can induce perverse incentives that lead to fishing practices that erode ecological conditions (Gibbs, 2009). Catch limits that do not apply to discarded fish can lead to highgrading, a wasteful practice in which lower-valued fish are discarded so that the quota can be fulfilled with higher-valued fish (Anderson, 1994). In the absence of robust enforcement and accountability, illegal and unreported catches can erode the ability of the fishery to reach ecological goals.¹

Empirical Evidence for Ecological Impacts of LAPPs

Because LAPPs have been implemented in many fisheries around the world, there has been significant opportunity to evaluate the evidence supporting the theoretical expectations described above. One common theme that has emerged from this body of work is that ecological indicators tend to show reduced interannual variability in several key indicators of stock health when compared to other fisheries. One of the first lines of evidence was the analysis of landings time series conducted by Costello et al. (2008). They found that periods of very low catches compared to the long-term maximum catches were less common in LAPPs than other fisheries that otherwise shared similar characteristics. Essington (2010) found similar variance-dampening effects of North American LAPPs on catch:quota ratios, fishing mortality rates, fishery landings, and target species discards, but not for population biomass. Moreover, there was little evidence of reduction in the mean levels of most of these metrics.

Essington et al. (2012) expanded the above analysis to include more than 140 fisheries from around the world, finding a similar overall pattern: catch shares reduce variance in landings and fishing mortality rate, minimally impact the mean levels of ecological indicators, and have no effect on population biomass. The latter finding was consistent with that of Chu (2009), who found no evidence that biomass levels were, on average, greater after program implementation in a review of 20 stocks. Surprisingly, the estimated response in mean fishing rate to catch shares was unrelated to fishing intensity prior to catch share implementation (Essington et al., 2012). That is, the stewardship incentive hypothesis would predict that fisheries with high fishing rates relative to the maximum rate of fishing mortality, or F_{MSY} , would exhibit a decline in fishing rates after LAPP implementation. However, fisheries with such high fishing rates did not have exceptionally large reductions in fishing intensity. At a regional level, LAPPs with high durability (i.e., access privilege extended for long periods of time) had the highest variance dampening in landings and average fishing mortality tended to be reduced in fisheries with high observer coverage and a low proportion of multispecies fisheries.

Melnychuk et al. (2012) took a different approach by asking whether LAPPs promoted fisheries that better met fishery targets. These targets included catch relative to catch quota, fishing rate relative to F_{MSY} , and population biomass relative to B_{MSY} , or the biomass that will allow a fish stock to provide the maximum sustainable yield. LAPPs and partial LAPPs (essentially, LAPPs in mixed-use fisheries where one sector was in a LAPP while others were not) generally had average catches that were closer to annual

¹ See, e.g., <https://oceana.ca/en/blog/rise-and-fall-codfather-north-americas-most-notorious-fishing-criminal> (accessed July 16, 2021).

catch quotas, lower intra-annual variability in catch:quota ratios, and higher catch:quota ratios than other quota-managed fisheries. LAPPs were slightly less likely to have large catch overages, but partial LAPPs frequently had catch overages. Generally, LAPPs did not perform as well as or better overall than comparable quota-regulated fisheries with respect to fishing rates or population biomass. The most prominent effect of LAPPs was in better matching of catches to quotas.

The improved catch:quota balancing of LAPPs is supported by analysis of several specific fisheries, including British Columbia (Branch, 2009), New Zealand, Iceland, and Australia (Sanchirico et al., 2006), and the Bering Sea and Aleutian Island (Abbott et al., 2015) multispecies groundfish fisheries. However, recent LAPPs have been less successful. The U.S. West Coast multispecies groundfish fishery has had relatively low catch:quota ratios for many stocks (Kuriyama et al., 2016; McQuaw and Hilborn, 2020). Generally, high-valued target species and one-half of the constraining species (species with low quota that potentially constrain fishing opportunities) had catch:quota ratios near 1, while less valuable species had catch:quota ratios usually less than 0.5. Generally, the U.S. northeast groundfish sector program had similar results; catch:quota ratios were low in that fishery, largely because of the constraints of low catch:quota for overfished Atlantic cod.²

How Might LAPPs Affect Ecological Indicators in Mixed-Use Fisheries?

The committee is unaware of any systematic meta-analysis conducted to reveal ecological outcomes in mixed-use fisheries. We therefore take the experiences from our understanding of how the LAPP components of fisheries change, as well as how LAPPs might alter the entire fishery system, to produce some hypotheses for how LAPPs might alter ecological outcomes in mixed-use fisheries.

Clearly, if the LAPP component of the fishery system constitutes a large amount of fishing effort and catch, then many of the benefits that are expected from LAPP fisheries might spill over into the entire fishery. If catch overages are reduced and fishing rates are kept within biological limits, then improvements in the LAPP fishery could lead to overall healthier stocks and therefore improved fishing opportunities in fishing sectors that are not part of the LAPP. While it is impossible to know what the biomass trajectory would have been in the absence of the LAPP, lower levels of compliance with total allowable catch (TAC) or other measures would likely have had negative consequences on stock status.

Another possible improvement is through reduced discarding. Although some LAPPs can promote discarding via highgrading, well-designed LAPPs avoid this through effective catch monitoring and counting discards against catch quotas. When discards count against the quota, and these discards are included in stock assessments and part of annual catch limits, it is unlikely that the LAPP itself will have biological consequences. That is, a change in discards will not alter the fishing mortality rate or produce inaccurate stock assessments. If discards are not reported, not incorporated in annual catch limits, and not fully treated in stock assessments, then reductions in discards could benefit the stock. However, unreported catch does not always lead to overfishing. Rather, only when there are temporal trends in the rates of unreported catch are annual catch limits at risk of exceeding biological limits (Rudd and Branch, 2017).

Bycatch of nontarget species in the LAPP component of a mixed-use fishery might also decline and thereby improve overall ecological status. Reducing the race to fish may allow more selective fishing practices, particularly if there is an economic incentive to avoid vulnerable species (e.g., through bycatch quotas or threat of Endangered Species Act listing). Changes in the timing and spatial distribution of fishing have the potential to either increase or decrease non-target-species bycatch. Finally, if overall fishing effort is reduced in the LAPP—through the consolidation of access privileges to the most efficient operators—then nontarget bycatch rates might also be diminished.

Finally, the introduction of LAPPs in one sector of the fishery might prompt changes in catch accounting that improves management of all fisheries. Creation of LAPPs usually requires a robust catch accounting system. These may include online catch reporting tools that allow vessels to send catch

² See <https://catchshareindicators.org/northeast/ecological-indicators/ratio-of-catch-to-quota> (accessed July 16, 2021).

information in near real time. Once these platforms are created, or other more accountable reporting mechanisms are adopted in LAPP fisheries, they may also encourage adoption of similar electronic reporting applications for other sectors not included in the LAPP for mixed-use fisheries (e.g., Topping and Suntz, 2015).

Little is known about how non-LAPP sectors respond to the changes that typically occur in LAPP sectors. While the spatial footprint of fishing likely responds to the introduction of LAPPs (Branch and Hilborn, 2008), the indirect effect of this change on competing sectors is unknown. Furthermore, without explicit goals and objectives for the non-LAPP sectors, it would be difficult to assess any impacts as positive or negative since an impacted factor may not be one of documented importance.

The implementation of IFQs can also have cascading effects on conservation programs for other species in a fishery complex, and particularly those that may be taken as bycatches in species-specific IFQ programs. A cogent example of this is for IFQs in the Gulf of Mexico, which consist of commercial IFQs for red snapper and for grouper-tilefish. The red snapper IFQ program was implemented in January 2007, and commercial allocations have not been exceeded since (see Figure 6.1). Because targeting reef fish often results in catch of multiple reef species (notably 12 groupers and tilefishes), these other species were included in a new IFQ program implemented in January 2010 (Stephen, 2020). An additional 2-year pilot program for the for-hire (or headboat) sector was implemented for red snapper and gag grouper (Stephen, 2020).

The conservation benefits of the red snapper commercial IFQ program (accounting for 51% of the annual catch allocation) were evident in the elimination of commercial overages (albeit small, see Figure 6.2) leading to improved conservation of the resource. The success of the program in doing this was a significant impetus in developing additional IFQ programs for other species in the reef fish complex (i.e., the grouper-tilefish IFQ plan; Gulf of Mexico Fishery Management Council, 2018a). In this regard, although the major reasons for the IFQ were economic, the result has been a program of increased adherence to conservation guidelines (at least by the commercial sectors). Thus, in contrast to the typical “serial depletion” scenario seen in many mixed-species fisheries (Orensanz et al., 1998; Pauly et al., 2002), the implementation of IFQs for some species and sectors in mixed-use and mixed-species fisheries may have the opposite effect in improving conservation of mixed resources (i.e., “serial conservation”).

Evaluating Ecological Consequences of LAPPs in Mixed-Use Fisheries: Case Studies

In the fisheries below, the committee takes a limited view of the ecological consequences that might have resulted from the implementation of a LAPP in a mixed-use fishery. The committee’s view is limited because only changes in the LAPP component of the fishery are considered (particularly those that might provide benefits or adverse consequences to other uses), but not the ecological consequences that might result from individuals leaving one fishery and entering another. The committee also does not consider how the formation of a LAPP altered behavior in other fisheries on the same stock, largely because of a paucity of information or evidence. Finally, elements of the LAPP—the limited access privilege and accompanying monitoring and accounting to support it—are separated out from other regulatory changes that might have been adopted (e.g., gear, and size or area restrictions) at the same time.

Gulf of Mexico Red Snapper LAPP

Did the LAPP Lead to Improved Catch: Quota Balancing in the Commercial LAPP?

No evidence.

The red snapper LAPP annual report documents that the ratio of landings to quota have fluctuated without trend slightly below 100% since the introduction of the LAPP in 2007 (see Figure 6.1). However, landings to quota is an imperfect measure of the ability to match catches to allowable limits because it does not account for discards. In this fishery, discarded fish do not count against quota. Indeed, a substantial

fraction of the total catch is discarded by the commercial LAPP (i.e., among those with IFQ shares). Depending on the gear and location, the mortality rates of discarded red snapper range between 56% and 64%, based on a meta-analysis of mortality rates as a function of fishing method, fishing depth, and season. Thus, catch overages, when large, could affect the ability of the fleet to achieve fishing mortality targets.

The committee uses discard ratios (fraction of fish captured that were discarded) as a proxy for catch:quota balancing. Discard fractions were calculated using the age composition reported for each region and gear combination for the LAPP component of the fishery, estimated size at age, estimated number of discards for each gear, region, combination, and the reported landings. Overall, the vertical line (bandit and handline) fishery component of the LAPP catches, lands, and discards a far greater volume of red snapper than the longline component (see Figure 4.1). In this dominant component, the fraction of fish discarded fluctuated between 0.05 and 0.35 in the western Gulf of Mexico, with no apparent trend through time. Discard fractions were substantially larger in the eastern Gulf of Mexico, fluctuating between roughly 0.15 and 0.65, with particularly high discard fractions in 2009-2012. Discard fractions in the longline fleet fluctuated more significantly (likely due to overall lower catches) but were generally low in the western region (except in 2014), and were exceptionally high in the eastern region particularly after 2010.

These data—while imperfect because they lack a basis of comparison to inform the counterfactual—do not support the hypothesis that catch:quota balancing was improved by LAPP implementation. In this case, the program design—wherein discards are allowed but do not count against individual quota—would not be expected to improve catch:quota balancing, as there is no immediate economic incentive to do so. The committee recognizes that these estimates only apply to fishing activities with available shares, and so do not account for discards onboard vessels where available shares had already been landed. Discards among those vessels and trips can be substantial, equaling or exceeding those estimated to occur on vessels with available share (SEDAR, 2018). Finally, we rely on data on reported and estimated landings, yet changes in enforcement and incentive structure may have improved compliance and reduced unreported catch.

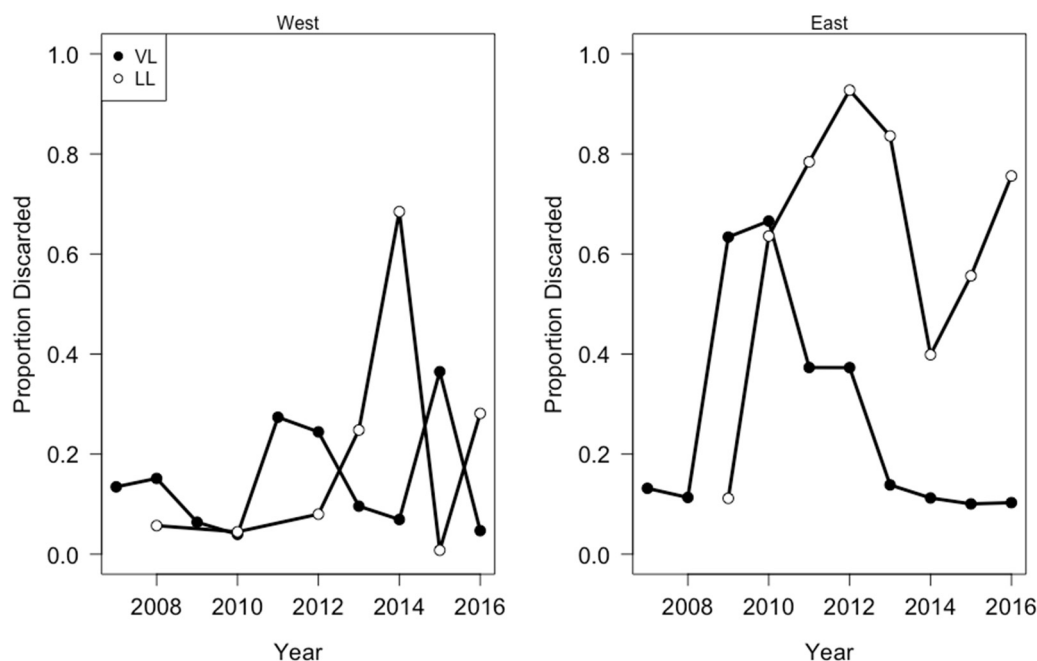


FIGURE 4.1 Estimated discard fractions (proportion discarded) for each gear type (LL = longline, VL = vertical line) and region. SOURCE: SEDAR, 2018.

Did the LAPP Contribute to Improved Stock Status (and therefore spill over to the recreational sectors)?

Unlikely.

While stock status has increased since the 2007 inception of the LAPP, there is no evidence that this improvement is related to the LAPP itself. Rather, the improvement is attributed to the rebuilding plan that drastically reduced quotas and curtailed recreational seasons and bag limits beginning in 2007. This has resulted in fishing mortality levels that are well within biological limits, and subsequent recovery of spawning biomass. The benefits of this recovery have not been distributed evenly across the Gulf, as recent recruitment trends indicate roughly twice the rate of recruitment in the western compared to eastern Gulf since the late 2000s. However, the 2018 stock assessment suggests that the recent spatial pattern of recruitment is likely more reflective of long-term average conditions, while the period of the late 1990s and early 2000s—where recruits were shared approximately evenly across the regions—was unusual. The 2016 spawning biomass estimate is below the management target but above the minimum biomass limit.

The committee cannot directly assess how changes in catch accounting might have improved stock assessment and management decisions based on the assessment. The committee recognizes that the LAPP included adoption of an electronic landings record that provides nearly real-time information on landings.

Did the LAPP Affect Discarding?

Unclear.

Agar et al. (2014) concluded that the LAPP was associated with substantially reduced discard rates, particularly in the western region. This claim was based on a comparison of the number of discarded fish between the periods 2002-2007 and 2007-2011. However, the committee is aware that the Council changed the minimum size limit from 15 to 13 inches in 2007, and several participants of the fishery claimed that this size regulation was responsible for lowering discards (i.e., regulatory discards were reduced). The panel is unaware of data on the age structure of discards prior to 2007 that could be used to partition discards on the basis of size limits. The committee therefore does not support the claim by Agar et al. (2014), because it is not possible to distinguish effects of the LAPP from those caused by the accompanying regulatory shift.

Because discards do not count against the landings quota, there is the potential for highgrading, where more valuable-sized fish are retained while others are discarded. We evaluated evidence for highgrading—and how it varied through time—for each gear and region by calculating the proportion of fish captured that were discarded for each age class (see Figure 4.2). The vertical line fishery showed clear patterns of discarding by fish age, where discard rates were greatest at young and older ages (this gear generally captures fish less than 11 years old). Discard rates were high for young fish because these were below the 13-inch minimum retention limit. In most years and in both regions, discard fractions increased as age increased from 5-6 years to age 11. As there are no regulatory restrictions on older (and larger) fish, this pattern is most likely due to a combination of highgrading and the restrictive nature of the overall TACs. Nevertheless, highgrading in a commercial fishery is a complex problem because different specialty markets and retailers may prefer either larger (e.g., fillets) or smaller (e.g., whole fish preparations) fish.

In comparison, the longline fleet showed little pattern in discarding proportions across ages, but this may be due to the relatively smaller sample size of observed longline discards.

The committee concludes that highgrading is occurring in this LAPP fishery, but also notes that the volume of discarding due to highgrading is relatively low. This is because the vertical line gears have selectivity toward smaller (and younger) fish, aged 7-8 years and under (SEDAR, 2018), and therefore catch small amounts of fish aged 9 years and older. The committee cannot evaluate whether highgrading is occurring more or less intensely than the period prior to the LAPP because of the absence of age-composition data prior to 2008.

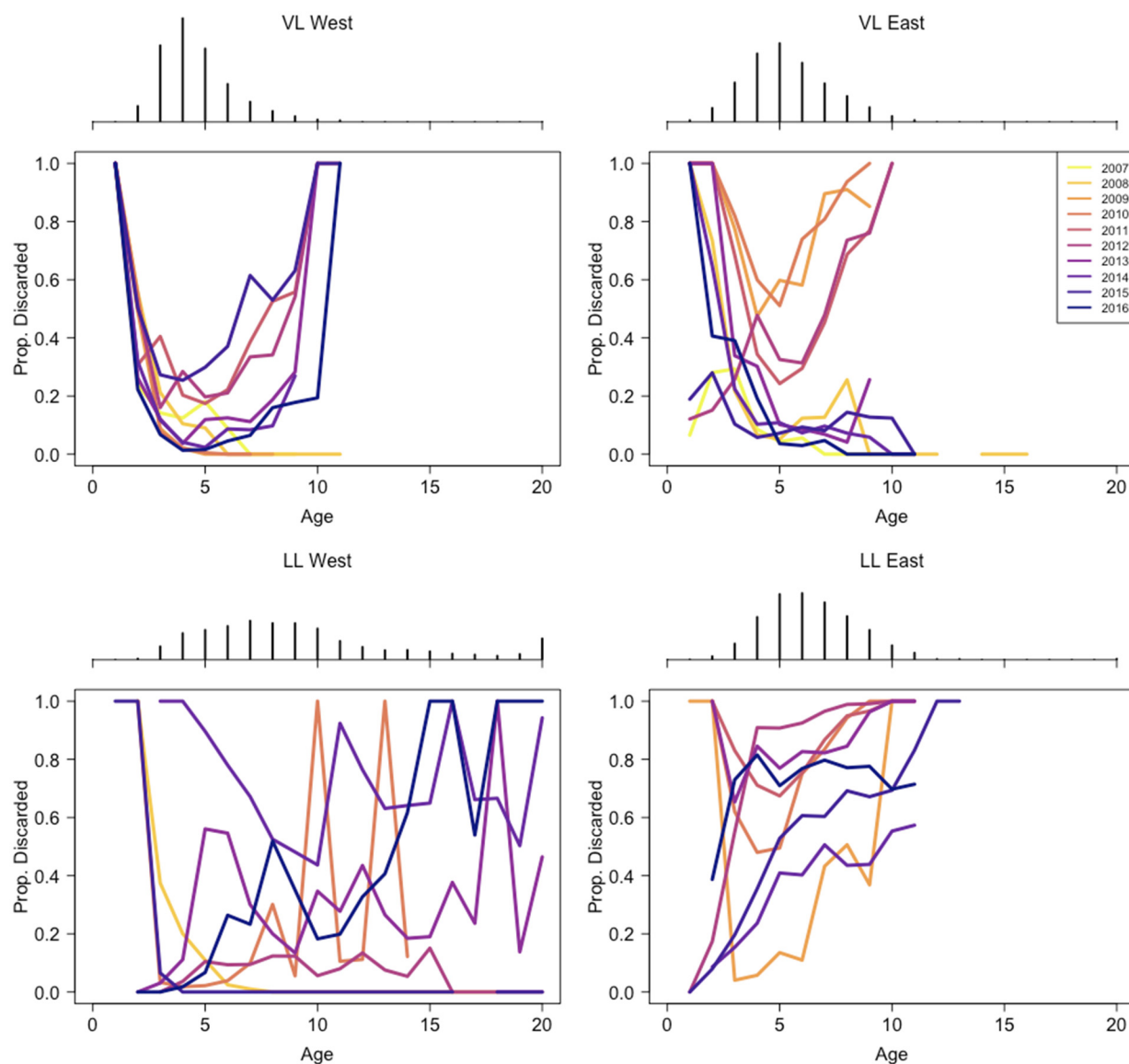


FIGURE 4.2 Proportion of fish captured that were discarded versus age. Each line denotes a different year (see legend). Lines only span ages that were captured in a given year. High variability in the longline fleet likely is a consequence of the smaller sample size. Stem plots above main panels represent the age composition of total catch for each gear and region combination. SOURCE: SEDAR, 2018.

Did the LAPP Affect Unwanted Bycatch on Trips Targeting Red Snapper?

Unknown.

Reducing unwanted bycatch was not among the goals of the red snapper LAPP. For that reason, unwanted bycatch—including interactions with endangered, threatened, or protected species—has not been analyzed by the National Marine Fisheries Service (NMFS) or the Gulf Council.

Gulf of Mexico Grouper-Tilefish LAPP*Did the LAPP Lead to Improved Catch:Quota Balancing?*

Possibly, but not with ecological benefits.

This multispecies fishery assigns quotas to groups or individual species: gag grouper; red grouper; deepwater grouper; shallow-water grouper; and tilefish. For the three multispecies groups, a single species has generally dominated the landings (yellowedge grouper, scamp, and golden tilefish, respectively). As is true of the red snapper fishery, quotas only apply to landings, although the quotas are set with consideration of expected levels of discards. For that reason, the design does not provide the same incentives for catch:quota balancing as would LAPPs that set quota on catch instead of landings.

There are two important dimensions to catch:quota balancing: one is economic and the other is ecological. The economic dimension refers to the ability of the fleet to land the full amount of quota that is allocated to it. Here, the emphasis is on avoiding quota underages. The ecological dimension refers to the ability to maintain catches within biological limits. Here, the emphasis is on quota overages. While catch:quota balancing may be relevant for the economic performance of the fishery, it has less relevance for ecological performance because landings are well below quotas.

Did the LAPP Lead to Improved Stock Status?

Partly, depending on species.

Because the LAPP has been in place for only 11 years, it is challenging to identify changes in population size, let alone attribute any such change to the LAPP *per se*. Population biomass is governed by fishing and also environmental events that affect recruitment, mortality, and growth. Many of these species suffer mortality during toxic algal blooms (“red tides”). For that reason, we focus attention on fishing mortality rate relative to biological limits (F_{MSY} or relevant proxy). For red grouper, fishing mortality rate has fluctuated without trend from 2000 to 2018 (SEDAR, 2019). For gag grouper, fishing mortality was notably lower post-LAPP, 2010-2015 (averaging 0.10), compared to the 5 years prior to the LAPP (0.42), and the six lowest mortality rates over the past 20 years occurred post-LAPP. Prior to the LAPP, fishing mortality rates regularly exceeded F_{MSY} proxies. Current fishing mortality rates are below overfishing limits (SEDAR, 2014). A stock assessment is currently ongoing for scamp, and there has not been a stock assessment for yellowedge grouper or golden tilefish that spans the post-LAPP period.

As noted for the red snapper fishery, it is possible that the improved landings accounting system, combined with at-sea observers, have improved data quality and timeliness and therefore improved the precision and accuracy of stock assessments.

Did the LAPP Reduce Discards and Unwanted Bycatch?

Not likely.

The 5-year review of this LAPP provides compelling evidence indicating that discarding remains common in this fishery, owing to size restrictions and the inability to effectively target fish above retention limits, other regulatory requirements, and market conditions (highgrading) (Gulf of Mexico Fishery Management Council, 2018a; Pulver and Steven, 2019). Highgrading was most significant for the tilefishes and deepwater groupers, but was less common (<5% of discards) for gag grouper, red grouper, and shallow-water groupers. While the ratio of retained to discarded red grouper was generally lower post-LAPP, this reduction is coincident with the reduction of the minimum size limit for red grouper in the commercial fisheries from 20 to 18 inches in 2009 (Gulf of Mexico Fishery Management Council, 2018a; SEDAR, 2019; see Figure 4.3).

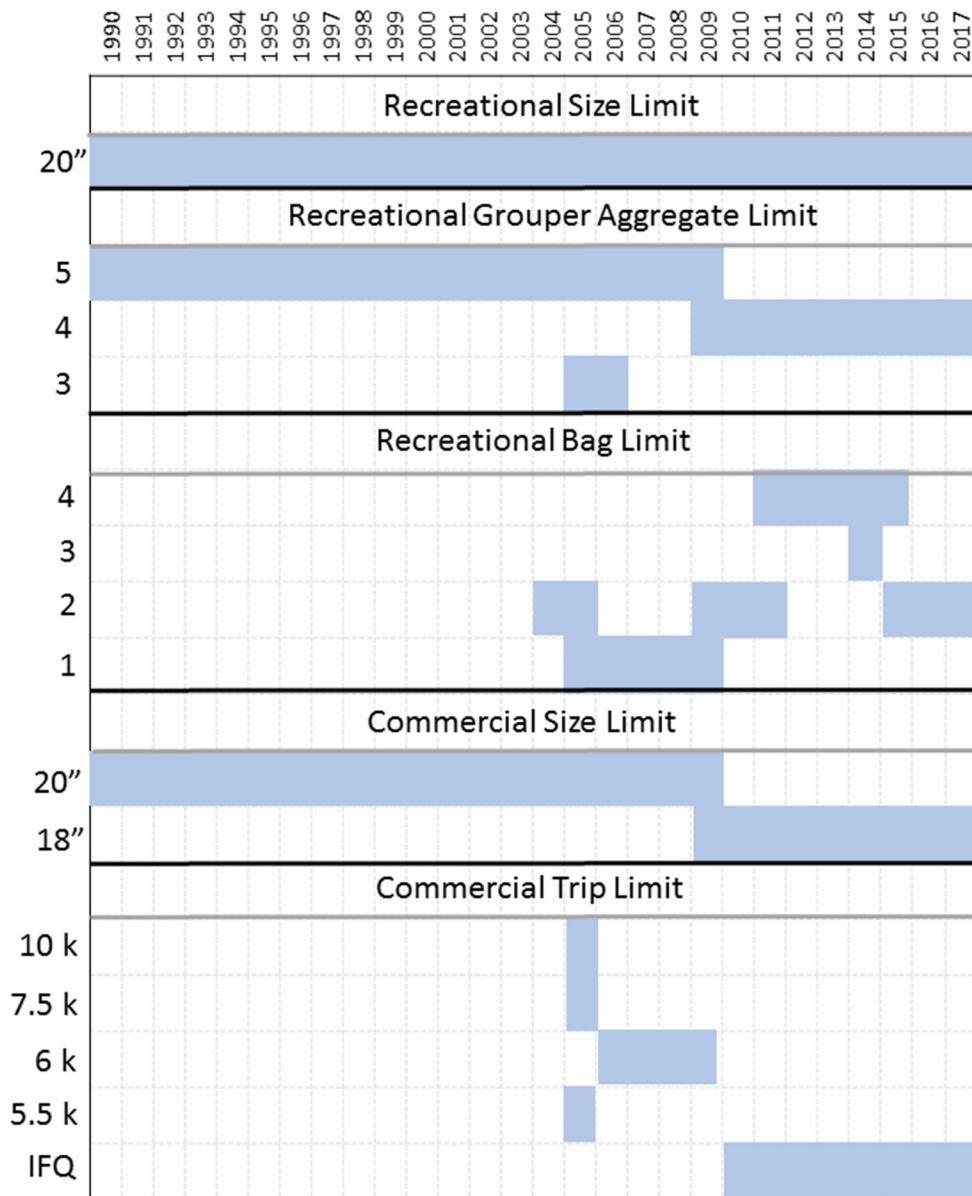


FIGURE 4.3 Summary of federal management regulations for Gulf of Mexico red grouper. SOURCE: SEDAR, 2019.

Because of the interplay of a number of simultaneous management measures it is often difficult to assign cause and effect, especially with respect to the implementation of LAPPs. Figure 4.3 illustrates changes over time in the management measures implemented for the red grouper component of the grouper-tilefish IFQ. Red grouper is the dominant commercial and recreational grouper catch in the eastern Gulf of Mexico. The LAPP for grouper-tilefish was implemented in 2010, 1 year after the increase in commercial size limits from 18 to 20 inches in 2009 (the recreational size limit has been 20 inches for many years). Also, in 2009 the recreational bag limit was increased from two to three, while the aggregate grouper possession limit was decreased from five to four. Landings of red grouper initially increased following 2010 for both recreational and commercial sectors of the fishery (see Figure 4.4), peaking in 2013-2014 but declining precipitously to near time-series lows in 2017.

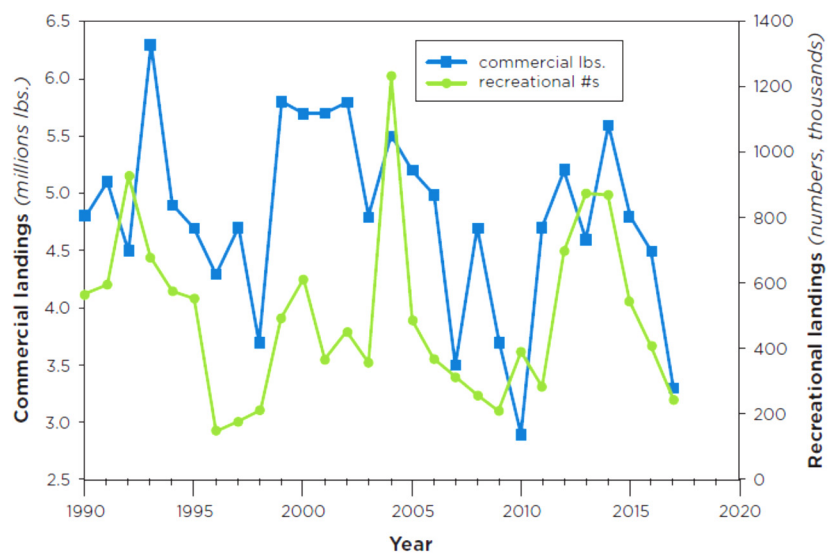


FIGURE 4.4 Recreational and commercial landings of red grouper in the Gulf of Mexico, 1990-2017. SOURCE: SEDAR, 2019.

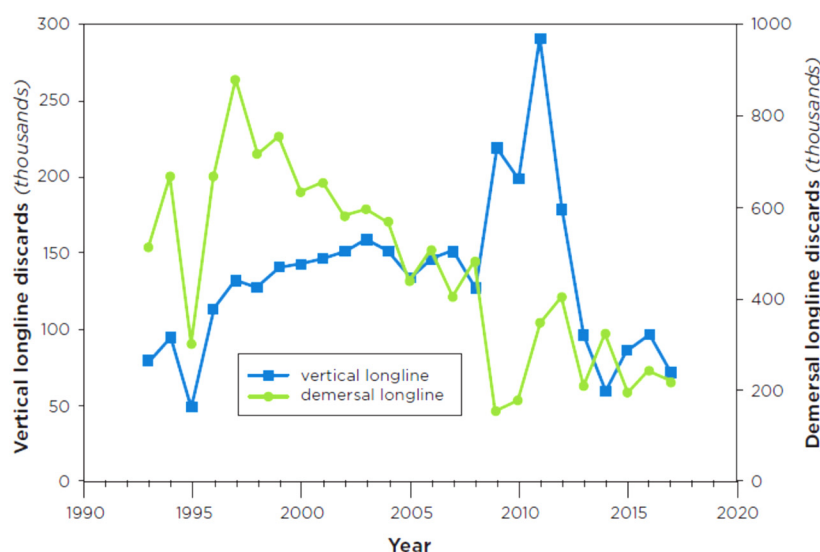


FIGURE 4.5 Trends in commercial discards for red grouper in the Gulf of Mexico. SOURCE: SEDAR, 2019.

Discards in the commercial sectors show divergent paths, with increases in discards followed by precipitous drops for the vertical longline (see Figure 4.5) and a sharp decline in 2009 (coincident with lowering of the size limit to 18 inches) in the demersal longline category (as noted above). For both sectors the levels of discards in the most recent assessment year (2017) were at or near time-series lows. Recreational discards did not show coherent patterns with commercial sectors (see Figure 4.6). While the headboat discard levels have declined somewhat since the implementation of the commercial IFQ, charter vessel discards have remained relatively high. Private vessel recreational catches (which accounted for 84% of the total recreational catch during 2013-2017) declined by more than half since 2015 coincident with the decline in overall catch, despite a reduction in the bag limit to two in most of 2015 and beyond 2015 (see Figure 4.3). Some of the differing trends may be because discards for headboats are self-reported through the Southeast Regional Headboat Survey, whereas private and charter vessel discards are estimated via the Marine Recreational Information Program/Marine Recreational Fisheries Statistics Survey. There was a

change in the methodology used for headboat discards before and after 2007. Prior to 2007 the ratio of kept to discard for the headboat catch was estimated based on the kept to discard ratio from the other two sectors (SEDAR, 2019).

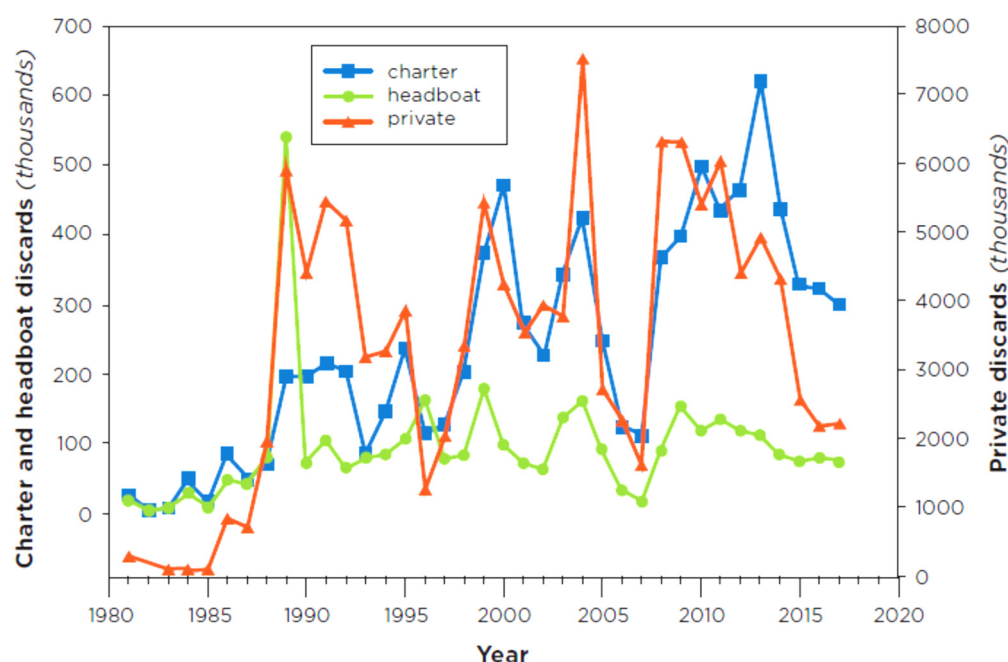


FIGURE 4.6 Discards in three recreational sectors for the red grouper fishery in the Gulf of Mexico. SOURCE: SEDAR, 2019.

The totality of the conservation plan for red grouper commercial sectors has seen a decline in the overall levels of discards in both fishery sectors. The institution of the LAPP has reduced the race to fish and thus the incentive to target low-valued small fish. However, other coincident factors (size limit changes) were, at least initially, responsible for the continued low level of discarding.

As noted above, the committee is unaware of any analyses that have examined rates of unwanted catches and, in particular, interactions with protected species before and after the LAPP was implemented.

Highly Migratory Species: Bluefin Tuna

Did the LAPP Reduce Discards?

Yes.

Theoretically, a LAPP for bycatch functions much like a LAPP for a target fishery by aligning individual incentives of individual vessels with management goals. Without a LAPP, a fleetwide quota on bycatch can incentivize a race to bycatch harvest just as there is a race to fish in a target fishery with a fleetwide total allowable catch since the costs of bycatch avoidance are borne individually, while the benefits accrue to all vessels (Abbott and Wilen, 2009). Although vessels may not actively seek out bycatch, they have little incentive to avoid it actively, but with individual bycatch quotas, vessels can internalize the common-pool externality. The expected value of bycatch quota is challenging to predict because it is tied to the profitability of the target fishery, the prevalence of the bycatch species, and the associated costs of avoiding bycatch. One important factor in determining this value is the magnitude of the overall bycatch quota allocation relative to the underlying prevalence of the bycatch species.

In many cases, the potential to avoid bycatch may be underestimated if based on catch composition from before an individual bluefin quota (IBQ) program is created, as incentives under the program unleash previously unrealized substitution possibilities (Abbott et al., 2015). In these cases bycatch allocations may be overly generous, leading to very low prices for quota. However, it is also possible for managers to overestimate the ability to avoid bycatch, leading to excessively stingy bycatch quota allocations. In such cases, bycatch may serve as “choke” species, such that the value of the target harvest entirely capitalizes into the bycatch quota price while the prices of target species collapse (Sanchirico et al., 2006). Finally, if bycatch is infrequent, there might also be issues with thin markets for bycatch quota as there are for low-quota species that are caught in multispecies trawl fisheries (Holland and Jannot, 2012).

The LAPP for bluefin tuna is unique because it was designed with the express purpose of reducing fishing mortality in the pelagic longline fishery. Prior to the IBQ system, this fishery routinely captured more bluefin tuna than the allocation of bycatch to the fleet overall. Although catch overages were discarded, the level of dead discards resulted in far more bluefin tuna being killed than the annual quota by a factor of two to three (NMFS, 2019). The 3-year review of this program indicates that the goal of the program was achieved. Total catch of bluefin tuna declined sharply and immediately following implementation of the LAPP. Catches (landings plus dead discards) are between one-half and two-thirds of the base quota allocated to the longline fleet (NMFS, 2019). Figure 4.7 illustrates these before-and-after trends.

South Atlantic Wreckfish

Did the LAPP Improve Catch:Quota Balancing?

Unlikely.

The wreckfish LAPP was the first finfish IFQ program instituted in the United States. It was primarily instituted because capacity was far greater than needed to fulfill the total allowable catch regulations put in place in 1990. Since that time, landings relative to quota have fluctuated based largely on changes to quota, which was reduced from 2 million pounds to 223,000 pounds in 2012 (Yandle and Crosson, 2015), and then increased roughly twofold in 2015 based on an updated stock assessment (Radameyer and Butterworth, 2014). Annual landings during this time fluctuated without trend between 190,000 and 376,000 pounds.

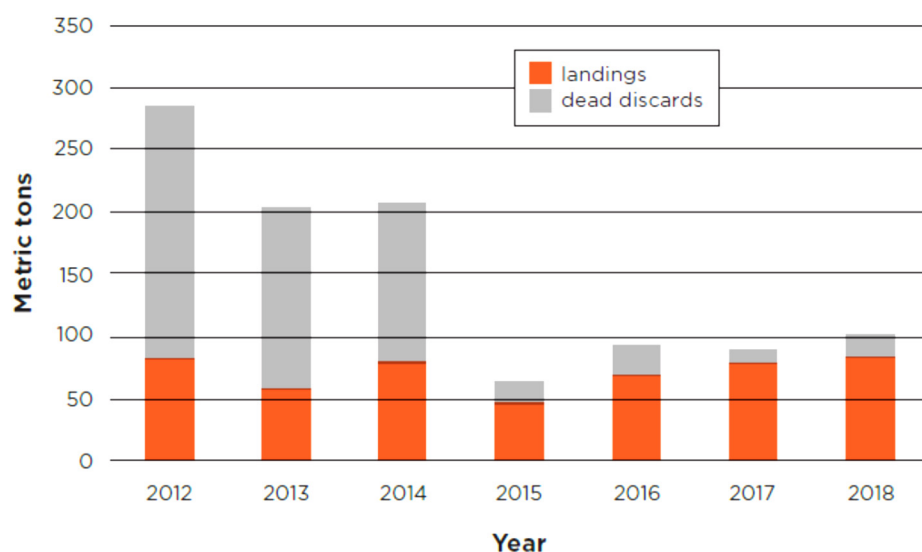


FIGURE 4.7 Bluefin tuna landings and dead discards in years before the IBQ (2012-2014) and after (2015-2018). SOURCE: Figure 3.1 in bluefin tuna 3-year review, NMFS, 2019.

Did the LAPP Improve Stock Status?

Unlikely.

According to the 2014 stock assessment, the stock was not overfished and did not experience overfishing for any year since 2000. The landings in the late 1980s and early 1990s were substantially (roughly fivefold) greater than most recent landings, and exceeded estimated maximum sustainable yield by a factor of two to five. Landings were reduced substantially beginning in 1995, largely due to market demands that led shareholders to target other species (Yandle and Crosson, 2015). Thus, the removals relative to biological limits were governed by opportunities to increase revenue in other fisheries, rather than by the LAPP itself.

Did the LAPP Reduce Discards and Other Unwanted Bycatch?

Unknown—insufficient data and analysis.

The committee is unaware of any detailed analysis that examined changes in discarding practices and bycatch. The latest 5-year annual review (South Atlantic Fishery Management Council, 2019) notes that information on discards and bycatch is limited to logbook and other fishery-dependent data, collected from a single fishing region in South Carolina.

Mid-Atlantic Golden Tilefish*Did the LAPP Lead to Improved Catch:Quota Balancing?*

No.

Generally, the ratio of catch to quota in the commercial LAPP has been relatively high and similar to levels seen prior to the implementation of the commercial LAPP. In the baseline period (2002-2009) catch:quota averaged 94%, and has fluctuated between 102% and 80% since then (Mid-Atlantic Fishery Management Council, 2017). The annual catch limit has not been exceeded in any of these years.

Did the LAPP Improve Stock Status?

Unlikely.

The stock is currently not being overfished and not subject to overfishing (Nitschke, 2017). This is largely due to successful rebuilding that began in 2003 and continued through 2012 (Nitschke, 2017) that reduced fishing mortality through a constant catch harvest control rule. Spawning stock biomass has increased steadily from a low in 1999 to the present, and a strong recruitment event in 2014 will likely continue that trend (Nitschke, 2017).

Did the LAPP Reduce Discards and Other Unwanted Catch?

The LAPP likely reduced discards. The effect on other unwanted catch is unknown.

Under the LAPP, discarding is prohibited. This prevents highgrading, which could otherwise impose increased fishing mortality because discard mortality is very high for these deep-dwelling fish. However, at-sea monitoring is limited in this fishery, so compliance with this regulation is not easily confirmed. There is no information on unwanted catch of other species in available reports and documents.

Summary and Synthesis

The implementation of LAPPs can have beneficial ecological impacts in mixed-use fisheries. The leverage that improved conservation within sectors of the fishery included in the LAPP has on meeting overall annual catch limits for the fish stocks is very much dependent on the proportion of the total fishery accounted for in the LAPP. For red snapper in the Gulf of Mexico (51%/49% split between commercial and recreational sectors), the elimination of commercial quota (landing) overages likely has been an important conservation tool, yet the full ecological consequences are difficult to discern because of discard mortality. This is, however, tempered by the fact that recreational catches for the same stock continue to exceed their allocations (see Figure 6.1). An experimental LAPP for the for-hire sector of the red snapper recreational fishery (a small component of the overall recreational fishery) resulted in eliminating exceedances in that part of recreational fishery (see Figure 6.1) but overall, the recreational portion of red snapper continues to exceed its regulated catch limit, thereby undermining the benefits to be accrued from more effective implementation of fishing mortality limits and thresholds. The importance of the LAPP outcome in this context is that it focuses the debate on sources of nonadherence to allocations in recreational sectors and how to solve them. Thus, for example, the Council implemented an experimental ITQ for the for-hire sector to help eliminate one source of allocation overrun, which was successful (see Figure 6.1).

As is true for all policy interventions, the outcome of LAPPs depends critically on design elements, and the LAPPs in mixed-use fisheries that are evaluated here were designed primarily to address economic or regulatory objectives, as opposed to specific ecological objectives. Consequently, it is not surprising that these LAPPs, in general, did not produce widespread ecological consequences. The one notable exception was the bluefin tuna IBQ program, which was designed specifically to minimize bycatch in the commercial longline fishery and where there was a clear and substantial benefit in the form of a sharp reduction in catch overages and other regulatory discards in the commercial fishery. However, in many of these LAPPs, discards do not count against the quota. Therefore, there was less incentive to match catches to quota, and nonregulatory discards remained common.

In theory, eliminating the “race to fish,” often seen in traditionally regulated fisheries, should result in increased incentives to target the most valuable (generally larger) individuals in a population and therefore reduce regulatory discards by avoiding aggregations of undersized fish. Of the LAPPs in mixed-use fisheries that were evaluated, discards in those sectors were either small or had inconsistent patterns in regulatory discards. Where present, attributing declines to modified behavior of fishers as caused by LAPPs is frustratingly elusive. Moreover, in at least one case (Gulf of Mexico red snapper), the large reduction in regulatory discards was due to a change in the size regulation that was bundled with the LAPP provisions. While the program as a whole, was effective at reducing regulatory discards, it would be a mistake to attribute this success exclusively to the LAPP.

Additional conservation measures that may be attributed to LAPPs include induction of “serial conservation” (at least through improved conservation of bycatch species). It is also an outcome from some LAPPs but is highly dependent on the circumstances of coincident fisheries. Similarly, quota balancing in mixed-species fisheries may create a strong incentive to meet but not exceed fishing mortality rate targets for complexes of stocks. More broadly, when overfishing is eliminated and stocks are no longer overfished, stocks become less volatile (less susceptible to being “recruitment fisheries”) and thus more resilient to year-to-year recruitment fluctuations. This has important ecological consequences for damping catch fluctuations and for trophic interactions when these species are both prey and predators.

5

Social and Economic Effects for Commercial Participants in Mixed-Use Fisheries

This chapter reviews the theoretical and empirical effects of Limited Access Privilege Programs (LAPPs) and the evidence for these effects in LAPPs for commercial fisheries. The committee considers the evidence regarding economic and social effects in general and in the five fisheries under direct consideration in this report. Commercial fishery participants are those directly engaged in the harvest side of the fishery as quota owners, captains, and crew members, and in the post-harvest side as buyers, dealers, and processors. In some cases there are commercial fisheries involved that are not in the LAPP as well, as for example the large number of vessels permitted to take small incidental catches of golden tilefish, which is otherwise allocated through a LAPP. Chapter 7 considers effects in communities where such participants work and/or reside.

The theoretical and empirical work on the effects of LAPPs on commercial fisheries is not specific to mixed-use fisheries. The hypothesized mechanisms for the effects of LAPPs are no different when other sectors such as for-hire or individual recreational angler sectors co-exist, although it is possible that other sectors that are not controlled could amplify some problems that LAPPs are meant to address, such as the race to fish. Similarly, empirical studies of LAPPs in mixed-use fisheries—whether they be retrospective or prospective policy analyses, rigorous *ex post* quasi-experimental evaluations, or simple *ex post* before-after comparison evaluations—have not distinguished between mixed-use and single-use fisheries. Findings are expected to apply in both settings.

The major economic and social effects on the commercial sector are reflected in the goals of LAPPs and the National Standards of the Magnuson-Stevens Fishery Conservation and Management Act (the MSA), which are laid out in detail in Chapter 3. This chapter evaluates the LAPPs of the study in relation to the following expected or commonly observed economic and social impacts:

- Reduced overcapitalization;
- Less participation in “derby fishing”;
- More economic efficiency in the fleet;
- Price effects from improved market timing or product quality;
- Profitability as reflected in quota prices;
- Improved safety at sea;
- Capacity spillovers into other fisheries;
- Changes in labor relations and employment;
- Economic, demographic, social, and cultural distributional effects;
- New roles (e.g., broker); and
- Barriers to entry for young and small-scale fishers.

Discerning Impacts

As discussed in Chapter 1, it can be difficult to establish causation when evaluating the social and economic impacts of LAPPs. LAPPs often coincide with stricter controls on overfishing, stock rebuilding programs, intensified monitoring, and other measures. For example, in the Mid-Atlantic golden tilefish fishery, certain successes of the fishery are better attributed to the 2001 Fishery Management Plan that established key measures for a healthy fishery (i.e., a constant quota rule and accountability measures),

rather than to the later implementation of the LAPP. In general, the 2007 reauthorization of the MSA that specified LAPPs also put in strict requirements for annual catch limits (ACLs) and gave authority to Scientific and Statistical Committees to set acceptable biological catches (ABCs) based on evaluation of the stock assessment science and uncertainty. ACLs are not allowed to exceed ABCs. These changes occurred at the same time that some LAPPs in this report were being adopted. As explored in other chapters in this report, implementation of IFQs in the red snapper fishery was accompanied by a large reduction in commercial (and recreational) total catch limits. In addition, external events have occurred since LAPPs implementation in these fisheries, including the *Deepwater Horizon* oil spill in 2010 that resulted in closure of fishing grounds and depressed markets in the Gulf of Mexico, continued globalization of seafood markets, and increased competition from farmed seafood.

Social science research on the social and economic effects of LAPPs nationally and globally is diverse and multidisciplinary. Social science spans the disciplines of economics, anthropology, sociology, geography, public administration, political science, and more. Variation in how fisheries systems are conceived and what research and data are preferred across disciplines can make integrating the approaches of these diverse fields both challenging and necessary (e.g., Charnley et al., 2017; Ferraro et al., 2019; Moon and Blackman, 2014; Moon et al., 2021). Economists developed the LAPP idea as a conceptualization of fishery systems that situated the goal of profit and the problem of open access in the commons as paramount, with goals to reduce derby fishing, decrease overcapacity, and promote efficient use of the natural resource. From other perspectives, such as in anthropology and geography, fishery systems are conceived of as place- and culture-based livelihoods, where access to fisheries—whether fully open or limited by circumstance or institutions—is paramount; therefore, the limitation and commodification of fisheries access, similar to systems seen in the forest and offshore oil industries, is seen as a possible source of broader social, cultural, and/or economic transformations.

Within these disciplines and their various conceptualizations of fishery systems are both quantitative and qualitative assessments of the socioeconomic effects of LAPPs. Much of the quantitative evidence reviewed below pertains to the entire fishing fleet (a complete census), which is a strength of the evidence base. Some quantitative data also draw on surveys of samples of participants in the fisheries, whose responses can be quantified and reported through statistical analyses, whether they pertain to economic measures like income and costs or to measures of well-being and satisfaction or perceptions and attitudes. How representative these samples are affects the strength of the evidence base. Qualitative data are collected through participant observation and in-depth interviews and are concerned with understanding fishery participants' perspectives, motivations, and experiences. Some of the data sources in this review are qualitative, particularly a set of studies done on social impacts of the grouper-tilefish LAPP. This kind of ethnographic research, as well as efforts to interpret surveys beyond statistical analysis, may identify important channels through which policy may have changed the operation of the fishery and potentially the resulting socioeconomic outcomes, which involve social relationships and power differentials (such as among individual fishing quota [IFQ] holders and crew) and also cultural values (such as criteria for job satisfaction and fairness). For example, qualitative data suggest the red snapper LAPP changed labor relations between captains, crew, vessel owners, and newly created shareholders in ways that have largely been missed by quantitative metrics. However, the purposive sampling that often underlies qualitative data collection programs may create challenges for drawing inferences about the representativeness of the findings for the entire population of fishery participants. Moreover, ethnographic research is very intensive and costly, and may be at a scale that is too restricted to represent the entire scope and diversity of groups involved in a fishery.

A challenge in interpreting both quantitative and qualitative data when assessing the impacts of a LAPP lies in the benefits of having a clear “counterfactual”—the likely outcome in a scenario in which the LAPP had not been implemented. Measuring the “causal effect” or “impact” of a LAPP requires an explicit or implicit counterfactual scenario. In principle, quantitative data should make such causal analysis easier. However, only some quantitative studies implement rigorous quasi-experimental design and most rely heavily on before-after comparisons of the treated unit (the fishery) to infer causation. For example, evidence for slowing the race to fish is based on a rigorous quasi-experimental design, whereas evidence

for consolidation uses only before-after comparisons. The assumption of a static future that often underlies such before-after comparisons may be unrealistic and potentially bias measures of impact. Qualitative studies of the impacts of LAPPs are frequently noncommittal about the relevant counterfactual (perhaps in part because the guidelines for the LAPP reviews only require that changes since the baseline be analyzed; Morrison, 2017b). They tend to have no explicit control group or prepolicy baseline—relying instead on the researchers’ interpretations of the unstated, counterfactual scenarios implicit in respondents’ accounts.

As noted earlier, this discussion of challenges in handling different kinds of data and discerning counterfactuals reflects the committee’s commitment to taking an interdisciplinary approach to its task. Successful interdisciplinarity often requires shared knowledge of and respect for divergent approaches and standards of evidence. It also benefits from cooperation in data analysis and interpretation where possible and transparency in reporting the results.

Overcapitalization and the Race to Fish

A primary goal set out in Section 1853a(c) is that a LAPP shall contribute to reducing overcapacity if the fishery is overcapitalized (see Box 5.1). All but one of the individual programs of this study have goals and objectives that emphasize reducing overcapitalization. A key objective of LAPPs, particularly those where trading is allowed, is to create a system where fleet size—or other indicators of capital investment and fishing effort—can be adjusted to better fit the state of the resource through the decisions and market transactions of permit holders albeit often within the context of buy-backs or other administrative and government measures. In addition, LAPPs provide incentives and a mechanism for less efficient fishers to exit the fishery, by selling or leasing the shares they hold.

BOX 5.1 Requirements for Limited Access Privileges.

(1) IN GENERAL.—Any limited access privilege program to harvest fish submitted by a Council or approved by the Secretary under this section shall—

- (A) if established in a fishery that is overfished or subject to a rebuilding plan, assist in its rebuilding;
- (B) if established in a fishery that is determined by the Secretary or the Council to have over-capacity, contribute to reducing capacity;
- (C) promote—
 - (i) fishing safety;
 - (ii) fishery conservation and management; and
 - (iii) social and economic benefits;

SOURCE: 16 U.S.C. § 1853a.

Reducing overcapitalization often becomes an issue that leads to consideration of LAPPs when the fishery has become a “derby” fishery, where participants race competitively for the fish. This is created by the use of fishery management regulations (or in some circumstances buyer demands)—such as pure open access, regulated open access, or regulated restricted access environments—that establish limited seasons or quotas. Under pure open access, the threat of other entrants competing for the catch incentivizes incumbents to fish intensively immediately before others enter and the fish are depleted. Under regulated open access, the regulator sets a limit on total allowable catch, opens the season, and closes the season when the fleet collectively lands the allowable catch. This style of regulation encourages harvesting as a race where fishers harvest as much as possible before a season has ended or a total allowable catch is reached, closing the fishery. Even if the stock is held at a sustainable level, the regulatory regime must shorten the season further if more vessels enter, exacerbating the derby conditions in a vicious cycle (Homans and Wilen, 1997). Under regulated restricted access, racing can still occur despite limiting access to a finite number of permit holders. These systems can have latent capacity such that restrictions on entry are too lax to eliminate incentives to race. Alternatively, these systems can create new incentives to increase capital

investment and race to catch a larger share of the total quota. The extent of racing generally will depend on how much latent capacity is in the fishery, stock availability, and the existence and efficacy of other input restrictions. Derby fishing was seen as a major source of overcapitalization for three of the five LAPPs in this study. A LAPP reduces the motivation to quickly harvest as much as possible by giving its holders the assurance of a specific share of the overall allowable catch and hence the freedom to decide when and at what rate and cost to fish.

The idea that individual quotas allocated to fishers would slow the race to fish has long been conventional wisdom in fisheries economics, but only recently have rigorous quasi-experimental tests provided causal evidence. Structural empirical studies of regulated open access and regulated restricted access identify the mechanism driving the race to fish under these institutional arrangements (Homans and Wilen, 1997; Huang and Smith, 2014). As such, they provide indirect evidence for what would happen under adoption of a LAPP. Before-after comparisons are also consistent with the story of slowing the race to fish (Brinson and Thunberg, 2016; Tveteras et al., 2011; Wilen, 2006). Hsueh (2017), using a rigorous quasi-experimental approach, finds that adoption of catch shares caused the race to fish to slow in the Pacific whiting (hake) fishery.

Compressed harvesting, or increased fishing effort in response to reduced season length, is an optimal strategy from an individual point of view when fishers need to compete for their harvest at sea. Allocating individual fishing quotas changes a fisher's objective from maximizing catch to maximizing profits, which could take more time. However, the objective is not to slow down; rather, the objective is to weigh all factors that affect profitability and welfare maximizing decisions for the quota owner, including into the future. In the case of Pacific whiting, an early bioeconomic analysis showed that fishing at a different time of year would allow for the harvest of fewer but larger fish under the same total allowable catch (TAC), and those fish could then be used to produce higher-valued products (fillets versus surimi) (Larkin and Sylvia, 1999). Additional travel costs could also be saved by allowing the fleet to specialize seasonally in different fisheries. In this case, the savings were not in the speed of harvest, but in the flexibility of timing of harvest (which could also have ecological benefits if the timing resulted in harvesting fewer larger fish; Larkin and Sylvia, 2004). Similar arguments hold for being able to supply fresh fish during peak demand (holidays), being able to work around family constraints (school schedules), and bad weather (to ensure safety).

Birkenbach et al. (2017) evaluated the causal effects of catch shares on the race to fish in 39 U.S. fisheries managed under LAPPs, including three of the LAPPs under review in this study spanning seven fisheries (i.e., golden tilefish, red snapper, and Gulf of Mexico grouper-tilefish). Using individual fishery matched controls and then analyzing the results using meta-analysis and in a pooled regression, they find that catch shares slow the race to fish, as indicated by lengthening seasons on the order of 0.8-0.9 months averaged across the 39 fisheries. Most of the largest effect sizes out of the 39 fisheries were Gulf of Mexico reef fish species in the red snapper or grouper-tilefish IFQ programs. Results for red snapper, red grouper, gag, other shallow-water grouper, deepwater grouper, and tilefish all showed a slowing of the race to fish, and all results were statistically significant in both model types except one model for red snapper. The more moderate effects for red snapper are consistent with the fact that management before the LAPP was implemented in 2007 included a number of season openings and closings rather than just one derby, which in monthly landings data gives the appearance of a relatively spread-out season despite the possibility of intense derby conditions within a month. Importantly, all six of these Gulf of Mexico species are mixed use, and in the analysis, they all use as controls other species, within the mixed-use fishery, that are not managed with LAPPs.

Fishing season lengthening sometimes did not occur among the 39 fisheries analyzed by Birkenbach et al. (2017). The extent of derby-style fishing varied substantially. There were heterogeneous regulatory environments pretreatment, catch share programs were configured differently, and biological and market conditions in each fishery did not always align with stretching out seasons. And, some fisheries experienced season contraction as a result of catch shares. In a modeling study of vessel behavior, Birkenbach et al. (2020) explain this anomalous result by showing that slowing the race in one fishery can

trigger season contraction for other species within the same complex. They find supporting evidence using microdata from Norwegian groundfish fisheries.

Racing is a mechanism that can lead to negative social and economic outcomes such as unsafe conditions, increased costs, inability to deliver high-value products, and market gluts when landings are concentrated in short bursts. On the other hand, the relatively open access and competitive nature of derby fishing may have positive values to some participants and some types of fishing communities, where, for example, alternative work is scarce or the derby fishery is only part of a complex of fishery and/or other work opportunities. These associated socioeconomic outcomes are expected to change under forms of governance that remove or mediate incentives to race, highlighting some of the trade-offs entailed.

Race to Fish in Study Fisheries

The causal effects of LAPPs on the race to fish, including results for most of the fisheries in this study, is illustrated by Figure 5.1 which is reprinted from Birkenbach et al. (2017).

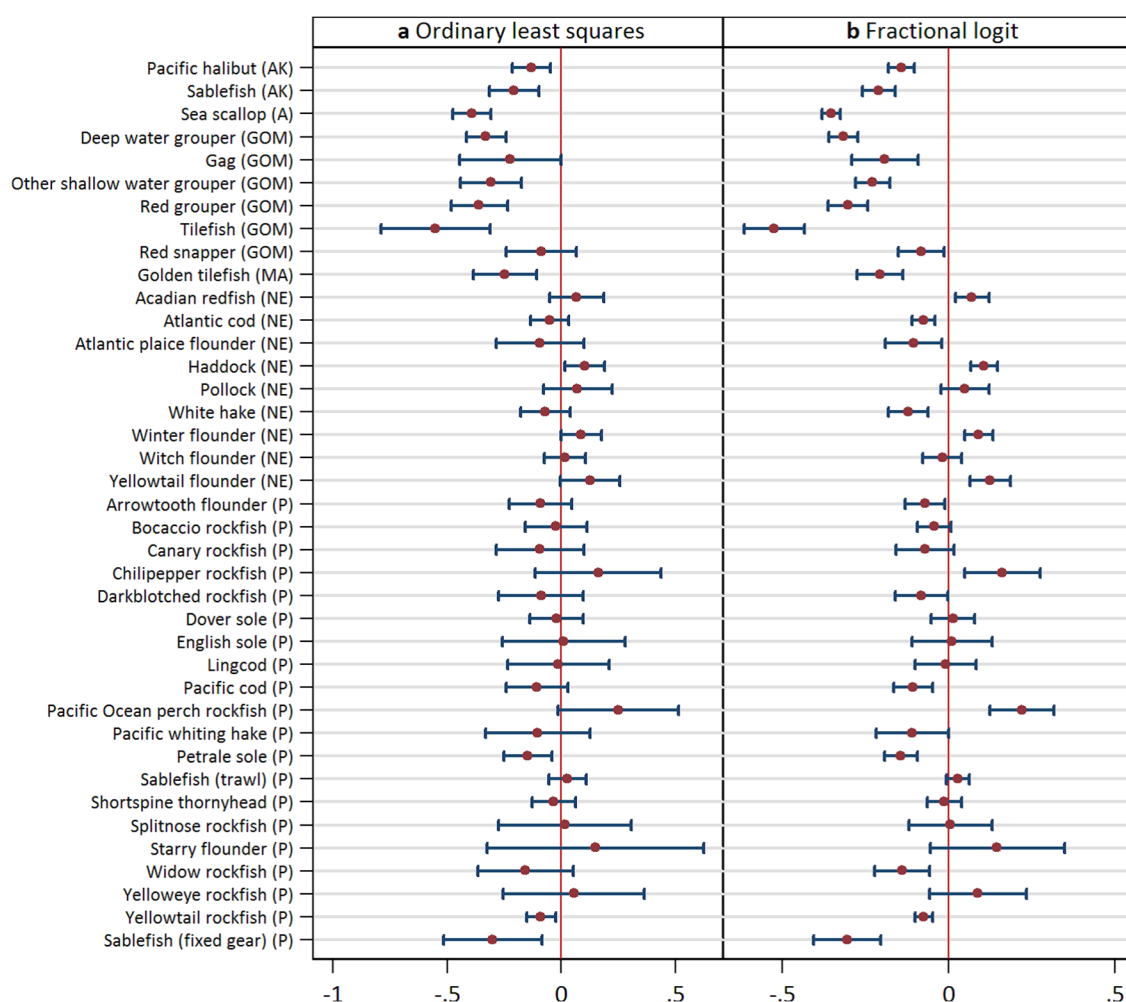


FIGURE 5.1 The causal effect of LAPPs on the race to fish. Depicts point estimate (red dot) and 95% confidence interval (blue bars) for the treatment effect of the LAPP on the Gini coefficient of within-year landings. A reduction in the Gini means that landings became more spread out as a result of the LAPP. SOURCE: Extended Data Figure 2 from Birkenbach et al., 2017.

Red Snapper (Gulf of Mexico)

Evidence for reduced race to fish: very strong and based on rigorous quasi-experimental design. Quasi-experimental evidence is consistent with before-after comparisons in the 5-year review.

A survey of participants showed that this was one of the most positive impacts of the program (Boen and Keithly, 2012).

Grouper-Tilefish Complex (Gulf of Mexico)

Evidence for reduced race to fish: very strong and based on rigorous quasi-experimental design. Effect sizes are heterogenous across program species, but all show clear evidence of slowing the race to fish. The quasi-experimental evidence is consistent with perceptions of derby conditions, although the baseline derby conditions were not as severe as in red snapper (Gulf of Mexico Fishery Management Council, 2013).

Bluefin Tuna (highly migratory species)

Evidence for reduced race to fish: not applicable. Derby fishing is not identified as a problem in the commercial sectors of the bluefin tuna fishery; the LAPP pertains only to the longline sector, in which bluefin tuna are caught only as bycatch.

Wreckfish (South Atlantic)

Evidence for reduced race to fish: weak based on fleet consolidation and application of theory of flexibility. The evidence is weak because the baseline for the 5-year review is well after the formation of the LAPP. There is no direct measure. The review states that there was a derby situation before the LAPP began, when the TAC was caught in 4 months. A decline in the derby fishery can be inferred from the dramatic decline in the number of vessels involved since the year immediately preceding the LAPP to the present, and that theoretically there is no reason to expect a derby with a very small fleet. The review also makes statements about fishers now fishing less in bad weather and that those who remain in the fishery are experienced and able to fish safely.

Golden Tilefish (Mid-Atlantic)

Evidence for reduced race to fish: strong and based on rigorous quasi-experimental design. Quasi-experimental evidence is consistent with patterns of landings changes, but the 5-year review suggests elimination of derby conditions was inconclusive. It is unclear why this is considered inconclusive, but that is the reason the evidence here is listed as “strong” and not “very strong.”

Safety at Sea

Commercial fishing is among the most hazardous professions in the United States with a rate of 80.8 deaths per 100,000 full-time equivalent workers in 2014 compared to the national average of 3.3 (Bureau of Labor Statistics cited in Marvasti and Dakhliya, 2017). Section 1853a(c) of the MSA also requires that a LAPP promote safety at sea, fishery conservation and management, and social and economic benefits. Promoting fishing safety is in theory linked with the decline in derby fishing, which at times has resulted in taking risks in poor conditions in order to compete for fish before a quota is reached or a season has ended. It could also be related to improvements in profitability, whereby there may be less pressure to take risks in vessel operations because of financial pressures. The conceptual argument for improved safety at sea as a consequence of LAPPs flows directly from mediating the race to fish. Because LAPPs allow fishers to decide when to catch fish rather than forcing them into competitive and often short openings, they can

avoid bad weather and other potential safety hazards. For example, a participant in a derby fishery faces the choice of taking a risk today to fish in bad weather or not catch anything at all, whereas a holder of some secure quota pounds means the fisher can choose to risk the bad weather to fish or wait until the weather clears to fish. The conceptual underpinning is so straightforward that it formed part of the narrative in the popular reality television show *Deadliest Catch*.

A social survey of Gulf of Mexico reef fish permit holders conducted in 2005 highlights safety concerns about derby conditions and the need for management changes in the fisheries. All permit holders were sent surveys, the response rate was 45.9%, and the adjusted response rate was 46.7% after adjusting for blank surveys from people no longer fishing in the Gulf and duplicate addresses (Zhang and Smith, 2011). When asked about the statement, “Seasonal closures force fishermen to fish in bad weather,” 80% of respondents agreed or strongly agreed (unpublished data from survey reported in Zhang and Smith, 2011).

There are four categories of empirical evidence about the effects of LAPPs on improved safety at sea: (1) indirect evidence based on econometric studies of fishing behavior; (2) before-after comparisons of accidents, injuries, and fatalities at sea; (3) quasi-experimental evaluation of exposure to weather risk; and (4) survey and ethnographic research with fishers about their perceptions of safety in their fisheries. Indirect evidence from studies of fishing behavior show that fishers are willing to trade off potential revenue gains against risks of fishing in bad weather or unsafe conditions. These results are consistent across fisheries with different gear types and operations, including California urchin divers avoiding bad weather and shark attack risk (Smith and Wilen, 2005); Florida lobster fishers avoiding high winds and hurricanes (Stafford, 2015); Gulf of Mexico reef fish fishers fishing less in bad weather (Marvasti, 2017; Smith et al., 2008); and Gulf of Mexico shrimpers fishing less in high waves (Smith et al., 2017).

Emery et al. (2014) specifically study an individual transferable quota (ITQ) fishery and examine risk-taking behavioral differences between fishers who own quota and fishers who lease quota. They find that those who lease quota have higher tolerance for weather risk, hoping to get higher prices for the catch to help make up for the cost of the lease. They do not compare risk taking with and without the ITQ and, as such, it may be that both quota owners and those who lease quota are safer relative to the counterfactual scenario of no ITQ. Moreover, the findings in Smith and Wilen (2005) provide a plausible explanation for why quota lessees would be less weather risk averse than quota owners. Specifically, Smith and Wilen (2005) find that risk tolerance is heterogeneous in the fleet, and physical risk avoidance is correlated with financial risk avoidance. If leasing quota is financially risky, it might select for individuals who have higher risk tolerance across both physical and financial domains. If, as is likely, quota owners are wealthier than quota lessees, a compatible explanation is that lower-wealth individuals have higher marginal utility of income and thus are willing to tolerate more physical risk.

Before-after comparisons can be as simple as comparing accidents at sea or fatalities before and after adoption of a new policy such as a LAPP. Fatality rates in Gulf of Mexico reef fish fisheries are shown in Figure 5.2.

But more sophisticated econometric studies can control for potentially confounding factors. Marvasti and Dakhli (2017) study the effects of the Gulf of Mexico red snapper and grouper-tilefish LAPPs on occupational safety and show that individual fish quotas led to reductions in fishing fatalities. Consistent with the theoretical mechanism for improved safety at sea, they find evidence that fishers take fewer trips in adverse weather conditions under individual quotas. Recent research in Iceland found that derby-style open access coastal fisheries in the summertime are no less safe than fisheries managed by LAPPs, although the coastal fleet was operating at a loss, which may have allowed it to achieve this parity in safety (Gunnlaugsson et al., 2021).

Pfeiffer and Gratz (2016) use rigorous quasi-experimental identification to show that adopting catch shares caused less fishing in unsafe weather conditions. They analyze the U.S. West Coast fixed gear sablefish fishery that was treated with catch shares, compare it to a segment of the fishery that was managed with trip limits, and find a 79% reduction in fishing on high-wind days.

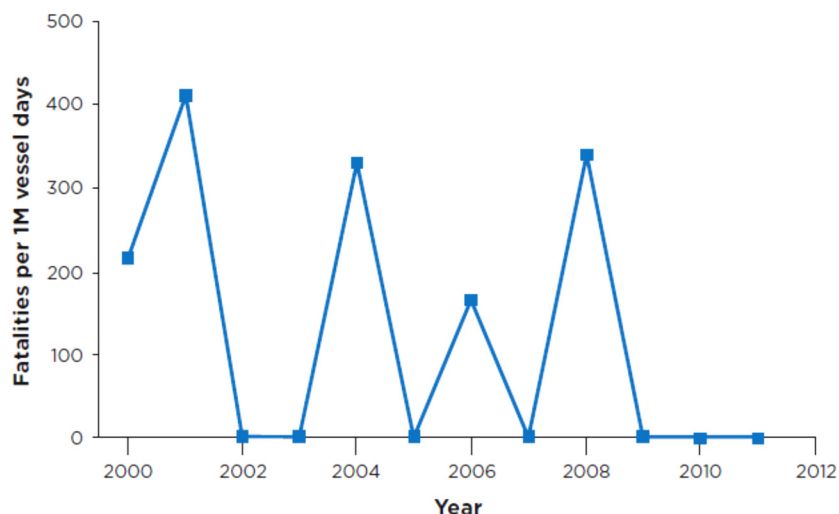


FIGURE 5.2 Fatality rates in Gulf of Mexico reef fish fisheries. SOURCE: Red snapper 5-year review.

Survey and ethnographic studies have explored fishers' perceptions of safety pre- and post-LAPPs in various fisheries. In some fisheries, improved safety is among the most agreed-upon positive impacts of LAPPs on the fishery, for example the North Pacific halibut fishery (e.g., Carothers, 2013, 2015; Hartley and Fina, 2001; Hughes and Woodley, 2007). However, there is some evidence to suggest that as larger shifts in fishery systems occur in the decades after LAPPs are implemented, such as shifts in crew members from more experienced to less experienced (as explored more below) and leasing arrangements discussed above, there may be a decrease in fishers' perceived safety at sea (e.g., Pinkerton, 2014; Pinkerton and Edwards, 2009; Ringer et al., 2018). Interviews with crew who worked on Bering Sea crab vessels soon after the implementation of LAPPs show that some crew felt less safe at sea as the fleet consolidated because there were far fewer vessels in remote icy waters should help be needed (Lazrus et al., 2011). However, these reports should be balanced against the overall evidence of decreased fatalities and accidents at sea that have been reported in the fishery after rationalization, as well as reports of delayed maintenance on fishing vessels during the derby fishery (NPFMC, 2017). Nonetheless, safety at sea was improving prior to rationalization, so causal attribution based on the before-after comparison alone is difficult.

Safety at Sea in Study Fisheries

Red Snapper (Gulf of Mexico)

Evidence for actual changes in safety: strong evidence for improved safety at sea based on rigorous econometric analysis of risk exposure (Marvasti and Dakhliya, 2017) and simple before-after comparisons (Gulf of Mexico Fishery Management Council, 2013). The evidence is not based on a quasi-experimental design providing a strong counterfactual (as in Pfeiffer and Gratz, 2016). The effect size is large relative to the background occupational safety hazard. The simple before-after comparison reveals "Annual fatalities per million vessel days in the Gulf decreased by 51%" (Gulf of Mexico Fishery Management Council, 2013). The evidence is consistent with much stronger causal evidence showing a slowing of the race to fish.

Evidence for perceived changes in safety: mixed but mostly favoring improvements in safety at sea. From the 5-year review: "Results from a recently completed survey of RS-IFQ participants in the Gulf indicate that the industry as a whole is relatively indifferent in terms of the RS-IFQ program impact on safety at sea. However, detailed analyses of safety-related responses by share size ownership and across geographical areas indicate that medium to large shareholders as well as RS-IFQ participants in the northern and western Gulf perceived the RS-IFQ program to have improved safety at sea in the Gulf" (Boen and Keithly, 2012).

Grouper-Tilefish (Gulf of Mexico)

Evidence for actual changes in safety: strong evidence for improved safety at sea based on rigorous econometric of risk exposure (Marvasti and Dakhliya, 2017) and simple before-after comparisons (Gulf of Mexico Fishery Management Council, 2018a). However, the evidence is not based on a quasi-experimental design providing a strong counterfactual. The effect size is large relative to the background occupational safety hazard and even larger in grouper and tilefish than in red snapper. The evidence is consistent with much stronger causal evidence showing a slowing of the race to fish.

Evidence for perceived changes in safety: moderately strong evidence for improved safety at sea based on in-person survey of captain and crew, simple before-after comparison (ECS Federal Inc. et al., 2017).

Bluefin Tuna (highly migratory species)

Evidence for actual changes in safety: weak. There is discussion in the 5-year review of greater fishing flexibility resulting from the LAPP, but there is no formal effort to quantify this flexibility, unlike in other LAPPs that this report addresses. As such, improved safety at sea is consistent with this qualitative discussion and the theory of reduced derby fishing but lacks specific evidence in support.

Evidence for perceived changes in safety: none.

Wreckfish (South Atlantic)

Evidence for actual changes in safety: weak and based on indirect application of theory to stylized facts. There is no quantitative evidence directly pertaining to safety at sea, but the fleet has shrunk and the derby conditions that raise safety issues have been eliminated (South Atlantic Fishery Management Council, 2019).

Evidence for perceived changes in safety: none. The review mentions a concern about expansion of the fishery raising potential safety issues due to inexperience, but this is a hypothetical concern that is only loosely tied to the LAPP.

Golden Tilefish (Mid-Atlantic)

Evidence for actual changes in safety: modest and based on before-after comparisons and indirect application of theory to stylized facts. The accident rate declined after the IFQ, but there is no assessment of the counterfactual (Mid-Atlantic Fishery Management Council, 2017). Improved safety at sea is also consistent with effort for a segment of the fleet shifting out of the winter season (Mid-Atlantic Fishery Management Council, 2017).

Evidence for perceived changes in safety: none.

Prices and Profitability

Profitability is primarily affected by revenues and costs. On the revenue side, the most straightforward metric is the price of fish. Implicitly, relying on price assumes that markets are competitive because in a competitive market, price is the marginal revenue. A number of studies indicate that LAPPs can increase prices by allowing fishers to time catches to market demand, avoid market gluts, improve product quality by not racing to fish, and fetch a premium by landing more fresh fish that otherwise would have to be frozen under derby conditions (Birkenbach et al., 2017; Grafton et al., 2000; Homans and Wilen, 1997, 2005). Evidence for price increases in LAPP fisheries mostly is in the form of before-after comparisons without a control fishery, although there is ongoing research to measure price changes relative to a valid counterfactual.

Avoiding market gluts by allowing landings to be more evenly dispersed throughout the year can also provide more stability in ex-vessel prices. In all four of the LAPP IFQ programs examined in this study (exclusive of the bycatch-based individual bluefin quota [IBQ]), ex-vessel fish prices were considered to have become more stable as a result of implementing the IFQ program. While none of the reviews provided quantitative evidence to support the conclusions, several referred to external studies including those that obtained information from stakeholder surveys.

While the price of fish is extremely important to total revenues, a long-run measure of profitability would also include consideration of individuals' time value of money (i.e., discount rate) and overall risk preference for participating in a given fishery.

Price Increases in Study Fisheries

Red Snapper (Gulf of Mexico)

Evidence for price increases: strong based on before-after comparison of inflation-adjusted prices. Red snapper experienced inflation-adjusted price increases after the LAPP (Gulf of Mexico Fishery Management Council, 2013), as shown in Figure 5.3.

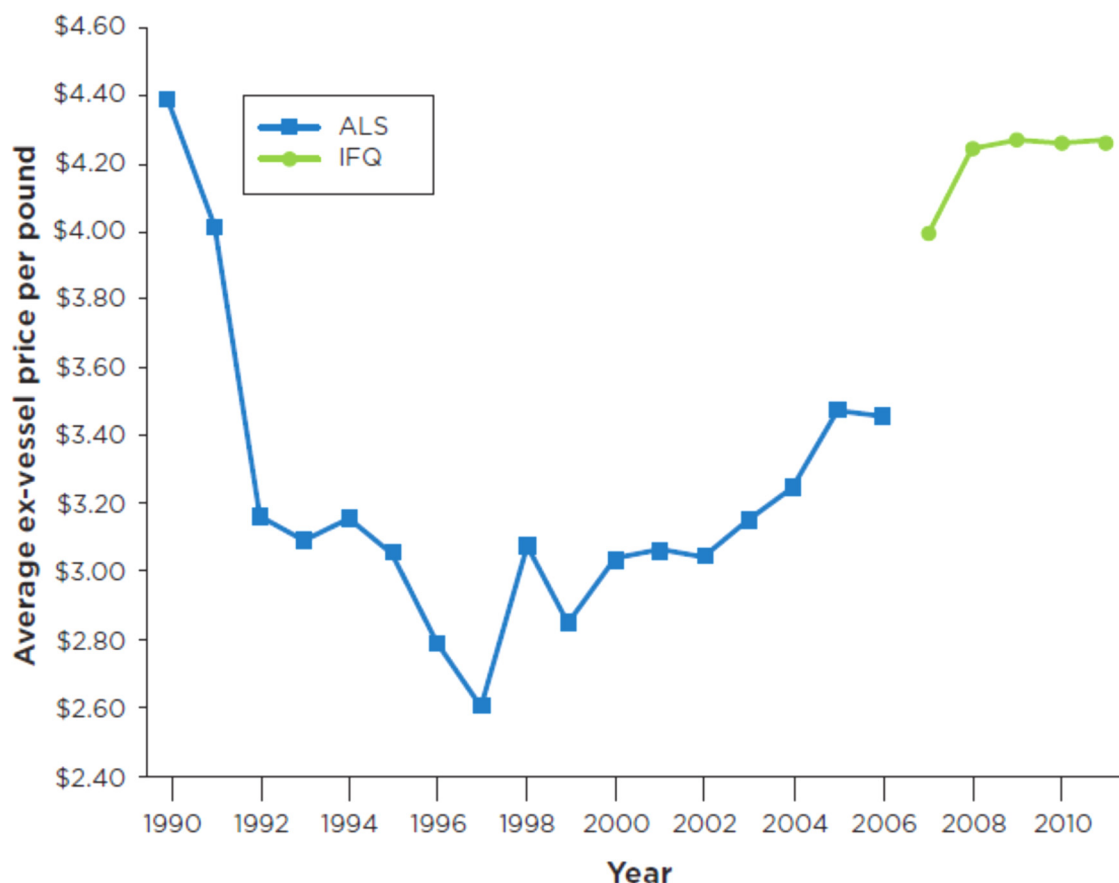


FIGURE 5.3 Inflation-adjusted red snapper prices before (1990-2006, Accumulated Landings System [ALS]) and after (2007-2011, Individual Fishing Quota [IFQ]) introduction of the LAPP. SOURCE: Figure 16 in red snapper 5-year review.

Grouper-Tilefish (Gulf of Mexico)

Evidence for price increases: strong based on before-after comparison of inflation-adjusted prices. All species categories experienced inflation-adjusted price increases after formation of the LAPP (Gulf of Mexico Fishery Management Council, 2018a).

Bluefin Tuna (highly migratory species)

Evidence for price increases: unknown (the 5-year review does not report ex-vessel price in the baseline pre-LAPP period). The market for bluefin tuna is mainly international, and therefore there is no theoretical reason why small changes in the numbers of bluefin tuna landed and sold would have an effect on price.

Wreckfish (South Atlantic)

Evidence for price increases: unknown (the 5-year review does not report ex-vessel price in the baseline pre-LAPP period).

Golden Tilefish (Mid-Atlantic)

Evidence for price increases: strong based on before-after comparison of inflation-adjusted prices (Mid-Atlantic Fishery Management Council, 2017).

Other Indicators of Efficiency

Changes in costs are more difficult to assess because cost information is typically proprietary, and the relevant comparisons are marginal cost curves, which are not directly observable. Productivity analysis relating inputs to outputs is typically used to assess cost changes. Higher productivity implies lower costs and thus higher profitability. A much simpler, but less reliable, indicator of productivity is catch per unit effort.

Productivity analysis relating inputs to outputs was done for the golden tilefish LAPP review. Productivity increased relative to the baseline in golden tilefish after adjusting for biomass changes (assumed to be independent of the LAPP management), with the exception of one year. This can be interpreted as modest to strong evidence for a decrease in costs due to the LAPP. Changes in profitability and efficiency can be interpreted from changes in revenues too, as was done for the bluefin tuna LAPP review. Maintaining profitability was an objective of the bluefin tuna IBQ program, balanced with the objective of limiting landings and dead discards. In this case, revenues (mainly from target species) declined, but that was a trend that began prior to and independent of the IBQ program for the most part.

Evidence of Profitability from Share or Quota Price Increase

Another indicator of overall profitability is the quota or share price. The quota price is an indicator of the discounted future stream of expected profits. As such, it is a measure of cost and revenue expectations from an operational perspective as well as anticipated stock health, regulation, and fleet structure. This makes quota price the most comprehensive measure of profitability. The drawback of relying on quota price to assess profitability changes in a LAPP fishery is that quota price does not exist in the baseline, pre-LAPP period. It can only be used to assess profitability changes after creation of a LAPP.

Evidence of Profitability from Share or Quota Price Increase in Study Fisheries*Red Snapper (Gulf of Mexico)*

Evidence for profitability increases: strong based on the trend of inflation-adjusted share prices. Red snapper experienced very large inflation-adjusted share price increases in the first 5 years of the LAPP (Gulf of Mexico Fishery Management Council, 2013). This is also consistent with a large increase in share value relative to estimated pre-LAPP share values provided by Fenichel and Abbott (2014).

Grouper-Tilefish Complex (Gulf of Mexico)

Evidence for profitability increases: strong based on the trend of inflation-adjusted share prices. Red grouper, gag grouper, and tilefish experienced very large inflation-adjusted share price increases in the first 5 years of the LAPP, suggesting large increases in profitability (Gulf of Mexico Fishery Management Council, 2018a). Deepwater grouper experienced more modest price increases in share price, suggesting more modest increases in profitability. Shallow-water grouper experienced modest share price increases in some years, but the most recent inflation-adjusted share price in the 5-year review is below the initial price in 2010. Substantial increases in profitability for most species in the complex are consistent with a large increase in share value relative to an implicit share value pre-LAPP as estimated by Fenichel and Abbott (2014).

Bluefin Tuna (highly migratory species)

Evidence for profitability increases: none. The configuration of the bluefin LAPP is different from others and share prices do not have the same meaning in terms of signaling profitability.

Wreckfish (South Atlantic)

Evidence for profitability increases: none. Share prices are not available consistently over time due to data confidentiality issues.

Golden Tilefish (Mid-Atlantic)

Evidence for profitability increases: modest. Quota prices are confidential and not reported in the 5-year review. However, there are two percentage changes reported, suggesting that quota prices increased substantially (144%) after 2010. However, quota prices subsequently decreased (−51%). The net effect is still positive, so it appears that profitability increased in the post-LAPP period.

Effort Reduction and Consolidation

LAPPs are expected to reduce total fishing effort and can be associated with consolidation in an overcapitalized fleet. Consolidation refers to changes in industry structure where catch, boat ownership, and/or quota holdings become more concentrated among fewer vessels, individual owners, or fishing firms. LAPPs can change industry structure through consolidation of ownership of quota shares and/or fishing vessels through at least two mechanisms: (1) transferability of catch shares, which tends to favor the more efficient operations, and thus less efficient ones disappear from the fishery or are bought out and consolidated with the more efficient ones; and (2) possible economies of scale that attend larger business ventures. Therefore, an examination of economic effects of LAPPs includes a focus on consolidation.

As described above, many LAPPs are structured to provide incentives for the consolidation of the fleet, particularly if the exclusive privileges are transferable. The actual effects will vary depending primarily on the size, age structure, the diversity of vessel efficiency of the fleet, and its overall annual catching capacity relative to the annual TAC. Often LAPPs are chosen because of identified overcapacity problems. As such they can fundamentally change fleet composition and structure, which can have repercussions throughout the fishery. In countries like Iceland and New Zealand, consolidation of fishing quota ownership following ITQ implementation was rapid and substantial (Pálsson and Helgason, 1995; Stewart and Callagher, 2011; Stewart et al., 2006). In the United States, some fisheries experienced rapid consolidation after LAPPs implementation. For example, in the first year of IFQ management, the number of vessels in the Bering Sea red king crab fishery contracted by 63%, indicating significant overcapacity of the fleet prior to implementation. Consolidation is a common but not universal outcome of LAPPs. For example, Olson (2011) notes that some fleets in New Zealand expanded after LAPPs due to recently discovered offshore stocks and the lack of vessels capable of harvesting far from shore at those depths, which led to state support for offshore fishing capacity. This example illustrates the limitations of drawing inferences about policy impacts without a counterfactual. Fleet capacity might have expanded anyway without the LAPP, or it might have expanded more or less.

Consolidation induced by a LAPP also has implications for the stock of capital available to fish in other fisheries. Fishers can enter or intensify fishing in other fisheries for which they hold permits. There is evidence that the New England groundfish sector catch share program caused spillover of fishing effort into adjacent Mid-Atlantic fisheries that were not managed with IFQs (Cunningham et al., 2016). Vessels can also be sold domestically or internationally and enter new fisheries. The interconnections of fisheries and the mobility of fishing capital highlights the difficulty in understanding individual fisheries in isolation (Kroetz et al., 2019b) and reinforces the need to avoid subsidies of fishing capital even when they are intended for a tightly controlled IFQ fishery (Smith, 2019).

Evidence on Consolidation in Study Fisheries

Red Snapper (Gulf of Mexico)

Evidence for some consolidation: modest. While Boen and Keithly (2012) report consolidation concerns from an early survey of participants, especially among smaller shareholders, the committee found little evidence for concern about market power (see also Mitchell, 2016). Further the evidence is all based on before-after comparisons, so it lacks statistical control of the counterfactual (Gulf of Mexico Fishery Management Council, 2013). The number of vessels participating in the red snapper fishery declined after the LAPP went into effect, and the concentration of landings and quota increased as indicated by the Gini coefficient and the Herfindahl-Hirschman index (HHI). The highest landings HHI (191.6 in 2011, up from a low of 106.4 in 2002) is still well below the standard threshold for a market showing “moderate concentration” (HHI = 1,500). That is, these values of the HHI are on the low end of the range considered unconcentrated and near the threshold for highly competitive. In light of this, it is unclear whether this amount of consolidation is economically or socially consequential. Also, the landings HHI was trending upward prior to the LAPP and vessel numbers were trending down, weakening the evidence for a causal effect of the LAPP on consolidation, as shown in Figure 5.4. However, this figure also shows that some increase in HHI was beyond what would be expected based on the trend alone.

Concern about consolidation. The 5-year review mentions concern about the structural aspects of consolidation because of quota distribution and public comment. Quota distribution data have shown that 29 accounts hold 61% of the red snapper fishery quota, and public comment has indicated that further consolidation may restrict access and adversely affect some communities (Gulf of Mexico Fishery Management Council, 2013). LAPPs have implemented caps on share ownership to account for the potential negative impacts of share consolidation, such as in the red snapper program, and given these caps the HHI could be rescaled to account for the effective maximum value in any quantitative analysis. However, identifying the actual entities—whether individuals, partnerships, businesses—that hold

accounts, and their linkages with other accounts, has proved difficult given the method of record-keeping employed. Thus, empirical data on consolidation of shares, as distinct from vessels, as an additional metric may not be as helpful as other measures or make it possible to discern certain types of social impacts. It may also be the case that consolidation in the landings or allocation markets, such as from the development of brokers, could affect social outcomes.

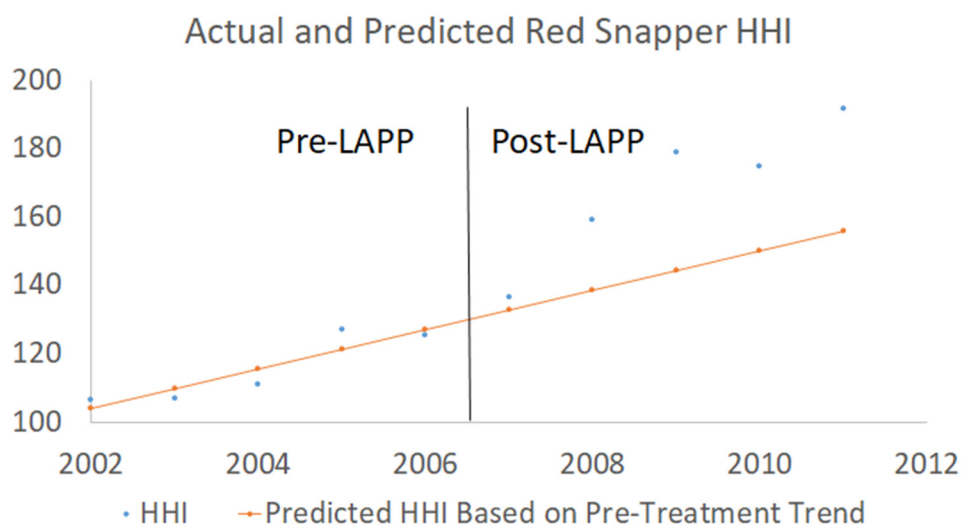


FIGURE 5.4 Concentration of Gulf of Mexico red snapper landings before and after the LAPP. Concentration is measured by the Herfindahl-Hirschman index (HHI). Actual values (blue) were trending upward prior to the LAPP. The trend (orange) is based on a linear regression of HHI on year using only data before the LAPP (2002-2006). DATA SOURCE: Table 7, red snapper 5-year review.

The modest consolidation of quota in the red snapper fishery is illustrated by Figure 5.5.

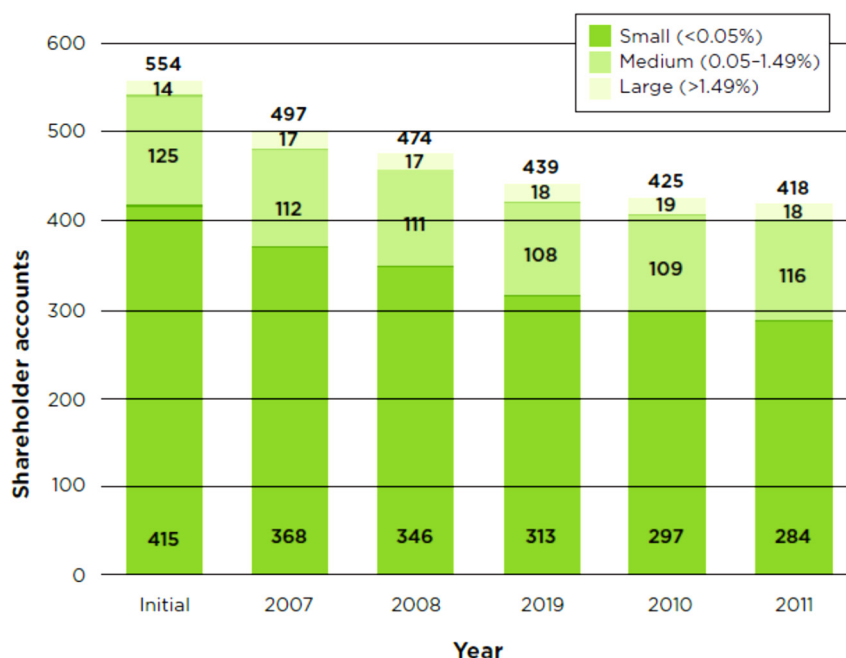


FIGURE 5.5 Number red snapper IFQ program quota shareholders over time by size. SOURCE: Red snapper 5-year review.

Grouper-Tilefish (Gulf of Mexico)

Evidence for some consolidation: modest. The evidence is all based on before-after comparisons, so it lacks statistical control of the counterfactual (Mitchell, 2016). This omission is particularly important because the LAPP went into effect in the same year as the *Deepwater Horizon* oil spill, which may also have affected post-LAPP outcomes. The number of vessels participating in the grouper-tilefish fishery declined after the LAPP went into effect. Measures of concentration vary across species within the complex. HHIs are in the unconcentrated range for red grouper, gag, deepwater grouper, and shallow-water grouper, while tilefish crosses the threshold of modest concentration in two of the post-LAPP years. If one defines the market narrowly enough, it is always possible to find evidence of concentration, so it is debatable whether splitting out the individual species in the grouper-tilefish IFQ is too narrow. In light of this, it is unclear whether consolidation in grouper-tilefish is economically or socially consequential. Also, the vessel numbers were trending down prior to LAPP implementation, weakening the evidence for a causal effect of the LAPP on consolidation. The 5-year review notes the relatively high Gini coefficients for the grouper-tilefish complex as well as red snapper, but notes that there was similarly high concentration prior to IFQs.

Concerns about consolidation. Ethnographic research in west Florida fishing communities (Overbey, 2016) showed that the initial distribution and subsequent consolidation made social distinctions between “big guys” and “little guys” more obvious than before; the latter were those who had to lease, work as crew for others, or leave the fishery. There is also a perception that a few of the “big guys” can exert undue control over the price of leasing allocation (Gulf of Mexico Fishery Management Council, 2018a). The cost of leasing allocation is central and critical to the typically small-scale, family-owned fishing enterprises of the region, affecting the entry of young people and the ability to attract and keep captains and crew.

This example also illustrates a divergence between perceived reality and the measurable economic conditions of the fishery. The HHIs for quota share holdings are all in the unconcentrated range in every period for red snapper, red and gag grouper, deepwater grouper, shallow-water grouper, and tilefish (Mitchell, 2016). Quota allocation holdings also fall in the unconcentrated range for red snapper, red and gag grouper, and shallow-water grouper in every period (Mitchell, 2016). Altogether, this evidence suggests that “big guys” are not controlling the price through market power. Only for tilefish and deepwater grouper do HHIs exceed the 1,500 threshold of moderate concentration and only in some parts of 2010, indicating little possibility for market power contributing to high quota prices. In the absence of evidence of market power, the more plausible explanation for high quota prices is that the fishery has become more profitable through reduced costs, increased revenues associated with better market timing, more stable supply chains, improved product quality, and overall improved stock condition most likely driven by stock rebuilding rather than the LAPP.

Bluefin Tuna (highly migratory species)

Evidence of consolidation: weak. The number of vessels in the fishery declined after LAPP implementation, but the number of vessels was declining prior to implementation. There are no calculations available to assess industry concentration.

Wreckfish (South Atlantic)

Evidence of continued consolidation: modest. The pre-LAPP data are not reported in the 5-year review, and instead before-after comparisons are made in the period prior to 5-year review and during the 5 years. This makes concentration comparisons to other fisheries more difficult, as there is not even before-after data on the fishery itself. Overall, the wreckfish fishery has become highly concentrated according to the HHI. This is not surprising given the small number of total participants in the fishery. The 5-year review concluded that the high concentration is unlikely to have negative effects on product markets given the

highly competitive nature of seafood markets. However, the highly concentrated HHI does suggest possible market power that would constrain new entry.

Golden Tilefish (Mid-Atlantic)

Evidence of continued consolidation: modest. The evidence is all based on before-after comparisons, so it lacks statistical control of the counterfactual. Prior to LAPPs, the golden tilefish fishery had just 14 active vessels and an HHI of 1,150 in the baseline period (unconcentrated). After LAPPs, the number of vessels declined to between 9 and 11, and HHI increased as high as 1,805 (in the range of moderate concentration). It is unclear whether this change is enough to create market power in the quota market that has consequences for entry into the fishery.

Labor and Employment

If the LAPP creates conditions for reduction in the numbers of boats and/or trips and other changes linked to greater efficiency, one can expect effects on the number and character of jobs at sea and on land, the nature of work, and conditions of employment. Asche et al. (2018) found no effects of LAPPs on labor in their cross-sectional correlative study of a large set of fisheries. However, the issues of employment changes and labor conditions frequently arise in debates and observations of LAPP fisheries and are expected to differ depending on the design and prior conditions of a fishery (Steiner et al., 2018).

Studies have shown that fewer vessels participating over longer seasons can result in both positive and negative outcomes for crew. For example, changes in the unit value of catch may affect wages and employment. The intended reduction of the fleet that often accompanies IFQ programs reduces captain and crew jobs as well as fishing opportunities for vessel owners who do not qualify for the initial allocation, some of whom may become crew on other boats (Overbey, 2016). For those who continue or begin when the LAPP is in place, there may be other changes. For example, if derby fishing ends, employment may be spread across a much longer fishing season, which could increase or decrease employment for affected crew members and change the nature of the work (e.g., Abbott et al., 2010). Research in Kodiak, Alaska, showed a decline in the value of skilled labor that led to a loss of power for crew members and an additional barrier to upward mobility due to the costs associated with acquiring quota (Carothers, 2015). People also see unfairness in a system in which quota owners can lease or sell their share when they leave the fishery, but crew are not similarly compensated and may have fewer alternatives (Terkla et al., 1988). The roots of the sense of inequity revealed in such studies lie in the practice of allocating IFQs almost exclusively to vessel owners, based on an assumption about the priority of capital ownership (e.g., “vessel owners and lease holders are the participants who supply the means to harvest fish, suffer the financial and liability risks to do so, and direct the fishing operations”; NOAA Fisheries, 1993) over the contributions of the skills and labor of hired captains, mates, and deckhands. One exception is the Bering Sea crab fishery where skippers of vessels received 3% of the allocated fishing quota.

The effects of LAPP-related consolidation on former hired captains and crew members are especially difficult to assess because there is usually no official record of their identities and histories of participation. As the 5-year review for red snapper states, “A survey of crew members and vessel owners who were omitted from the IFQ fishery would be helpful to gauge the level of stress and impact the decisions of management had on them and their families” (Gulf of Mexico Fishery Management Council, 2013). Such a survey does not exist. However, a general survey of crew in the northeast and Mid-Atlantic regions (Henry and Olson, 2014) provides some insight into the situations and perspectives of crew in general. The survey indicated that crew members rarely participate in the management process, often feel as though their opinions are irrelevant, and exhibit a high level of distrust of management. Many indicated that they do not have access to health insurance and that earnings predictability is a concern. Nevertheless, survey participants “exhibit a high level of attachment to fishing as an occupation and satisfaction with the non-economic aspects of fishing as a career” (Henry and Olson, 2014).

A major social question is how the wealth that is created by more efficient fisheries is distributed in relation to expectations of participants in the fishery and the larger community. The owner-captain-crew relationship is central, and most commercial fisheries have a tradition of remunerating captains, mates, and deckhands via a “lay” system of sharing both costs and returns with the owner(s). The costs of quota shares are taken into account in a variety of ways within these systems, and may come to be seen as unfairly disadvantaging crew members (e.g., Pinkerton, 2014; Pinkerton and Edwards, 2009). Leasing costs and even cost recovery fees are often deducted from the lay, together with other costs of the voyage, before shares to the owner and crew are distributed. This can be perceived locally as a social problem because of expectations derived from the longstanding systems in fisheries of sharing risk and rewards in labor contracts. Thus, even though the actual pay may be the same or better, and working conditions including safety at sea may improve, some participants are dissatisfied, adopting historically inaccurate but evocative terms such as “sharecropper” to refer to what they perceive as the loss of a more equitable “sharing” in the remuneration system, which is colored by the social status differential that emerges between shareholders and others with LAPPs.

Despite a rich ethnographic literature, there are strikingly few quantitative analyses that attempt to measure the causal impact of LAPPs on labor. This is largely driven for most fisheries by the lack of crew registries and even the most basic data on vessel crew employment and pay. In the few cases where such data do exist, they are often not available either before or after the policy change, making any inferences about changes in the welfare of crew difficult to substantiate with or without efforts to assess counterfactuals and confounding variables.

Abbott et al. (2010) provide an exception to the lack of data before and after the policy change by utilizing data collected from vessels in the years immediately preceding and following the implementation of IFQs in the Bering Sea and Aleutian Island crab fisheries. Utilizing simple before-after comparisons, they show that, while employment measured in total employees declined dramatically due to consolidation under the IFQ, a metric of employment that considers the “intensity” of employment (its duration) for crew on the same vessels before and after IFQs did not decline. However, improvements in harvesting efficiency did reduce the amount of crew time required per a unit of landings. These findings highlight the importance of adopting a multidimensional notion of measures of employment, where IFQs may expand some margins at the cost of others.

The issue of changes in share contracts or a shift toward daily wages is often seen as a negative aspect of LAPPs by crew members (e.g., Carothers, 2015; Eythorsson, 1996; McCay and Brandt, 2001; Olson, 2011; Pinkerton, 2014, 2015; Ringer et al., 2018). However, the cost of leasing quota can be removed from the ex-vessel revenue prior to the crew being paid. An analysis of the British Columbia halibut fishery showed lower returns to crew from the practice (Pinkerton and Edwards, 2009), but other studies, in that fishery (Casey et al., 1995), in the Mid-Atlantic surf clam fishery (Brandt and Ding, 2008), and the West Coast groundfish trawl fishery (Steiner et al., 2018), found that the added cost to crew was more than compensated by increases in crew income.

In their quantitative crab fishery study, Abbott et al. (2010) found no evidence of changes in the share contracts used to define crew remuneration, while the overall seasonal pay of noncaptain crew undoubtedly increased for the majority of crew relative to pre-IFQ years. When calculated as a daily “wage,” the majority of red king crab crew saw their pay increase as well—driven in part by the reduction in labor hours per ton of harvest and a consolidation-induced increase in the number of fishing versus nonfishing days per vessel compensated by the lay system—while the evidence for snow crab was more mixed. On the whole, it could be argued that crew outcomes improved for those that were able to remain in the fishery, particularly in light of well-documented improvements in safety in the fishery.

Although revenues may be the same or higher, the share of landings devoted to crew pay may decline. In other words, the rents created by additional productivity are not divided proportionally with crew, but are instead capitalized into the price of quota, a factor that might affect job satisfaction and perceptions of equity within the fishery (Steiner et al., 2018). Effects on job satisfaction may reflect perceptions of some participants in the fisheries that reduced shares are evidence of devaluing labor. More generally, the traditional “co-venturer” nature of crew employment in fisheries may be altered, coming

closer to wage labor relationships (Pinkerton, 2014). Whether these changes in remuneration practices constitute a net gain or loss to crew is unclear. Movement toward a wage may reduce the upside risk from a highly successful season (or from working on a particularly skilled vessel), but it also shelters captains and crew from the downside risk associated with poor fishing or shocks to input prices (e.g., fuel). Furthermore, while some crew members employed before the LAPP transition may find this new arrangement undesirable and either persist in the fishery anyway or seek alternative employment, some new crew members may be specifically attracted to the new terms of employment in the LAPP. The overall effects of remuneration changes under LAPPs are therefore uncertain and depend strongly on the risk preferences of a changing population of crew members.

While useful, the Abbott et al. (2010) study suffers from some shortcomings including the lack of a comparison group to control for confounding trends and the inability to follow outcomes for those crew that exited the fishery. Finally, the study only focuses on the short-run effects of LAPPs potentially failing to reveal longer-run impacts to crew as quota consolidates, the rate of leasing among vessels increases, and as “sticky” remuneration practices, such as a crew’s share of net revenues or the list of costs that are deducted before calculating this share, change.

Evidence on Labor and Employment Shifts in Study Fisheries

No information is available on labor and employment shifts due to LAPPs for the wreckfish, golden tilefish, and Atlantic bluefin tuna programs. Confidentiality may be a factor for the wreckfish and golden tilefish cases, given the very small number of vessels involved. The general problem is, as noted above, the lack of records on hired captains and crew. However, special efforts were made for the two Gulf of Mexico LAPPs.

Red Snapper and Grouper-Tilefish Evidence on Labor and Employment

Boen and Keithly (2012) report a reduction in crew size in the red snapper fishery since IFQ implementation, especially in the western Gulf region and among small and medium-sized vessels (Gulf of Mexico Fishery Management Council, 2013). The 5-year review asserted that while crew sizes decreased, the ability to hire and retain stable crews increased, suggesting that holding a quota share, and hence the capacity to know how much the vessel will actually fish, may help recruit and keep crew.

Efforts were made in a 2016 in-person survey of 153 captains and crew members to assay changes since the IFQ program for grouper and tilefish species in the Gulf of Mexico began in 2010 (ECS Federal Inc. et al., 2017). Strength of the findings was constrained by the lack of a baseline survey and quantitative data on incomes, and by underrepresentation of captains and crew who no longer fished as well as regional, ethnic, and age differences. Respondents were almost all white males from Florida who participated before IFQs and continued participating in grouper and tilefish fishing. As expected given consolidation, they generally reported less work available, with less choice and flexibility to move among vessels. Income measures were roughly unchanged. Crews reported a slight reduction in the stability of their annual incomes, and both captains and crew reported a slight reduction in their ability to earn large increases in income. While many fishers experienced increased revenue shares, there was, on average, a decrease. It was unclear whether this decrease was caused by IFQs directly, general labor market conditions (e.g., fewer jobs in the fishery driving down wages), or some other change. Approximately one-third of respondents said that they were worse off than before IFQs, but it was not evident what the causes were. The respondents reported a significant increase in safety, mixed perceptions of job satisfaction, and a general concern with lack of perceived fairness, focusing on the fact that holding quota did not require active participation in fishing.

Another source (QuanTech, Inc., 2015) is based on a mail, telephone, and Internet-based survey of people identified as shareholders; the total response rate was 35.6%. The “lay” or share system predominates, accounting for 88% of the enterprises that hired crew. A very small percent paid crew a flat rate per day, trip, or season, and the difference before and after was small (from 7.6% to 10%; Table 17 of

QuanTech, Inc., 2015), therefore not indicating a shift toward wage labor. Although there were differences in the share system of distribution of revenues to owner, captain, and crew, they reported virtually no change in the system pre-IFQ to post-IFQ (Table 19 of QuanTech, Inc., 2015), but by and large they deducted the expense of shares before paying captain and crew (Tables 15 and 18 of QuanTech, Inc., 2015). In contrast to crew and captain reports of greater difficulty finding employment in the fishery post-IFQ, in this study there was a marked increase in the percentage of respondents who felt that retaining skilled crew and hiring skilled replacement crew was “difficult” or “very difficult” post-IFQ (Table 12 of QuanTech, Inc., 2015).

Griffith et al. (2016) conducted qualitative research on labor relations in the grouper-tilefish ITQ program. Their studies included 176 interviews (25% of the approximately 700 shareholders). They note that “very likely due to the contentious nature of the program” those who no longer fished in these programs refused to be interviewed (Griffith, 2018). Concern about changed social relations within the fisheries came up in many discussions by interviewees of the situation where some who received small allocations are forced to lease some or all of the quota share they need, at what they see as high costs (one term used is “usury”), or to become crew members rather than owner-operators. Hired captains and crew members, including many with long histories of participation, viewed themselves as disadvantaged in the initial allocation, stating that the shares went to boat owners with reef fish permits rather than to fishers on vessels. As such, some of the labor outcomes associated with the IFQ stem from the particular design of the initial allocation, not necessarily the transition to IFQs.¹

Rise of New Roles

A social consequence of LAPPs with economic implications is the emergence of new social roles and relationships (Wingard, 2000). The initial allocation sets up the conditions and structure for a realignment of social and economic positions within a fishery and within communities. In the existing IFQ systems, the initial allocation is set up to “grandfather in” those historical participants who meet qualification criteria, and those criteria tend to be designed to reflect the status quo at the time decisions are made by the Council or other bodies (Creed, 1991; McCay, 2001). One reason for this in overcapitalized fisheries is the desire to not attract new capital (i.e., vessels) into the fishery. The process that follows, involving sales, lease exchanges, and so on, often results in a continuation or intensification of existing differences in capital, wealth, and status, as shown in a large number of cases worldwide (Shotton, 2001). From the perspective of those with no or small shares, the situation is sometimes viewed as intensifying differences between “winners” and “losers,” as learned in an ethnographic study of west Florida grouper-tilefish participants, where many appreciate the benefits of the IFQ program but identify the intensified gap between the “haves” and the “have nots” as a problem (Griffith et al., 2016; Overbey, 2016). The Mid-Atlantic golden tilefish LAPP 5-year review also noted as a social impact the persistence of this sentiment, coming out of a long history of progressive consolidation of ownership and participation and exclusion of some with perceived claims to the fishery based on their roles in developing it.

With the initial allocation comes the rapid appearance of a new socioeconomic class of individuals and other entities that control access to the fisheries, the IFQ shareholders, and a corresponding group dependent on them for access. As seen in the Gulf of Mexico IFQ programs, shareholders have formed associations and been active in representing their interests in fisheries management venues and the courts, potentially changing the political economy of the fisheries.

Furthermore, shareholders and others have become brokers, buying and selling allocation, as might be expected given the transferability of the shares and annual allocations and their possible value of market clearinghouses. A LAPP is a constructed market and, as in other sectors of the economy that have financial assets like commodity futures or equities associated with them, it creates opportunities for employment in

¹ As Griffith (2018) noted, in most of the U.S. LAPPs, history has become a commodity because measures of historical landings are used to determine initial allocations of IFQs, and those measures take on an identity and value of their own. The history created by a particular fishing crew becomes an attribute of the vessel and goes with it if the vessel is sold.

the trading of assets. The rise of a new broker class was mentioned in the 5-year review of the red snapper LAPP as a social impact (Gulf of Mexico Fishery Management Council, 2013). In surveys and interviews with participants in the IFQ fisheries, there is a frequently expressed idea that it is unfair for some people to profit from owning and/or trading quota shares or allocations without actually fishing. “The increase in the number of shareholders not landing any fish has led to perceptions that many are profiting from the program at the expense of hard-working fishermen” (Gulf of Mexico Fishery Management Council, 2013). This moral sentiment is colored by concern that outside investors might be profiting, which was made more possible in 2012 (for red snapper) and 2015 (for grouper and tilefish) allowing “public” ownership, removing the requirement that one had to have a limited access reef fish permit to hold and use a quota share. However, identifying such brokers is difficult in the Gulf LAPPs because it requires landings and allocation trading data; Ropicki et al. (2018) referred to participants that do not own shares or fish commercially but buy and sell allocation as “allocation brokers,” acknowledging their roles in facilitating a market.

The Councils are authorized to address the issue of ownership of catch shares by people who are not active in the fishery. In Section 1853a(c)(5)(E) of the MSA (see Box 5.2), Congress reflected the social concern about outsider control over fisheries in a provision that authorizes LAPPs “to harvest fish to be held, acquired, used by, or issued under the system to persons who substantially participate in the fishery, including in a specific sector of such fishery, as specified by the Council.”

It should also be noted that new relationships among fishers, dealers, brokers, and others have formed in many other ways, as shown in a social network analysis done for the grouper-tilefish 5-year review, but the social and economic impacts of such new arrangements have not been studied extensively (red snapper is an exception; Ropicki and Larkin, 2014). The committee was unable to find information that allows assessment of what the actual impacts are on fishers and their access to allocation across all the cases of this study; however, Ropicki et al. (2018) identify six different categories of LAPP participants and discuss proposed impacts to each by changes suggested in Amendment 36B (i.e., increase share ownership among harvesters, limit allocation/harvest consolidation, and increase harvest flexibility). This study also emphasizes that socioeconomic outcomes are affected by the size and composition of several interrelated markets (i.e., markets for shares, allocations, and fish landings).

Distributional Inequities

Commercial participants in a fishery are not identical. In economic terms, participants can differ by size and type of ownership, target portfolios, vessel characteristics, and level of investment. As such, implementation of LAPPS also can have differential impacts on diverse operators and operations and these impacts can be amplified under LAPPS such as when they utilize additional management measures (such as vessel permit requirements) or allow for leasing (which creates markets for two types of assets: quota shares and annual allocations). In response to distributional concerns such as these, the Councils have been responsive and have instituted a suite of additional criteria for allocation within the commercial sector including allocating quota by area and vessel characteristics (size, targets, owner-operated, inclusion of other species, etc.). While such supplemental measures may solve or address critical management issues, perhaps unsurprisingly they can create dependencies and advantages that were not anticipated. One such example is in the Gulf of Mexico.

The 5-year review of the red snapper program identified two primarily distributional impacts within the commercial sector: relatively high regional discard rates due to regional differences in stock improvements (a disadvantage of allocating based on past catch in absence of a well-functioning transfer market) and an increase in quota owners that were not fishing (and, relatedly, an increase in lease-dependent fishers). Since the very purpose of the mandated reviews is to assess success and adjust the program, the Council sought to address these impacts through Amendment 36. In particular, Amendment 36B was drafted to include red snapper and grouper-tilefish participants and included several options that were designed to do one of three things: “increase ownership of shares by harvesters, limit consolidation in the harvest sector, or increase harvest flexibility” (Ropicki et al., 2018). To foster dialogue on potential

outcomes in advance of adoption, Ropicki et al. (2018) used available data from the catch share, allocation, and landings markets to systematically compare likely impacts on six participant types in the red snapper fishery based on whether they were active fishers, owned shares, and bought or sold allocation. While Amendment 36B did not answer several key questions to perfectly match the proposed outcomes, the insights gained on the causal mechanisms for effects in such fisheries could prove valuable. With respect to changes that could increase ownership of share by harvesters—a common narrative to achieve more equity—all of the options considered would likely either flood and devalue the share market or shrink and increase the value of the allocation market. These outcomes undermine the intended benefits to harvesters who move from being allocation dependent to an investor fisher and to those who prefer the flexibility of using the allocation market (i.e., supplementers and remaining allocation-dependent fishers). More importantly, there is no guarantee that if more shares were available in the market, they would go to allocation-dependent fishers.

Social and Cultural Diversity

LAPPs can require significant trade-offs between increasing economic efficiency and maintaining a diverse fleet structure. Removal of less efficient vessels suggests a trade-off between increasing economic value and the social objective of maintaining diverse participation, as documented for Alaska's halibut and sablefish fisheries (Kroetz et al., 2015). Fleet diversity is not just about vessel size classes or areas fished or technology; it is also about the demographic, socioeconomic status, and cultural identities of participants. Studies of LAPPs worldwide show loss of access rights in LAPPs fisheries on the part of young, small-scale, low-income, Indigenous, minority, and rural fishers (e.g., Carothers and Chambers, 2012; Pinkerton, 2019; Stewart et al., 2006; Yandle and Dewees, 2008; Young et al., 2018). For various reasons, these populations can disproportionately be excluded from LAPPs at initial allocation or fare poorly under the trading that follows. They may have diverse motivations for fishing and less access to auxiliary institutions that support LAPPs fishery participation, like education, credit, and banking (Carothers, 2008, 2012; Davis, 1996; Langdon, 2018; Maurstad, 2000; McCormack, 2007, 2010). Furthermore, although these are often less economically efficient fishers, and thus the ones pinpointed for removal from the fishery based on economic goals, their livelihoods, identities, and cultures can be highly dependent on fishing, so the loss of access can be catastrophic. Moreover, smaller-scale, place-based fishers are likely more dependent on local stocks, with incentives to favor conservation (Bennett et al., 2018). A demographic trend—the aging or “graying” of the fleet—has been studied in limited entry and LAPP fisheries in several regions in the United States (e.g., Cramer et al., 2018; Donkersloot and Carothers, 2016; Johnson and Mazur, 2018; Ringer et al., 2018). Economic and social barriers to entry and upward mobility in LAPPs fisheries and incentives that lead to older quota owners keeping rather than divesting their fishing assets (e.g., Szymkowiak and Himes-Cornell, 2015) are contributing factors to this demographic trend.

In fisheries where onshore processing is part of the supply chain, trading of quota shares can benefit some coastal communities, where the owners of those shares decide to land their catches, and hurt others, where local fishing firms have sold out or were not granted adequate quota shares, and thus reduce the amount available to the processing firms. This was a major problem in Iceland in the early period of ITQs (Pálsson and Helgason, 1995). Quota share transfers have also led to a significant shift in fisheries participation and control between rural and urban regions in Alaska, with important cultural and political implications as rural Alaska is primarily made up of Indigenous communities including 229 federally recognized Tribes (Carothers et al., 2010; Donkersloot and Carothers, 2016; NPFMC, 2010). Chapter 7 examines community dimensions of the LAPPs in mixed-use fisheries.

As noted in Chapter 2, in defining LAPPs, Congress included provisions to recognize and protect small-scale, owner-operated fisheries and respect the needs of fishing communities. There were provisions to mitigate unfair initial allocations, high costs of entry after the initial allocation, excessive consolidation and concentration of ownership, and other known and anticipated socioeconomic consequences of creating tradable individual privileges. Consequently, the LAPPs of this study have had various features such as caps on ownership of shares or holding of allocations; tiered vessel size classes and other measures to reflect

fleet diversity in initial allocation (the golden tilefish and red snapper IFQs), and owner-on-board provisions intended to prevent what is deemed as excessive consolidation and maintain fleet diversity. The original red snapper and golden tilefish IFQs now allow any U.S. citizen or permanent resident to own and trade shares or allocation (since 2012 and 2015, respectively) but the commercial reef fish permit is still required to harvest.

Such measures and others are devised because of recognition that market-based allocation can have effects on fleet diversity. However, the data for the fisheries in this study are not collected and analyzed currently in ways that allow for assessing the effects of the program on small-scale fisheries, owner-operator fishing enterprises, minority fishers, or any other socioeconomic or demographic group. The section above on consolidation discusses evidence for degrees of concentration of ownership or inequality in participation, using the standard measures, the Gini coefficient and the HHI. From this perspective, the LAPPs in this study vary in the extent to which the consolidation occurred, and it is unclear whether any consolidated enough to create market power in the quota market (Mitchell, 2016). This can be relevant, through the price of shares, for entry into the fishery and thus social diversity.

Evidence for how participants assessed the distributional effects of the red snapper LAPP is from two surveys. An early survey of IFQ shareholders underscored disapproval of the IFQ design process, including how voting took place, which fed into general distrust in fisheries management (Miller, 2010). A second survey of the perceptions and attitudes of participants (Alsharif and Miller, 2012) also identified a high level of opposition to IFQs, mostly because of fear that small-scale fishers would be pushed out of the fishery. “When it comes to protecting the interests of the small scale fishers and fishing dependent communities, respondents (82–88 percent) overwhelmingly believed the IFQ fails” (Alsharif and Miller, 2012). Although the required environmental impact assessment stated that “investment in IFQ shares would not necessarily be prohibitive for small operators, part-time fishers, or fishers who participate in several fisheries throughout the year,” many respondents felt that the cost of buying shares was in fact prohibitive, and there was only a small net gain from leasing shares (Alsharif and Miller, 2012).

Evidence of Diversity in Study Fisheries

Red Snapper and Grouper-Tilefish Evidence

For the Gulf of Mexico LAPPs it is difficult to investigate distributional impacts because of the challenge of identifying the actual entities involved. Groups of individuals and businesses can have affiliated or shared ownership of quota shares and boats, some vertically integrated. However, these relationships are not fully recorded in the record-keeping system, resulting in the underestimation of consolidation (Mitchell, 2016). The overall conclusion for the grouper-tilefish review was simply that, “as economic theory would suggest, the distributions of GT landings and revenues have become somewhat more unequal since the IFQ program was implemented” (Gulf of Mexico Fishery Management Council, 2018a). The analysis was done at the vessel level but does not indicate which vessels remained and had the higher landings and revenues, and which did not. Data in the red snapper and grouper-tilefish reviews are not reported in a way that would allow quantitative assessment of the distributional outcomes among different categories of participants.

Unfortunately, data were not available to the committee about social and cultural diversity dimensions of the fisheries of the study, beyond ethnographic appraisals of the grouper-tilefish IFQ in various communities of Florida, Louisiana, and Texas (Griffith et al., 2016), and the National Oceanic and Atmospheric Administration community studies discussed in Chapter 7. Surveys done for the grouper-tilefish IFQ review indicate the ages, racial and ethnic identity, location, and gender of respondents but emphasize lack of adequate representation of regional, age, and other differences in the sample (e.g., ECS Federal Inc. et al., 2017). This is despite knowledge of tremendous diversity in the Gulf of Mexico and the Southeast Atlantic region, both at sea and in the processing and marketing sectors on land, including ethnic Cajuns, Spanish speakers, members of the United Houma nation, African Americans, and Vietnamese and Hmong Americans (e.g., Durrenberger, 1995; Griffith, 1999; Hoskins-Brown, 2020; Kang, 2016; Levin et

al., 2010; Margavio et al., 1993; Sullivan et al., 2018). The participation of these groups in the coastal, shrimp, and shellfish fisheries is well known; the committee was unable to find documentation of their presence or absence in the federal waters fisheries under review in this study.

Evidence of Distributional Impacts from Other Cases in This Study

No information was available to the committee for Atlantic bluefin tuna or wreckfish. For golden tilefish in the Mid-Atlantic, the only evidence for distributional impacts of the LAPP in the 5-year review is a qualitative report from a Council visioning process of 2011-2012. It stated that those who did not own significant quota in the golden tilefish ITQ system, “especially early participants in the fishery, are frustrated and feel as though they were pushed out of the fishery,” and some felt that the qualification dates were set to benefit certain businesses over others, even though the Council can document its efforts to represent all stakeholders in the process (Mid-Atlantic Fishery Management Council, 2017). In that initial allocation process, of the 31 limited access permits in the prior management system, 18 did not qualify because of low landings during the qualification period. Of those, only 8 had actually been engaged in fishing for tilefish, and after the ITQ system was implemented, all 8 focused on other fisheries, and four landed some tilefish via leased allocation or incidental landings (Mid-Atlantic Fishery Management Council, 2017). No information was provided about vessel sizes, comparative economics of the alternative fisheries, or how many later obtained quota shares.

The golden tilefish LAPP in the Mid-Atlantic includes an allocation of 5% of the TAC to an open access incidental catch fishery. Vessels possessing an “open access commercial/incidental” permit are allowed a trip limit of 500 pounds of golden tilefish (whole weight). Although they take a small amount of the TAC, this class of more than 2,000 vessels, spread throughout the region, benefits from the ability to add incidentally caught tilefish to their portfolios, and a few of those vessels are able to lease quota shares as well.

Fisheries Conservation and Management

As noted in Chapter 4, a possible positive effect of IFQ programs is that holders of exclusive rights or privileges have increased interest in sustainable fisheries management because the IFQs, if transferrable, become assets that will deliver a stream of long-term economic benefits (Moloney and Pearse, 1979; Munro and Pitcher, 1996; Squires et al., 1998). However, the theory is based on the idea that those rights are truly exclusive and secure property rights, whereas the LAPPs are only partially privatized and contingent privileges.² IFQ shareholders do not own fish, nor is their ownership of rights to catch a portion of a total allowable catch fully exclusive or secure, because the government retains the right to adjust allocations and even end the program (Bromley, 2009; Copes, 1986). Consequently, the effectiveness of LAPPs in promoting voluntary behaviors oriented toward conservation goals may be weaker than cases where ITQs or IFQs are more fully privatized with indefinite duration (Sumaila, 2010). This theory has been tested and refined through economic modeling, particularly in regard to the duration of the right and/or expectation that it will be renewed (Costello and Deacon, 2007; Costello and Kaffine, 2008; Deacon et al., 2011). However, it is important to recognize that, in practice, LAPPs are integrated with other dimensions of fisheries management that have major effects on conservation outcomes, making this theory difficult to apply to actual cases.

² Depending on features of an IFQ share within a particular regulatory context, the share can have more or fewer property-like attributes. For example, programs may make shares fully transferable, nontransferable, or put limits on transferability. The question of exactly where LAPP permits fall on this spectrum is beyond the scope of our statement of task. We assume throughout the report that LAPPs can have *some* property-like features, but do not entail the same kinds of rights as, say, real estate.

Barriers to Entry of Young and Small-Scale Fishers

Recruitment into the fishery by young people, small-scale fishers, rural fishers, minorities, and Indigenous peoples can address socioeconomic concerns. Fishing is a traditional livelihood for many people. It is also a trade that has long favored people who work their way into it, accumulating knowledge, experience, and capital over the years, perhaps with the help of family or neighbors, often with the hope of eventually owning one's own business. One benefit of LAPPs in encouraging new entry is that they can be passed down to family members in the same way agricultural land can be bequeathed. This creates a mechanism for passing along wealth that one has accumulated from investment in the fishery over one's career, and it allows for renewal of the labor force. It also presents a limitation in that fishers may overlap with their children in fishing the same amount of quota, which presents similar challenges in agricultural land.

When the privilege of fishing is capitalized into marketable quota shares, the price of becoming an owner-operator can be too high for many who are not able to obtain quota from family members. This is the same in any number of industries in which the fixed asset becomes more expensive as the industry becomes more profitable. What differs with LAPPs is that the initial owners are usually grandfathered into the program and can anticipate “windfall” rewards from ownership and sale of the shares, setting up potential situations of “winners” versus “losers” within communities. Crew may perceive that they are newly disenfranchised, having little chance of becoming owners and often having reduced percentages of the take in the share systems used for reimbursement. And small coastal communities dependent on the fisheries for supplies to processing plants and other economic benefits can be vulnerable when the few quota holders decide to sell, but none of the younger people in the community can afford to buy, resulting in the loss of quota to that community (e.g., Coleman et al., 2018; Ringer et al., 2018). This issue is important in the design of the initial allocation and subsequent markets, calling for consideration of auctions and corresponding loan markets to facilitate new entrants without access to capital.

The issue of the high barriers to access for new entrants and small-scale fishers is one that Congress recognized when delimiting LAPPs. The Councils are encouraged to come up with measures to enable the participation of both new entrants to the fisheries and existing small-scale fishers. To date, none of the LAPPs in this study have developed such measures, although the issue is one that has arisen, especially in the Gulf of Mexico fisheries where it was discussed in the grouper-tilefish 5-year review and in draft Amendment 36B of the Reef Fish Resources management plan (August 2, 2019). The grouper-tilefish review “concluded that fostering access for new entrants would be consistent with the program objectives [including reducing overcapitalization], as new entrants are often participants in the fishery, e.g., crew and hired captains who do not own shares but could buy allocation. The review suggested consideration of loan programs, share redistributions, and quota banks to provide access to quota” (Amendment 36B) (Gulf of Mexico Fishery Management Council, 2019). The August 2, 2019 draft of Amendment 36B considers numerous alternatives, and Ropicki et al. (2018) discuss this as well.

This question is of course closely related to the issues of perceived excessive shares and ownership of shares by nonfishing entities, through the availability of shares or leased allocations and their prices. In the work of the Gulf of Mexico Council on Amendment 36B, reforming these is considered along with ways to ease the costs of leasing or purchasing access privileges for young people or others (the definition of which is itself a challenge to the Councils; see also Ropicki et al., 2018). To this end, in 2021 the Southeast Regional Office of the National Marine Fisheries Service made loans through the Fisheries Finance Program available for purchase or refinancing of existing debt for ITQs.

BOX 5.2 Section 303A(c)(5)

(5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall—

- (A) establish procedures to ensure fair and equitable initial allocations, including consideration of—
 - (i) current and historical harvests;
 - (ii) employment in the harvesting and processing sectors;
 - (iii) investments in, and dependence upon, the fishery; and
 - (iv) the current and historical participation of fishing communities;
- (B) consider the basic cultural and social framework of the fishery, especially through—
 - (i) the development of policies to promote the sustained participation of small owner-operated fishing vessels and fishing communities that depend on the fisheries, including regional or port-specific landing or delivery requirements; and
 - (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery;
- (C) include measures to assist, when necessary and appropriate, entry-level and small vessel owner-operators, captains, crew, and fishing communities through set-asides of harvesting allocations, including providing privileges, which may include set-asides or allocations of harvesting privileges, or economic assistance in the purchase of limited access privileges;
- (D) ensure that limited access privilege holders do not acquire an excessive share of the total limited access privileges in the program by—
 - (i) establishing a maximum share, expressed as a percentage of the total limited access privileges, that a limited access privilege holder is permitted to hold, acquire, or use; and
 - (ii) establishing any other limitations or measures necessary to prevent an inequitable concentration of limited access privileges; and
- (E) authorize limited access privileges to harvest fish to be held, acquired, used by, or issued under the system to persons who substantially participate in the fishery, including in a specific sector of such fishery, as specified by the Council.

SOURCE: 16 U.S.C. § 1853a.

6

Social and Economic Effects of LAPPs for Recreational Fishery Stakeholders in Mixed-Use Fisheries

Introduction

This chapter considers the evidence regarding positive, negative, or neutral social and economic effects from the implementation of Limited Access Privilege Programs (LAPPs) in mixed-use fisheries for stakeholders in marine recreational fisheries. Whereas Chapter 5 considers the implications of LAPPs for stakeholders within the commercial fishery sector itself, our focus is on impacts that span the “mixed-use” gradient to influence stakeholders within the recreational sector. Importantly, like the commercial sector, the recreational sector is often composed of stakeholders with distinct interests and that may experience heterogeneous impacts from the LAPP. In most cases the recreational sector can be broken down into (1) anglers fishing from private vessels or from shore (although the latter category is of limited importance for federally managed species), (2) anglers primarily accessing the fishery as passengers onboard for-hire vessels (e.g., charter or headboat vessels), and (3) for-hire operators who provide recreational for-hire trips to paying customers. Our consideration of LAPP impacts is limited to these groups; a broader assessment of the effects of LAPPs in mixed-use fisheries on coastal communities and other stakeholders is contained in Chapter 7.

Evaluating the impacts of LAPPs in mixed-use fisheries requires careful consideration of the nature of recreational and commercial fishery management in mixed-use fisheries, as well as how LAPPs have altered this management. All of the mixed-use fisheries that include LAPPs for the commercial sector and are analyzed herein have parallel management programs using output controls (seasons, bag limits, trip limits, and size regulations) for the recreational sectors. These recreational control mechanisms have had varying degrees of success in controlling recreational harvest to constrained sectoral allocations. This has entailed maintaining a longstanding regulated open access system of retention (bag) and size limits to limit the fishing mortality impacts of individual anglers, coupled with season openings and closures as the primary mechanisms to limit the cumulative fishing mortality of the recreational sector (Arlinghaus et al., 2019). In some cases (e.g., the U.S. Gulf of Mexico reef fish fisheries) this approach has been supplemented by limited entry programs and enhanced reporting requirements for for-hire vessels. In other words, the LAPPs evaluated in this study are only “mixed use” in the sense that the fisheries stocks regulated under the LAPPs are pursued by private recreational, for-hire recreational, and commercial fishers, with all sectors falling under federal management.

An implication of this fact is that the effects of LAPPs in mixed-use fisheries on recreational participants are most likely to arise from some form of spillover between the changing terms of fishery access on the commercial side of the LAPP and the availability, access, or quality of recreational experience available to recreational anglers. Spillovers and conflicts between the recreational and commercial fishing sectors are longstanding (e.g., Berkes, 1984; Bishop and Samples, 1980), ranging from tensions over allocation of scarce harvest between sectors, perceptions of different habitat or stock impacts, competition for fishing grounds, or concerns of incompatibility between the character of coastal development favored by recreational fishers and other tourists versus commercial fishing interests. We are not concerned in this chapter with detailing the nature of these spillovers for each of the evaluated fisheries; indeed, interactions between recreational and commercial fisheries beyond the existence of conflict have only been sparsely addressed in the literature. Rather, our focus is on answering the following question: *How have the*

management changes from LAPPs in the commercial sector of mixed-use fisheries changed the nature and magnitude of spillovers between the commercial sector and recreational fishery participants?

As complex social-ecological systems, we expect the ecological, social, and economic state variables affecting recreational stakeholders to change over time in ways that may be quite difficult to predict—even in the absence of the implementation of a LAPP. Therefore, in order to assess the impacts of a LAPP on a particular fishery, it is not sufficient to simply point to changes in these variables before and after the LAPP went into effect (i.e., the outcome of the mandated reviews). Instead, one must establish—whether empirically, through bioeconomic modeling, or through qualitative scenario construction—how these changes differ from what would have likely happened in the absence of the LAPP (Ferraro et al., 2019). In other words, any judgment about the impact of the LAPP is predicated on an implicit or explicit assumption about the “no-LAPP” counterfactual scenario. Unfortunately, the information required to rigorously evaluate these counterfactual scenarios is sorely lacking in the literature, in large part due to very sparse longitudinal social and economic data of any kind on the recreational component of the fisheries in question. Given these shortcomings, we instead proceed by drawing on theory and the empirical literature on recreational-commercial spillovers to establish plausible causal pathways and mechanisms for commercially focused LAPPs to create spillovers to the recreational sector. We then draw on the peer-reviewed literature, Council and NMFS analyses, as well as insights provided to the committee by stakeholders to assess the evidence for or against these particular spillovers. We conclude by summarizing the overall weight of the evidence and providing suggestions for data collection and research to more rigorously evaluate these questions in the future.

Theoretical Pathways of Impact

In this section, we explore the potential pathways and mechanisms whereby the introduction of a LAPP in the commercial sector could potentially impact recreational stakeholders. To identify these pathways and mechanisms, we first draw on the small literature on recreational and commercial conflicts to identify possible pathways for impact across the sectors (whether positive or negative), even in the absence of a LAPP for the commercial sector. We then draw on the broader empirical literature and theory on commercial rights-based management to posit mechanisms for how the introduction of a commercial LAPP could alter the nature of this impact.

There are many possible ways to categorize the potential pathways of impact. Our categorization is broken into within-season impacts—those that play out through mechanisms occurring within a season—and between-season impacts—those requiring multiple seasons to show their full impact.

Within-Season Impacts

One potential source of conflict between recreational and commercial fishers is the overlap of each sector’s fishing effort in space and time. This can create negative spillovers from commercial to recreational anglers (or vice versa) due to literal overlap of gear, resulting in tangled or fouled gear or a simple perception of a nuisance that mars the recreational fishing experience for some (Bocquey, 2017). Furthermore, the sequencing of recreational and commercial fishing effort within the season may result in one sector or the other obtaining a *de facto* privileged position in terms of the availability and catchability of their target species. This may especially be the case for fish species with strong in-season depletion effects—so that those that fish early enjoy much higher success rates than those fishing later—or species with strong seasonality in their catchability due to spawning aggregations or strong inshore-offshore migration patterns. While these sources of conflict are a possibility, there is little evidence from the literature that they are a frequent or major source of conflict in mixed-use marine fisheries.

The introduction of a commercial LAPP may alter these within-season spillovers by changing the overall amount of commercial effort as well as its temporal distribution. As noted in Chapter 5, consolidation combined with the reduction of “derby” incentives may lead to less commercial fishing effort per unit time on average, as well as a tendency for this effort to be spread over a longer season (Birkenbach

et al., 2017). These outcomes are especially likely if the markets for the species in question tend to saturate, yielding lower prices as the quantity of landings increases at a given time (Birkenbach et al., 2020). This will often, but not always, result in less commercial effort at the beginning of the season, with a slower “drawdown” of stocks within the season for species with strong intraseasonal stock effects. However, it is important to note that IFQs and other LAPP-like policies have not always led to longer, less intense fishing seasons—particularly in multispecies settings (Birkenbach et al., 2020).

The result of these reallocations of commercial fishing effort under LAPPs could be either positive or negative to recreational anglers. Anglers could benefit from lower overall intensity of commercial fishing effort, and it is possible that incentives under the LAPP could shift commercial effort away from favored recreational fishing times. However, this need not be the case. For example, in the common case where recreational anglers primarily fish in the spring and summer and traditional commercial fishery seasons start with the calendar year, it is possible that the slowing of derby fishing by the LAPP could create an overlap in the recreational and commercial fishery that did not previously exist. The literature is silent on this question, both in terms of the overall tendency as well as providing any individual case studies. Nor did the committee receive any assertion of within-season impacts in the open session meetings, which included recreational stakeholders.

Between-Season Impacts

Many of the spillovers between commercial fishing and recreational anglers are transmitted by variables that are relatively slow to change. As a result, the effects of LAPPs may take some time to unfold.

Stock Spillovers

Recreational and commercial fishers in mixed-use fisheries draw from a shared common fish stock. In most cases the Council allocations to each sector are based on a predetermined share of the biologically determined total allowable catch. In this case, any improvement in the overall stock of target species, however achieved, benefits all sectors proportionally to their allocation shares. As a result, if a LAPP leads to a change in fishing mortality, either from landed harvest or discarded catch, this can alter the harvest available to the recreational sector in future years.

Catch shares (i.e., IFQs) and other LAPP-like programs may affect the trajectory of fishing mortality in at least three ways, relative to the status quo management in place before the individual fishing quota (IFQ) is in place (see also Chapter 4). First, commercial fishers may have an incentive under their newfound *de facto* “shareholder” status in the allowable catch to lobby for lower short-run catch limits in order to have a larger, ostensibly more profitable, stock and allocation in the future. Indeed, there is some empirical evidence for this claim (Branch, 2009). Second, improved monitoring and enforcement due to vessel-level accountability under catch shares often prevents overfishing of quota and also leads to larger more profitable future stocks. Third, catch shares may reduce regulatory discards, although catch shares may conversely exacerbate discards if quotas are based on landings rather than catch, and if there is little at-sea enforcement. While early studies suggested that IFQs and other catch share programs could help fisheries avoid or reverse fishery collapse (Costello et al., 2008), the subsequent literature has generally shown—both from comparisons before and after catch shares within individual fisheries and by comparisons of changes over time with paired non-catch share fisheries—that catch share fisheries are less likely to be overfished after the management change, but have not improved biomass in most cases that sought to increase stock size (Essington, 2010; Essington et al., 2012). However, there is evidence that catches are better able to track quotas under catch shares, leading to better achievement of management targets and reduced variability from year to year (Essington, 2010; Melnychuk et al., 2012). There is also evidence that catch shares have reduced discard rates in some North American fisheries (Essington, 2010).

Given these results, we expect that imposing a commercial LAPP may confer some benefits to recreational anglers if one or more of the following occur: (1) the LAPP leads to fewer commercial overfishing events and less variability in achieving management targets, (2) the LAPP secures greater

cooperation from commercial fishers for stock rebuilding activities (when rebuilding is required), or (3) the LAPP reduces regulatory discards. In these cases, recreational anglers will be partial beneficiaries of improved or more stable stocks. The extent of potential benefits depends heavily on the counterfactual management. If the pre-LAPP management was able to maintain stocks at roughly the same target levels as under the LAPP, then anglers may see few spillover benefits through the stock. Indeed, if a LAPP were to induce a net increase in discards, and the discards are not specifically debited from the commercial sector, then the recreational sector may find its overall allocation diminished by the LAPP.

Allocation Spillovers

The determination of the share of the total landings or fishing mortality allocated to the commercial versus recreational sector has been the most frequent source of conflict between recreational and commercial fisheries, both in the United States (Abbott, 2015) and internationally (Borch, 2010; Crowe et al., 2013; Kearney, 2001, 2002). In the United States alone, the Councils have faced several hotly contested reallocation decisions in recent years, often requiring substantial investments in research to help support decision making (Agar and Carter, 2014; Agar et al., 2014; Gentner et al., 2010).

All of the LAPPs reviewed in this report have altered the management of the commercial sector, holding constant the preexisting allocation between the recreational and commercial sectors. There is, therefore, no *direct* link between the adoption of LAPPs in these mixed-use fisheries and any subsequent change (or lack of change) in the allocation between recreational and commercial stakeholders. However, many recreational stakeholders argue that the creation of a commercial LAPP in a mixed-use fishery effectively creates a *de facto* right that may be more difficult for the Councils to adjust than under the previous terms of management. This inertia may be facilitated by the LAPP's effect in increasing the political power and organization of the commercial sector; this organization is created in part through the articulation of specific goals and objectives of the LAPP, which are not discussed systematically for the recreational sector. Both ongoing participants in the commercial fishery and those planning to sell or lease their quota shares in future seasons have an incentive to maintain the value of their allocations. This economic common interest, combined with the consolidation of quota share among fewer, more efficient operators that occurs in some LAPPs, may increase the benefits and lower the costs of quota owners of engaging in collective action to defend the value of their total allocation "pie" by resisting reallocation of quota to recreation, or perhaps even expanding the commercial allocation at the cost of the recreational sector. Therefore, LAPPs may *indirectly* strengthen the allocation claims of the commercial sector through a political feedback loop.

Evidence for or against these claims is lacking in the literature and is by its nature difficult to formally evaluate. Nevertheless, it is the case that catch shares have typically been accompanied by the formation or strengthening of industry groups of quota holders that, in addition to providing a variety of valuable services to their members in terms of marketing, research, brokerage, and so on, also serve as strong advocates for shareholder interests to the Councils and at the national level (Pinkerton, 2014). It therefore seems plausible to assume that the bargaining position of the commercial sector in terms of maintaining its allocation has tended to improve under LAPPs. However, this finding must be placed in appropriate context in that recreational anglers' interests in many marine fisheries have long been aggressively pursued in the United States, at both the state and federal levels, by well-funded angler associations such as the Coastal Conservation Association and the International Game Fish Association. These organizations have a strength of influence at both the state and federal levels in the United States that often exceeds that in many other industrialized nations (cf. Kearney, 2001), although that influence is stronger in particular regions and fisheries (e.g., nearshore and reef fish fisheries in the South Atlantic and Gulf of Mexico) than others. Indeed, these organizations have been instrumental in the designation of some nearshore species (e.g., red drum) as "gamefish"—essentially allocating 100% of the catch to recreational users. Therefore, while commercial LAPPs are very likely to enhance the political bargaining power of quota owners, it does not follow that this necessarily creates an asymmetry in any contentions over fishery

allocations. Indeed, in some cases, the result may be something closer to a restoration of parity between sectors. We separately evaluate the evidence for indirect allocation spillovers for each fishery below.

Effort Displacement

One possible consequence of a commercial LAPP is that some vessels that exit the commercial fishery due to the LAPP may choose to refit their boats as for-hire recreational vessels. There is very little assessment of this possibility in the literature; however, the only study to examine former fishers' employment after exiting fishing found that only 6% entered charter fishing (Stewart et al., 2006). Furthermore, the ability of commercial fishers to enter the for-hire sector depends on the nature of the rules of access. In the U.S. Gulf of Mexico, both charter and headboat vessels must possess a limited entry permit, thereby requiring that any new entrants obtain a permit from a current permit holder, limiting the scope for new effort to enter the fishery.

One other pathway for commercial effort to bleed into the recreational sector that was noted during our open meetings is the creation of quasi-recreational “catch share experience” or “dude fishing” trips whereby a commercial vessel fishing under IFQ takes on customers that work as crew, paying for the trip in an indirect sense by purchasing their catch from the dealer after landing it at a rate above the normal ex-vessel price. This has only been reported in the Gulf of Mexico reef fish fisheries, so we discuss it below for that case.

Evidence of Impacts for Individual Fisheries

Gulf of Mexico Red Snapper and Grouper-Tilefish

We consider the red snapper and grouper-tilefish LAPPs together since many of the commercial vessels participate in both programs and since many recreational fishers catch species that are also commercially caught under both LAPPs as well as a number of reef fish not covered under either LAPP.

While the commercial and recreational sectors share common fishing grounds, there is little evidence from published literature, Council documents, or the open sessions with representatives from all sectors of significant physical overlap or congestion between recreational and commercial vessels or gear in the Gulf reef fish fisheries. Nor have we seen allegations of, or found evidence for, significant “stock effects,” whereby the harvest of one sector asymmetrically reduces the catch of another. Given the finding from the 5-year reviews that both LAPPs have reduced the number of active vessels in the fishery (Gulf of Mexico Fishery Management Council, 2013, 2018a), it is possible that the LAPPs could have reduced interference or competition between commercial and recreational anglers. However, it is controversial whether the LAPPs themselves caused much of the capacity reductions; quota reductions associated with the LAPPs combined with external economic factors may have played a dominant role instead (Agar et al., 2014). The LAPPs, particularly the red snapper IFQ, did serve to spread commercial fishing effort much more smoothly across the year from far more compressed spring and fall derby seasons (Agar et al., 2014; Birkenbach et al., 2017). In principle this could have resulted in more overlap of recreational and commercial effort than before the LAPPs, since Gulf of Mexico recreational effort is generally at its highest in the late spring and summer. However, we have found no investigation of the potential impacts of this overlap for either sector, nor did representatives from either sector mention this overlap in our open session meetings. Therefore, given the current state of evidence, our assessment is that the two reef fish LAPPs have had minimal to no impact on the recreational sector in terms of within-season impacts.

Regarding between-season impacts, there could be positive benefits to private and for-hire anglers and owners (holding constant the overall allocations between sectors) if the commercial LAPPs facilitated the rebuilding of target stocks or prevented the overharvest of commercial allocations relative to counterfactual management—thus making more harvest available to recreational stakeholders. While some species affected by the LAPPs, most notably red snapper, have experienced significant rebuilding since their implementation, it is unlikely that the vast majority of these gains are attributable to the LAPPs *per*

se. The individual accountability and extra monitoring provisions of the LAPPs have reduced the challenge of meeting management targets—reducing the variability of harvest relative to allocation for the commercial sector and maintaining harvest below the allocation in every year since LAPPs were instituted. Nonetheless, reported commercial harvest did not systematically exceed its allocation in the years immediately prior to the LAPPs, suggesting that the incremental effects of the LAPPs on stock status are minor (see Figure 6.1).

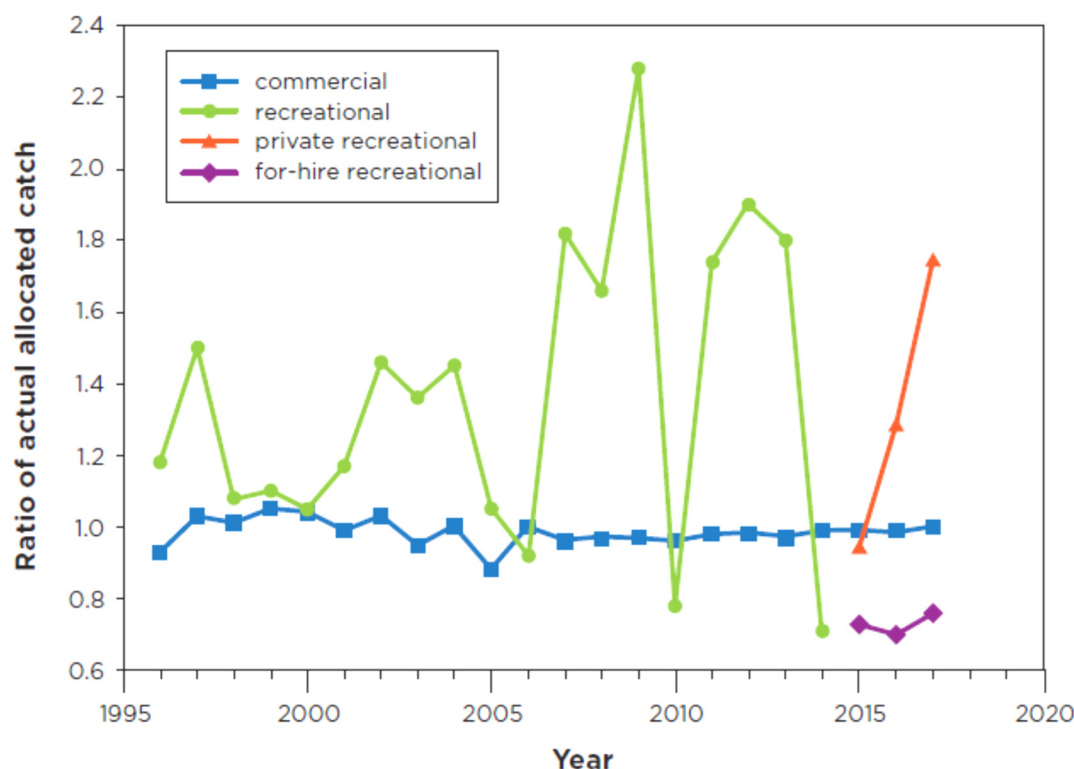


FIGURE 6.1 Ratio of actual catch to allocated catch for Gulf of Mexico red snapper by sector. DATA SOURCE: Gulf of Mexico Fishery Management Council, 2018b.

In the case of red snapper, a significant cause of recent stock rebounds was likely the large reductions in commercial allocations (and harvest) implemented in the mid and late 2000s. As well, following hurricane Katrina in 2005 there was a significant reduction of shrimp fishing effort and a concomitant reduction in red snapper bycatch from this fleet. Although these reductions were implemented simultaneously with the red snapper IFQ, they were part of a broad-based effort to hasten the rebuilding of the stock beginning in 2005 (NOAA Fisheries, 2020). The IFQ was a means to facilitate commercial harvest under the reduced allocations, but the reduced allocations would likely have occurred regardless of the IFQ program. The recreational sector saw its own red snapper allocations similarly reduced at the same time, facing drastically reduced season lengths and bag limits, as well (see Figure 6.2), thus showing that the reductions in commercial quota imposed under the IFQ were part of a separate, broad-based reduction in fishing mortality by the Council for all sectors and not attributable to the LAPP itself (NOAA Fisheries, 2020). On balance, it seems unlikely that the commercial LAPPs alone have contributed significant spillover benefits in terms of stock recovery to recreational stakeholders.

Conflicts over allocation of reef fish between recreational and commercial sectors, and to a lesser extent between private and for-hire recreational sectors, are very heated in the Gulf of Mexico. This is particularly the case for red snapper (Abbott, 2015). Despite a stable allocation, recreational anglers have seen the lengths of their federal fishing seasons (and the individual bag limits) plummet since the mid-

2000s (see Figure 6.2). This development was driven by a combination of recreational effort flooding into the fishery, which is expected as entry is unrestricted and fishing popularity grows, but also in response to successful stock rebuilding, reductions in federal seasons to compensate for unilateral noncompliant seasons in state waters, and increasing average weights of harvest (so that fewer fish can be harvested under biomass based quotas).¹ The fact that these developments occurred at the same time that the commercial season became effectively year round under LAPPs (see Figure 6.1) has fueled pressure from the recreational sector for a greater allocation in order to afford more fishing opportunities. The optics of the diametrically opposed trends in available fishing days has fueled accusations of differential treatment between the commercial and recreational sectors, despite the fact that commercial allocations were rarely exceeded while recreational catches often exceeded allocations by 50% or more, especially after the adoption of the red snapper LAPP (see Figure 6.1).

The commercial sector has pointed to these quota overages by recreational anglers to argue that additional allocations to recreation, at the cost of commercial fishers, are against the interests of conservation. Thus, commercial LAPPs for Gulf of Mexico red snapper have likely increased political pressure on the recreational sector for accountability for its harvest, albeit at the cost of refueling longstanding acrimony between the sectors. Pressure has especially increased on the portion of the recreational sector fishing from private vessels due to recent changes in governance. The division of the recreational allocation between the for-hire and private angler sectors under “sector separation” (Amendment 40) has provided the for-hire sector some relief from short seasons as operators no longer must compete with private anglers for their share of the harvest (see Figure 6.2). The for-hire sector has since remained well within its separate allocation (see Figure 6.1), and an experimental program in 2014–2015 for the headboat portion of this sector further demonstrated that a for-hire LAPP can result in increased fishing opportunities, higher profits for headboat operators, and stronger accountability for harvests (Abbott and Willard, 2017). These developments have almost certainly increased the focus of the commercial sector on ensuring collective accountability from private recreational anglers.

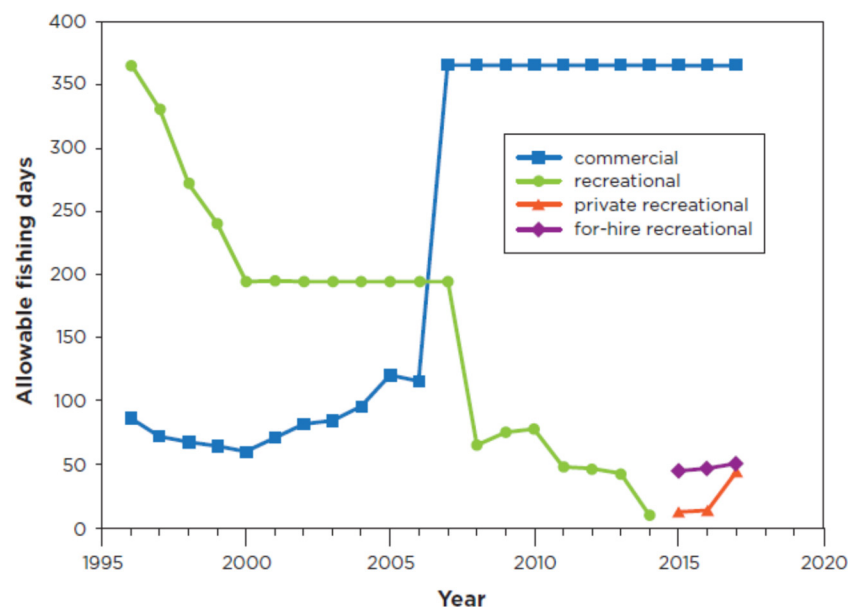


FIGURE 6.2 Allowable fishing days in federal waters for red snapper in the Gulf of Mexico by sector. DATA SOURCE: Gulf of Mexico Fishery Management Council, 2018b.

¹ It is important to note that the recreational fishery is simultaneously managed within state waters by a consortium of states that have developed a more liberal harvest policy than the federal management scheme, and which is resulting in catch overages for the recreational private vessel sector, in particular.

The overwhelming majority of comments presented in open sessions concerning sources of recreational and commercial conflict with stakeholders from this region concerned the equity of the current allocation and whether alternative allocations might be justifiable on economic and equity grounds. The question, given the charge of the committee, is not whether the current, or alternative, allocations are justifiable or not, but rather whether the implementation of the two reef fish LAPPs has served to alter the trajectory of these allocations compared to a world in which the LAPPs were not put into place, but where concerns regarding rebuilding stocks and other management goals were still addressed through alternative policy measures. There is no scientific basis on which to predict how allocations might have evolved in this counterfactual situation. However, it is noteworthy that relative sectoral allocations have remained unchanged since the implementation of IFQs.² Amendment 28, which was strongly supported by recreational fishing interests, would have reallocated 2.5% of red snapper harvest away from the commercial sector and toward the recreational sector. This allocation basically formalized the *de facto* allocation that had been in place in previous years due to the private recreational sector's overharvest in excess of its allocation—an overharvest that was discovered upon recalibration of the Marine Recreational Information Program (MRIP) to improve its sampling in time periods it had previously missed. However, a federal court later vacated the amendment, providing the following argument:

Amendment 28 enables the recreational sector to catch more fish in the future because they caught more fish in the past, in excess of applicable restrictions. AR 020353 (“During the period when the recreational harvest was managed as a quota (1997–2012), actual recreational harvest in pounds of red snapper exceeded the quota in 9 out of 16 years, including 5 of the last 6 years.”). Consequently, Defendants create a system in which one sector must demonstrate an increase in landings in excess of their quota in order to obtain an increase in their allocation. The flaw with that system is that the commercial sector can never obtain an increase in their allocation because the commercial sector can never exceed their quota due to the IFQ program. AR 020354 (“[T]he IFQ program has ended quota overruns.”). Amendment 28 therefore places the commercial sector at a permanent disadvantage by failing to take into account the IFQ program and its impact on reallocation. The Court cannot deem such a scenario fair and equitable as required by National Standard Four.³

The fact that the commercial sector was governed by IFQ—and therefore was viewed as accountable as a sector for its catch in a way that the recreational sector is not—was an important factor in the court's decision to vacate the Council's attempted reallocation of red snapper harvest to the recreational sector. Therefore, while Amendment 28 may have faced a similar fate even if the commercial sector had not been governed by an IFQ, the presence of the LAPP strengthened the legal argument. It is therefore possible that the recreational sector has seen their *de facto* allocation of red snapper reduced (although their formal allocation has remained unchanged) as an indirect result of the commercial LAPP. However, we wish to emphasize the indirect nature of this inference.

Regarding effort spillovers from the commercial fishery to the recreational sector, the presence of limited licensing for charter and headboat vessels in the Gulf of Mexico suggests that this spillover is blocked in that new entrants must retire an existing permit. It is possible that some commercial fishers left the region and opened for-hire operations in other regions, but data are lacking to assess this possibility. With regard to “catch share experience trips,” our research suggests at least two companies operating out of Galveston, Texas, offer full-day catch share experience trips in which anglers pay the equivalent of \$16.00–\$18.00/pound for 100–200 pounds of red snapper and other reef fish catch—significantly more than the commercial ex-vessel price. However, such trips have only been documented for the Gulf of Mexico reef fish fishery and have only been offered for a small handful of trips (Stephen, 2020). While these trips

² In the case of red snapper, commercial has 51% of harvest, while recreation has 49%. In 2015, the Gulf Council implemented “sector separation,” so that the recreational quota was subdivided between the for-hire and private recreational sectors.

³ *Guindon v. Pritzker*, 240 F.Supp. 3d 181, 195 (D.D.C. 2017).

are intriguing as a creative, yet apparently legal, example of how an ostensibly commercial LAPP can nevertheless cater to recreational anglers—in the absence of a mechanism to directly move quota between the sectors—the small scale and limited demand for these trips suggest that they are a relatively minor concern at present.

In summary, we find minimal evidence for any spillovers, negative or positive, from the creation of commercial LAPPs for red snapper and grouper and tilefish in the Gulf of Mexico to recreational stakeholders. To the extent that there has been any negative effect on the recreational sector, it has occurred indirectly through the existence of the IFQs serving to enhance the legal and political validity of the commercial sector's claim to its allocation. Most importantly, irrespective of the existence of a LAPP for the commercial sector, the most important consideration in developing a management program is that it can reliably result in catches not exceeding allocations consistent with achieving, on a continuing basis, the maximum fishing mortality rate targets and limits for the stock. In the case of red snapper for the Gulf of Mexico, this is apparently true for the commercial and for-hire sectors and not true for the private, recreational sectors.

Atlantic Bluefin Tuna

The IBQ program for Atlantic bluefin creates a very narrowly defined LAPP, providing transferable short-run quotas to limit and allocate the bycatch of bluefin, particularly regulatory discards, for the pelagic highly migratory species longline fleet. It does not create a LAPP for any other recreational or commercial retention of the species except for an individually assigned allocation to the small and inactive purse seine fleet, which can trade with the pelagic longliners. Therefore, the scope for impacts to the private and charter recreational sectors is relatively narrow.

The longline fleet is far more southerly in terms of the orientation of its fishing grounds than the recreational, charter, and targeted commercial bluefin fisheries. Indeed, open meetings with NMFS personnel and industry representatives confirmed that the pelagic longline fleet has very little overlap in terms of its grounds, to the point that many fishers in the other sectors are not even aware of its existence. We therefore posit that there are no direct, within-season impacts of the IBQ on recreational anglers or charter vessel owners.

With regard to between-season impacts, there is some potential that the IBQ may have created conditions whereby recreational anglers could enjoy a larger total quota in the future. The mechanism is as follows. Prior to the IBQ, the pelagic longline fleet regularly exceeded its bluefin allocation due to dead discards. In order to remain within the overall U.S. quota from the International Commission for the Conservation of Atlantic Tunas for bluefin mortality, NMFS had to cover these overages with underutilized quota from other categories, primarily from the purse seine fleet. However, since the implementation of the IBQ, the longline fleet has remained well under (often less than 50%) its overall quota allocation. While broader contextual factors may have caused some of this reduction, both the 3-year program review (NOAA Fisheries, 2019) and representatives from the pelagic longline fleet in our open meetings confirm that incentives for bycatch avoidance under the IBQ are partially responsible. As a result, NMFS no longer must cover overages from underutilized quota categories. This has created the possibility for a reallocation of the purse seine category's quota to other sectors, including private and charter recreational anglers, even though some of it is currently leased to the pelagic longline sector to facilitate the market in IBQ for those who need to lease some, because of the practice of holding IBQ as insurance against possible bycatch (Thomas Warren, personal communication, 2021). This reallocation is currently under consideration as Amendment 13 under the highly migratory species management plan; the version out for public hearings as of June 10, 2021, includes disbanding the purse seine sector and reallocating its share of the bluefin quota.

South Atlantic Wreckfish

As described previously, the recreational component of the wreckfish fishery is very small. While social media postings of recreational wreckfish harvest do occasionally occur, the MRIP recorded only one

recreational wreckfish landing between 2009 and 2016 (Stephen, 2020). This low observation is driven in large part by the difficulty and cost of harvesting wreckfish given its distance from shore, depth of habitat, and the essentially single-species nature of the fishery. The allocation of 5% of the annual catch limits to recreational harvest in 2011 was designed primarily to accommodate any bycatch in the recreational snapper-grouper fishery, legalizing retention that was previously prohibited by those lacking a commercial permit. Our conclusion, therefore, is that the recreational wreckfish fishery—to the extent one exists—is primarily limited by natural factors that curtail wreckfish’s attractiveness as a game fish, with the IFQ system having essentially no additional effect.

Mid-Atlantic Golden Tilefish

The nature of the golden tilefish fishery, governed by the Mid-Atlantic Fishery Management Council, combined with the information gathered from commercial and recreational participants during the open sessions suggest that there is essentially no within-season conflicts between recreational and commercial harvesters in terms of gear fouling, spatial/temporal overlap, or depletion effects by one sector on another. Both the recreational and commercial effort levels are small and spread over a very large area. Since the IFQ was implemented, the number of active commercial participants and effort has declined slightly (Mid-Atlantic Fishery Management Council, 2017). However, given the question of whether these declines were caused by the IFQ versus other contemporaneous factors, and considering that there was little evidence of interaction between the sectors before the IFQ, we expect this has had minimal effect on the recreational sector. Therefore, there is no evidence that the LAPP had any appreciable within-season impacts on recreational stakeholders.

With regard to between-season spillovers through the stock, the 5-year review notes that stock assessments, although highly uncertain due to a paucity of fishery-independent data, indicate that biomass has generally grown since the implementation of the IFQ (Mid-Atlantic Fishery Management Council, 2017). However, most of the improvements in catch per unit effort and the recovery of the stock were achieved before Amendment 1 created the IFQ program, suggesting that the constant quota rule and accountability measures established under the 2001 Fishery Management Plan were largely responsible for these gains, not the addition of the LAPP provisions. It is therefore unlikely that the recreational sector has seen increases in stock status (and therefore improved catch rates) that can be specifically tied to the LAPP itself.

With regard to allocation spillovers, the recreational sector operates under open access without any explicit allocation. The recreational sector therefore faces no explicit limit on its catch due to the LAPP. However, while estimates of recreational golden tilefish effort and catch are highly uncertain, there has been increasing concern at the Council level that recreational effort for this species is increasing due to its rebuilt biomass, open access management, and increased restrictions on other recreational target species in the region. In order to enhance data collection and establish some baseline regulations, the amendment creating the LAPP also created some new restrictions for the recreational sector. These included the creation of a new open access permit and trip reporting guidelines for charter vessels as well as establishing an eight-fish bag limit (for the first time) for private and charter anglers. These requirements are likely to have fairly minimal impact as charter operators already are required to have permits and adhere to trip reporting requirements for the other species (e.g., highly migratory species) they target. Furthermore, the bag limit was set to a level that was unlikely to bind for the vast majority of anglers (Mid-Atlantic Fishery Management Council, 2017). Subsequent restrictions were enacted in 2018 including limiting recreational anglers to hook-and-line gear with five or fewer hooks, requiring open access tilefish permits, and trip reporting for private anglers targeting and retaining golden tilefish; the latter changes essentially harmonize the reporting requirements for private and charter recreational vessels.

Overall, the new restrictions on recreational fishing are mostly driven by the need to better understand the magnitude of recreational effort and catch and are likely driven as much by concerns about the apparent increase in recreational effort and landings upon the resurgence of the stock as by the institution of the IFQ itself. Furthermore, these measures place no significant bound on recreational effort or catch in

the fishery, with the bag limits and gear restrictions primarily serving to preserve the recreational character of the fishery rather than limit the catch of recreational anglers. It is therefore unlikely that the golden tilefish IFQ itself has resulted in any significant newfound restrictions on access or the recreational fishing experience for private or charter recreational anglers beyond those required to effectively monitor recreational effort and harvest.

Conclusion

As repeatedly noted above, there has been very little research focusing on spillovers between commercial LAPPs and the broader suite of catch share management approaches and their effects on recreational stakeholders. Indeed, even the mandatory program review documents for each of the LAPPs considered ignore this set of questions, likely because such concerns lie outside the stated goals and objectives of the LAPP and therefore are not the focus of reviews that are intended to “describe and analyze the effects that have actually taken place since the ‘baseline’ time period prior to ... the program’s implementation” (Morrison, 2017b).

Given this research gap, we have attempted, first, to identify pathways and mechanisms whereby it is *possible* that a commercial LAPP may affect recreational stakeholders and, second, to assess the case for the salience of these theoretical impacts in the particular cases in question. Our findings can be summarized as follows.

First, while direct, within-season impacts of commercial LAPPs on recreational anglers that work through changing the intensity and spatiotemporal effort and harvest patterns of commercial harvesters are certainly possible, we found no substantial evidence of these effects, either positive or negative, in the mixed-use fishery LAPPs examined under this study. This finding is likely simply a product of the coincidence that there is very little evidence for significant within-season interactions between the recreational and commercial fleets in any of these fisheries. Therefore, there was very little opportunity for LAPPs to create a spillover through these interactions. It is possible that in other fisheries with different characteristics, such as those with highly spatially and temporally concentrated resource abundance and strong in-season stock effects (e.g., anadromous fisheries), there is greater potential for spillover.

Second, with regard to indirect, between-season effects of commercial LAPPs that work through the stock itself, we found no convincing evidence that the LAPPs in question have contributed additional catch opportunities for recreational anglers. There is no evidence that any of the IFQs contributed to faster resource recovery and biomass growth relative to what would likely have occurred in their absence. Nevertheless, IFQs likely did facilitate and improve the cost effectiveness of resource recovery in at least one instance—the Gulf of Mexico red snapper fishery—by helping make significant cuts to commercial quota allocations politically feasible to the commercial sector. Importantly, there is also no evidence that any of the LAPPs we reviewed created negative feedbacks to the stock in a way that would harm recreational stakeholders other than the fact that by exceeding the recreational allocation (and thereby increasing fishing mortality) those overages may have retarded the pace of stock rebuilding in red snapper in the Gulf of Mexico.

Third, there is some evidence in at least two of our cases—the Gulf of Mexico red snapper IFQ and the IBQ for Atlantic bluefin fisheries—that commercial LAPPs may impact recreational stakeholders through indirect effects on the size of the recreational allocation itself. The creation of a commercial LAPP may strengthen the political bargaining power of the commercial sector or, as seen in the Gulf of Mexico, buttress the legal argument for protecting the commercial sector’s allocation. This can introduce additional inertia in regulatory reallocation processes and perhaps block or delay reallocations from commercial fisheries to recreational fisheries that may be viewed as desirable from a management perspective. However, we must warn that this outcome is highly contingent upon the political economy and legal considerations at play in a given situation and should not be treated as generalizable. Furthermore, it does not follow that such inertia is always a bad thing in an adversarial, co-management setting such as that seen in the U.S. Council system. Indeed, it may improve the overall parity of the bargaining position on either side of an allocation decision, helping to prevent unwise reallocations that may impose an undue burden on

one party for the benefit of another, and potentially even fostering experimentation toward “win-win” solutions. The Gulf of Alaska guided angler fish program is a good example whereby charter operators were allowed to lease quota from commercial halibut harvesters (Kroetz et al., 2019a). Finally, the Atlantic bluefin tuna IBQ also shows that LAPPs may also create positive spillovers to recreational fisheries through the allocation mechanism—particularly if the incentives in the LAPP are used to reduce bycatch in one sector in order to facilitate greater targeted fishing in another.

The overall evidence for policy-relevant spillovers between commercial LAPPs and the recreational sector in existing U.S. mixed-use fisheries is weak. The spillovers that we were able to identify primarily operate through the indirect mechanism of the recreational-commercial allocation. These spillovers are ambiguous in terms of their impact on the recreational sector, and also highly contingent on the political and legal context. The lack of consistent, strong effects of commercial LAPPs on recreational stakeholders is perhaps not surprising given that all of the mixed-use fishery LAPPs were designed to address management challenges within the commercial sector while leaving the situation within the recreational sector unchanged. Nevertheless, our analysis of theoretical pathways of impact suggests that significant spillovers are possible and should be considered in the design of any new LAPPs in mixed-use fisheries. Furthermore, the Councils and NOAA Fisheries should consider these factors as they consider the criteria to evaluate in their mandatory program reviews. This will require careful consideration of the goals and objectives of the recreational sector and the associated need to gather longitudinal data on the recreational sector both before and after these new programs come into place.

Broader Community Social and Economic Effects

Approaches to Broader Community

Fisheries are complex socioecological systems, and changes within those fisheries, whether prompted by management measures, market forces, or other internal and external factors, affect and are affected by far more than the immediate participants. In that regard, we are charged to examine the effects of Limited Access Privilege Programs (LAPPs) in mixed-use fisheries on the “broader community.” The committee takes this to mean how the social and economic effects identified in previous chapters lead to other consequences for the broader community.

There are several ways of approaching the study of effects on the “broader community.” Very few studies provide a comprehensive perspective on fisheries that enable delineation of their broader contexts, constraints, and consequences. One approach is to identify and study the impacts of management changes on the commodity or supply chain that links fish in the sea to consumers (Seung, 2016; Seung and Kim, 2020). Commercial fisheries, in particular, tend to be part of fairly durable and structured networks of provision, supply, and demand, such that changes in one component can have regular or predictable changes in another. Suppliers of credit and government subsidies and regulations and, for some fisheries, international negotiations are also part of this larger system. The only studies that trace such networks or supply chains for the mixed-use fisheries of this study identified by the committee are those of the global network for bluefin tuna, which include distinct species of Atlantic, Pacific, and southern bluefin. Although these studies highlight the interpersonal and social dimensions of the international management system (Telesca, 2020), as well as the role of futures markets and subsidies in contributing to overexploitation (Bestor, 2001; Longo et al., 2015; Telesca, 2020), they offer little about how changes in the U.S. component of bluefin tuna management affects the larger system. A recent study of eastern Atlantic bluefin shows that open access continues to characterize the overall pattern of overexploitation and stock dynamics (Li et al., 2021). As such, recent improvements in the stock condition are not attributable to a break from open access. Rather, reduced pressure on the bluefin tuna resource is associated with management systems that raised the effective cost of open access fishing during a period when global prices for bluefin tuna also declined.

The reviews of the LAPPs do not assess the effects of LAPPs on supply chains or larger markets, beyond providing data on ex-vessel prices that may or may not signal shifts in market conditions in response to the working of LAPPs (see Chapter 5). The review of the grouper-tilefish individual fishing quota (IFQ; Gulf of Mexico Fishery Management Council, 2018a) notes that this is difficult because no data on retail sales of the IFQ-regulated species are collected. However, some of the reviews refer to the importance of domestic and foreign markets, the effects of which contribute to the difficulty of determining the impacts of LAPPs *per se*. The leading example is bluefin tuna, where the decline of participation in the pelagic longline fishery (that is involved in individual bycatch quotas) is best attributed to market conditions in the international trade for swordfish and tunas.

A second way of approaching “broader effects” generates estimates of economic value based on multiplier effects, such that the ex-vessel price of fish at the dock gains from added value as it moves through the system. This is central to regional economic modeling for fisheries (Seung and Waters, 2006) and is used for recreational fisheries as well as commercial fisheries. Keithly and Roberts (2017) provide an overview of the economics of both commercial and recreational fisheries in the Gulf of Mexico from the perspective of expenditures and multiplier effects. The National Oceanic and Atmospheric Administration (NOAA) publishes Fisheries Economics of the United States, which includes these “economic impact” metrics, including employment, sales, and value-added impacts of fisheries. In addition, the National Ocean

Economics Project¹ provides economic and demographic information on changes and trends along U.S. coasts and coastal waters, including nonmarket valuation research on the recreational fisheries. As useful as these sources are for estimating economic impacts of commercial and recreational fisheries, broadly defined, they are not at the scale or level of detail appropriate to the analysis of impacts of particular management innovations such as LAPPs on particular fisheries.

In the rest of this chapter, we follow the practice of the formal LAPP reviews in taking a third, place-based, approach to the question of the impacts of LAPPs on communities. We focus on geographically defined communities, usually coastal municipalities and larger regions, and the place and impacts of fisheries in the demographics, economics, quality of life, institutions, and other attributes of these places. National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Act (the MSA) recognizes the importance of providing for the sustained participation of place-based fishing communities that are substantially engaged in and/or dependent on fisheries and minimizing adverse impacts on such communities.² A place-based notion of community also allows for use of regularly collected census and labor data. It benefits from NOAA's investment in gathering data for profiling communities and assessing attributes that can be related to the health and dynamics of fisheries (Jepson and Colburn, 2013).

Macinko (2007) discusses considerations for understanding place and community in fisheries management. Fishing livelihoods are often deeply connected to geographic places. It should be acknowledged that fishing communities, as thought of and experienced by participants in fisheries and increasingly acknowledged in the literature, can also be occupation-based networks involving multiple places, reflecting social capital and shared experiences, interests, and values. A survey of commercial groundfish fishers in New England (Holland et al., 2013) found that respondents defined their fishing communities in multiple ways, mostly in terms of where they tied up their vessels and landed their fish (the place-based communities). Also near the top of the definitions offered was “the fishermen who fish in the same area you fish” (p. 139, Table 1) irrespective of homeport or place of residence. Gear- or species-based and regional communities of this kind are important as sites of information exchange, mutual support, and other forms of social interaction that make up a community (see St. Martin and Olson, 2017, on “communities at sea”). The value of information exchange, especially as it relates to place-based fish dealers, was also supported in studies of the trading markets for red snapper allocation (Ropicki and Larkin, 2014).

Furthermore, evidence of community-level representation may appear as interest groups and organized stakeholders in fisheries management. This type of stakeholder engagement may be of particular importance in analyzing the effects of LAPPs in mixed-use and other fisheries. In theory, the creation of secure and valuable exclusive fishing privileges that are not connected to place may foster the development of organized groups that become more vested in fisheries management and research (Scott, 1996), as has been shown in New Zealand (Yandle, 2003). Groups like the Shareholders Alliance of the Gulf of Mexico, created to represent the interests of IFQ shareholders in the reef fish fisheries, may be effective in influencing policy, as have been groups organized to represent the interests of other sectors, particularly recreational fishing, as discussed in Chapter 6.

It is also important to keep in mind the actual structure and dynamics of the interest groups that represent the sectors. The committee is not aware of focused research into this question in the study region, except for a survey-based study on the red snapper fishery that distinguished between the “recreational sector” and “recreational industry” (Hervás Ávila, 2018). The study pointed out that the industry was large and powerful, referred to as “super stakeholders,” and was often driving agendas that were viewed by some respondents as misaligned with the interests and attitudes of private anglers. For example, the survey showed that “recreational anglers on average were very precautionary with respect to fishing regulations, whereas the ‘super stakeholders’ took stances that prioritized access for recreational fishers over science-based conservation measures.” The majority of anglers also supported the right to fish for commercial

¹ See <https://www.oceaneconomics.org> (accessed July 16, 2021).

² 16 U.S.C. § 1851(a)(8).

fishers, whereas the vocal leaders of the recreational industry advocated measures to reduce commercial fishing, fueling conflict in mixed-use fisheries.

Community Concerns and LAPPs

Community concerns were important in the process of development of the LAPP provisions for the 2006 MSA Reauthorization by Congress. Stoll and Holliday (2014) quote a 2006 report prepared by the U.S. Senate Committee on Commerce, Science, and Transportation on the MSA, where the Committee writes:

These provisions were created in response to the concerns of communities and shoreside businesses around the country over the economic harm that could result from consolidation of quota in IFQs and similar programs.... In particular, the Committee recognized that many small, poor coastal communities lack the resources to enter fisheries that may be subject to future LAPPs, and they have often been overlooked in allocation decisions.

This aligns with the allocation requirements specified in Section 1853a(c)(5) (see Chapter 2, Box 2.2), which directs the Councils or the Secretary of Commerce to “consider the basic cultural and social framework of the fishery ... through the development of policies to promote the sustained participation of small owner-operated fishing vessels and fishing communities,” “include measures to assist, when necessary and appropriate, entry-level and small vessel owner-operators, captains, crew, and fishing communities through set-asides of harvesting allocation,” and “ensure that limited access privilege holders do not acquire an excessive share of the total limited access privileges in the program.” They conclude that this language (e.g., Section 1853a(c)(3), (4), and (5)), coupled with National Standard 8, provides a clear signal to the Councils and the National Marine Fisheries Service (NMFS) to consider community safeguards that support small-scale and community-based interests.

It should be noted that Sections 3 and 4 of Section 303A(c) lay out a framework for allocating catch shares to community-based entities (“fishing communities” and “regional fishery associations” rather than individuals). However, as of 2014, the Councils had yet to adopt processes to establish fishing communities and regional fishery associations—entities for holding catch shares (Stoll and Holliday, 2014)—except for the Community Development Quota and Community Quota Entity programs in the North Pacific, and none have occurred in the study regions since that date. The LAPPs of this study are IFQs for individual entities rather than catch shares for communities or nonprofit associations.

In theory, the effects of LAPPs on the fisheries (see Chapters 4, 5, and 6) can ripple into larger communities. Any positive or negative effects of LAPPs on private and for-hire recreational fisheries could affect ancillary businesses, such as marinas and fishing supply houses. Downsizing of commercial fishing enterprises and fleets, an objective of many LAPPs, can reduce employment, hurt ancillary businesses, reduce commercial footprint in waterfronts vulnerable to gentrification, and so forth. Alternatively, increased profitability and more consistent employment associated with LAPPs could inject more economic value into local communities and associated ancillary businesses. Sharper social distinctions that may emerge, such as between those who hold quota shares and those who do not, can result in conflict within communities that have shared fishing identities and are tightly networked. Increased profitability of enterprises well situated in their LAPPs can benefit some local communities at the expense of others. Where quota shares come to be owned by outside investors or retired fishers, much of that wealth is likely to go elsewhere. Small-scale fishers that were not granted quota shares in the initial allocation and/or are unable to acquire IFQs (such as through lack of access to capital) may move into or intensify their effort in other fisheries, with possible pressures on those fisheries, or may not be able to continue fishing livelihoods, with impacts for the next generation.

More generally, changes that occur with LAPPs can affect both the structure and viability of regions and communities, as shown in reviews of IFQ programs in Australia, Canada, Iceland, New Zealand, Norway, and the United States, among other countries (e.g., Carothers and Chambers, 2012; McCormack,

2017; Olson, 2011; Young et al., 2018). Fishing livelihoods have traditionally been deeply embedded in fishing communities and central to fishing families' and communities' connection to place and well-being. As a result, the shift in management to regulating fishing rights as commodities that can be detached from place can fundamentally restructure fishery systems with implications for community life. LAPPs can affect community structure "through changing relations between people and shifts in dominant values—and affect the viability of fishing communities as some are disproportionately impacted by geographic shifts in fishing businesses, aspiring new participants find entry increasingly difficult and smaller operations are increasing [sic] dominated by larger ones" (Olson, 2011). "Graying of the fleet" and rural-to-urban migration of fishing quota is a common trend in many LAPP fisheries (e.g., Coleman et al., 2018; Cramer et al., 2018; Donkersloot and Carothers, 2016; Karlsdóttir, 2008; NOAA Fisheries, 2010; Ringer et al., 2018). Lost access to fishing livelihoods can affect community, family, and individual health and wellness. In regions with long-time experience with LAPPs they are often still viewed as divisive and negative within fishing communities even decades after program implementation (e.g., Carothers, 2015; Chambers and Carothers, 2017; McCormack, 2017; Wingard, 2000).

We discuss elsewhere in the report the importance of consideration of counterfactual scenarios. Would these community impacts have occurred without LAPPs? Some impacts are directly related to the creation of the LAPPs (e.g., community conflict about who got access and who did not. But other impacts are less clear. Our committee received a presentation on such a counterfactual case in Alaska. The community of Metlakatla experienced some of the negative community effects found with LAPPs in state and federal fisheries; however, the Metlakatla Indian Community manages its own sovereign Tribal fisheries, which are not managed with LAPPs. Their community engagement in fishing and local fishing economy is substantially different than that of similarly sized communities in the Gulf of Alaska, as is youth engagement in fishing (Langdon, 2019; Metlakatla Indian Community, 2017).

There is very little research in this regard for the LAPPs and mixed-use fisheries of this study. The mandated LAPP reviews have little to report about effects on communities despite the guidance (Morrison, 2017b). The NOAA Social Indicators for Coastal Communities (SICC) data developed in recent decades have good design features for assessing impacts, in efforts to code places in terms of fishing dependence, engagement, and vulnerability, but, as will be discussed below, they are not yet systematically developed to enable examination of trends that might suggest effects of changes in fisheries governance. Therefore, the committee is limited to identifying the major communities involved and their degrees of fishing dependency, engagement, and vulnerability (not always with regard to the particular LAPP fishery), supplemented by insights from surveys, LAPP review observations, and other studies.

Place-Based Communities

Place-based communities are recognized in federal fisheries because National Standard 8 requires "that an FMP take into account the importance of fishery resources to fishing communities,"³ with the goals to "(1) Provide for the sustained participation of such communities; and (2) To the extent practicable, minimize adverse economic impacts on such communities." The MSA defines fishing community as "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such a community."⁴ In interpreting this definition, the National Marine Fisheries Service has stated that "[a] fishing community is a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries (for example, boatyards, ice suppliers, and tackle shops)."

Limiting an analysis to fishing communities as defined above misses many places where fishers and their families reside but which are not "substantially dependent on or ... engaged in" fisheries because

³ 50 C.F.R. §§ 600.345.

⁴ 16 U.S.C. § 1802(17).

of other types of business and ways of life. We follow the NOAA practice of looking more broadly at community, in terms of engagement in the fisheries at any level, regardless of degree of dependence, while retaining a focus on communities with higher degrees of engagement as particularly worthy of attention. This is important in the northeast and southeast coastal regions of the United States, where towns and ports are often as much or more dependent on tourism and retirement living as on commercial or recreational fishing, even when they retain strong fisheries and perhaps identities as fishing communities. Taking this broader perspective, social scientists at NOAA have developed “Community Profiles” or “Snapshots” of communities involved in the fisheries of all regions that can be found on the NOAA website.⁵

Data on place-based fishing communities are available in the community profiles in greater detail in the reviews of the LAPPs that incorporate NOAA’s community profiles and social indicators, and in a NOAA study of the community dimensions of U.S. catch share programs (Colburn et al., 2017). In the latter, social indicators of fishing community vulnerability and resilience were generated for each catch share program, including the LAPPs in this study except for the bluefin tuna individual bluefin quota (IBQ), using the criteria and methods developed by NOAA (Jepson and Colburn, 2013). “Community” is basically the homeport of vessels engaged in the fisheries being studied, irrespective of where those involved in the fishery actually live, what fishing grounds they more often use, and where the vessels actually land their catches. Consequently, this approach is limited in its ability to capture information about all of the places affected by those who fish and the social relationships connecting places. It also cannot reveal commodity chain relationships and regional dynamics.

This approach offers descriptive measures of the ports that appear important to a fishery or fishery management system. Regional quotients measure what share a particular place has in landings for a species or species complex, identifying the communities that stand out as particularly important. A community vulnerability index is based on measures of the extent of both engagement in and reliance on commercial and recreational fishing. A resilience index is based on a set of indices of social vulnerability involving personal disruption, population composition, poverty, housing, and labor force measures. The analyses also provide indices for social vulnerability and environmental justice indicators, an important but often overlooked dimension of fisheries (Jepson and Colburn, 2013). These analyses are especially important, given “the tendency for ITQs to exclude indigenous peoples or those who are otherwise marginalized politically and economically due to structural factors, such as racism” (Young et al., 2018). Analyses of racial and environmental justice are likely to become more central with NOAA Fisheries’ *Human Integrated Ecosystem Based Fishery Management, Research Strategy* and the Biden Administration’s Executive Order (EO) 13985 and reinvigoration of EO 12898.

The increased awareness of racial challenges that pervade many aspects of American life reinforces the need to understand how marine resource management and environmental change impact diverse groups of Americans. The NOAA Fisheries Human Dimensions Program has studied this question for more than two decades and is focused on better recognizing that ocean and coastal environments – and management choices about them - have different impacts on different groups. Better defining the complexity of how people relate to the environment will enable us to improve resource access and increase the value for Americans of all genders and racial, ethnic, and cultural backgrounds. (NOAA, 2021)

The SICC are helpful in identifying communities for further assessment of impacts of changes in a fishery and could be used for outreach to ensure appropriate representation in the participatory parts of management processes. They are available in a systematic time series for the period 2006 to 2018. For the specific LAPP fisheries of this study, they are available only to 2013 in the NOAA study “Community Participation in Catch Share Programs” (Colburn et al., 2017), which is a key source of data for this analysis.

⁵ See <https://www.fisheries.noaa.gov/national/socioeconomics/fishing-community-profiles> (accessed July 16, 2021).

Although the community profiles can provide a time series enabling comparison of indices from a baseline (usually 2006-2008) that may capture the implementation of LAPPs, they may be limited in identifying causal links between such changes or patterns and reasons for observed changes connected to specific fisheries and specific management measures. Effects of individual policies on whole communities are not likely to be substantial enough to be identified in community-level indices.

Information on recreational fisheries engagement and reliance is part of the community profiles, but changes in variables such as employment cannot be sorted out between recreational and commercial fisheries. The issue of impacts of LAPPs in mixed-use fisheries on communities could address relationships between the commercial LAPP fisheries and the for-hire and private recreational fisheries, in terms of access to and competition for infrastructure, municipal support, and community institutions. The committee has not been able to find information on this except for limited early studies. Clearly, many of the major ports for the commercial LAPP fisheries also have sizable for-hire and/or private angling-related businesses (e.g., Montauk, New York; Fort Pierce, Florida; and Barnegat Light, New Jersey, among others), and a study done in the 1990s described relationships between commercial and recreational fishers in the fishing communities engaged in swordfish, tuna, and shark fisheries (Wilson and McCay, 1998).

The environmental justice indices of the SICC lack sufficient granularity, reflecting a more general problem in assessing social and community fisheries impacts, namely, the lack of data on ethnicity, race, age, and many other sociodemographic aspects of people who fish for a living or work in other sectors of the fisheries. The community studies are the only systematic sources of information of this kind but their indices are quite general and in most cases not specific to particular fisheries. Moreover, the focus on major fishing communities can miss fisheries that are dispersed among many places. Nor do they capture the actual dynamics of the fisheries associated with the communities, for example, the extent to which people are engaged in more than one fishery or whether crew members commute over long distances. These studies also can miss important social groups involved in a fishery that may be dispersed among many places, as, for example, the low-income Vietnamese American fishers in Louisiana who are active in the Gulf of Mexico pelagic longline fishery but commute to fishing ports (NMFS, 2019).

The next section of this chapter reviews the information available on place-based communities involved with the mixed-use fisheries of this study, framed by the committee's concern that there is little information available to assess what differences the LAPPs have made. It is followed by a committee effort to use the NOAA social indicators data to see whether it can tell us anything useful about the effects of LAPPs on one dimension of community—employment—as the basis for a discussion of potentials for better assessing community impacts of changes in fisheries management.

Communities by Fishery

Red Snapper (Gulf of Mexico)

The red snapper fishery of the Gulf of Mexico is large overall and is very much a “mixed-use” fishery, with major for-hire and private angler sectors. It is a component of the very large reef fish fishery in the Gulf of Mexico and closely related to the grouper-tilefish IFQ program.

The 5-year review had little information on the social and economic effects on communities of the IFQ program for red snapper but made an effort to discuss both “suggested” and “revealed” social impacts of IFQ measures. They state: “a comprehensive study of the social impacts resulting from implementation of the RS-IFQ program has not been conducted due to limitations of time and personnel.” A key question they would like to explore: “How have fishing communities and fish houses been affected by the RS-IFQ program?” For the most part, their treatment of community impacts overlaps with the analysis of effects of LAPPs on the commercial sector found in Chapter 5, with a stronger emphasis on social concerns than on the economic benefits.

As discussed in Chapters 3 and 5, reduced overcapacity is likely to have affected employment, but the extent of employment change was unknown. There were reports of reduced crew size in some vessels, especially the small and medium-sized operations and in the western Gulf, but total days fished in the

fishery increased after declining initially (Gulf of Mexico Fishery Management Council, 2013), and the effects of the LAPP cannot be easily isolated from changes in the annual catch limit. “We are currently unable to measure direct impacts from any reductions in overcapacity at the community level” (p. 32). Similarly, there was no empirical evidence for positive or negative community effects of elimination of “derby fishing” and of share consolidation, although public comment indicated that further consolidation may “be a barrier to access for others and have negative impacts for some communities” (pp. 32-33) even though no evidence of excessive consolidation was found and a cap on share ownership is in effect.

Treated as a community impact in the 5-year review was the emergence of new participants in the fishery: brokers involved in managing trading. Some shareholder accounts were known to be involved only in trading, approximately 20-27% of accounts annually (p. 56). The review reported awareness that the program is criticized for creating a class of shareholders who did not fish, “who live off the profits of leasing allocation,” but stated it was unknown how important this was. By leasing out annual allocation, perhaps because they do not own a reef fish permit, these shareholders allow flexibility for harvesters to adjust their scale of operations.

The review recognized that there were perceptions of other unfair and unequal outcomes, based on studies by Alsharif and Miller (2012), Boen and Keithly (2012), and Griffith et al. (2016). One was the difference between shareholders with small allocations and those with larger IFQs. There were also allegations that some boat owners charged the crew for purchase of allocation and the perception of “sea lords” living off the work of others. Smaller shareholders were perceived to have been negatively impacted as well those in the eastern Gulf. The west coast of Florida was identified as a region that was allocated relatively little quota share due to low historic harvests but now has abundant red snapper. Social network analysis was done to better understand share and allocation trades but was unable to test these and other allegations with the data (Gulf of Mexico Fishery Management Council, 2013), recognizing that the computer system created for managing the IFQs was not created to answer such questions. One complication is that shareholders can move quota between multiple accounts. A later study focusing on price dispersion across the fishery, also using social network analysis, found inefficiencies in the trading markets due to regionality in information sharing and as a result of the noncentralized nature of the transfer markets that rely on individual negotiation that would need to be learned by new participants in the market (Ropicki and Larkin, 2014).

The review further addressed community impacts by looking at patterns and changes in fishing engagement in terms of pounds and dollars using the SICC. It identified the top 20 homeports and found little change in the fisheries engagement measure over 10 years for the largest communities identified: Panama City, Florida; Galveston, Texas; Golden Meadow, Louisiana; Destin, Florida; and Cameron, Louisiana (Gulf of Mexico Fishery Management Council, 2013). However, there was considerable change among the communities with lower degrees of engagement in some years, some showing precipitous decline (Golden Meadow/Leeville, Louisiana; Grand Bay, Alabama; and Port Isabel, Texas) while others showed an increase (Pascagoula, Mississippi, and Houma, Louisiana) (see Figure 7.1). Similar analyses were done for indices of community vulnerability and resilience. For example, it was determined that the communities of Apalachicola, Florida; Panama City, Florida; and Golden Meadow, Louisiana, exhibited vulnerabilities to social or economic disruption, including regulatory change.

With these data, it was not possible to test whether the changes were related to the LAPP, such as reductions in inputs or consolidation of share ownership. Ethnographic research is important to interpret these graphs. For example, social scientists explained that one small community that showed sharp decline did so simply because a fleet of vessels simply moved to another port (M. Jepson, personal communication during Open Session Meeting, 2021).

Grouper-Tilefish (Gulf of Mexico)

The grouper-tilefish IFQ is closely linked with the red snapper IFQ, with some overlap in participation. A greater effort was given toward examining the social and economic effects of the grouper-tilefish IFQ for the 5-year review. Its review offers the only comprehensive effort to capture social and

community dimensions. It uses an updated version of the Colburn et al. (2017) study of community engagement, regional and local quotients, social vulnerability, and resilience. In addition, there was a captain and crew survey (ECS Federal Inc. et al., 2017), a survey of shareholding participants (QuanTech, Inc., 2015), and, uniquely, a large ethnographic study focusing on particular communities (Griffith et al., 2016).

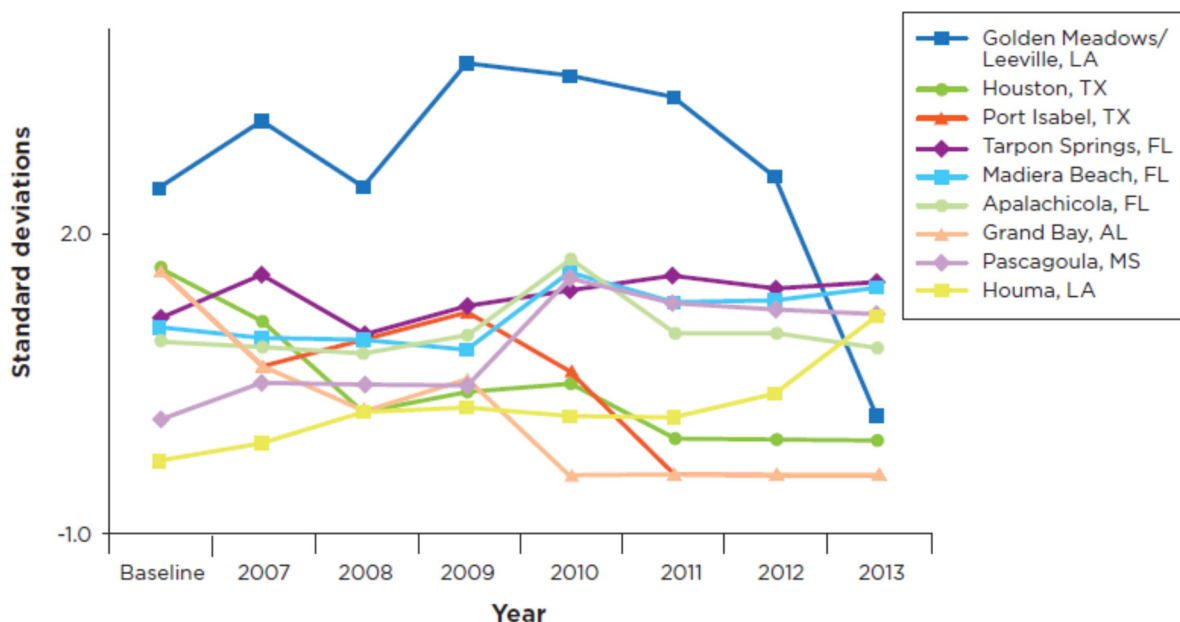


FIGURE 7.1 Fishing Engagement Index scores of communities highly engaged in the Gulf of Mexico red snapper IFQ program for fewer than all years from the baseline (2004–2006) through 2013. SOURCE: Colburn et al., 2017.

The results are mainly focused on socioeconomic impacts on participants in the fisheries, reported in Chapter 5, rather than on communities *per se*. But some community members expressed the view that separating ownership from active participation (the “armchair captain”) is counter to their community values—and there are perceptions that labor relations seem changed for the worse on the boats, where captains and crew become more like “sharecroppers,” working on someone else’s property for a small share of the harvest, rather than full co-venturers with the owners. These can be construed as community matters in the sense of the local culture of shared expectations, values, and history. While the “sharecropper” metaphor may be problematic—given that the crew worked on shares with the owner before the LAPPs—it may be interpreted as expressing dissatisfaction with new relations of ownership and work. Fairness of initial allocation is a related issue. Unlike the operation of tradable LAPPs, the initial allocations are indeed zero sum. One fisher’s share is a share that another does not receive.

An important economic context for expressions of perceived inequity is seller’s remorse. To the extent that consolidation of share ownership has occurred after the formation of LAPPs—which the empirical evidence in Chapter 5 suggests is not large enough in magnitude in our study fisheries to affect market power—it comes about when participants sell shares and exit the fishery. Selling shares is a bet on the future, and when the share price or the lease price increases, it is not surprising that sellers would have remorse just as they would when selling property or a financial asset that subsequently increases in value. Share values for a number of fisheries, particularly red snapper, have increased. It is plausible that some individuals who sold their shares would interpret the outcome as unfair when in actuality they simply guessed wrong. Alternatively, it is possible that these sellers did not have the information or tools needed to calculate the fair market value of this new type of financial asset (e.g., Ropicki and Larkin, 2015), or to find a trading partner and negotiate a good price given the large and unrestricted trading region.

Differing views on consolidation are another example. Griffith et al. (2016) argued that community concerns about consolidation of ownership and incentives for greater specialization be understood in relation to the widely shared history of diverse, multispecies, and multigear fisheries—the small-scale fisheries identified by Congress as worthy of consideration. Another cultural matter reflecting community identity and values were concerns people shared about how long commercial fishing would continue, given aging fishers and barriers to entry, including share costs, which resulted in fewer young fishers. However, aging of fishing fleets is a widely documented global phenomenon, so the counterfactual for evaluating the effects of a LAPP on aging of the participants would need to account for this reality.

Although the NOAA SICC-based study of community engagement, vulnerability, and resilience (Colburn et al., 2017) included coded measures of recreational fisheries, we found no documents on their place in local communities, and we heard nothing in our meetings about effects of LAPPs on the recreational dimensions of communities.

Central and Southwest Florida

Exemplifying the strength of ethnographic research in better depicting community aspects of fisheries, Overbey (2016) carried out open-ended interviews with participants in the grouper-tilefish IFQ program in central and southwest Florida, the major center of grouper fishing. She found that the fishing communities are characterized by strong historic and family ties to the fisheries, which are made up of fishing enterprises, dealers, and owners and managers of seafood markets and restaurants. Individuals may assume multiple roles in these aspects of the fisheries, and these are often family businesses. Generally, fishers often own one or two vessels, usually using bandit or rod and reel vertical methods to harvest multiple species, although the larger-scale enterprises may be longlining offshore. Women have visible and important roles in all aspects of the fishery and are recognized as key business leaders and partners (Overbey, 2016). Finally, and central to how people experience and evaluate IFQs, “[a] value for independence, an ethic of hard work, and historic family ties to fishing draw and keep these individuals in the fishery. Holding shares and allocation instills confidence and ensures their success” (Overbey, 2016).

Overbey (2016) found virtually unanimous approval of the grouper-tilefish IFQ program for the flexibility and autonomy created, which fit well with the value of independence, the value that drew and has held many in this livelihood. However, there were major concerns expressed by large and small participants alike, including the problem of regulatory discards of red snapper due to the scarcity of red snapper shares in the eastern Gulf, and the effects of the initial allocation and subsequent trading on creation of sharp distinctions between “winners” and “losers,” with concern that a few of the winners can exert undue control over leasing costs. A big issue, given the timing of the research, in 2016, 1 year after “public” shareholding was allowed in the grouper-tilefish LAPP, was the prospect that the influx of ownership of shares from the outside would worsen the situation for fishers, increasing the cost of leasing and elevating fears of a takeover by a few wealthy companies or individuals.

A major theme in all of the regional studies (Griffith et al., 2016) concerns the future of the fisheries and their place within communities. The cost of buying or leasing IFQs makes entry difficult for the young; it also contributes to problems experienced getting and keeping good captains and crew, because of the effects of the cost of leasing and the 3% recovery fee on their incomes, all of which suggest, to many people interviewed, that fishing is a “dying industry.” The creation of clear differences between “winners” and “losers” also threatens social and economic relationships in once tightly networked communities. Here the counterfactual is important. Claims of high cost of entry are not based on a comparison to a counterfactual fishery without a LAPP and thus are difficult to evaluate. Lee and Thunberg (2013) simulate a counterfactual New England groundfish fishery that maintained days-at-sea regulation rather than adopting the LAPP. Although consumer welfare declined under both the LAPP and days at sea, welfare losses were greater without the LAPP. Moreover, competitive pressures from imports and other features of globalization could also result in impressions of a dying industry in the absence of a LAPP. Finally, derby-style fisheries with quota overages and associated stock declines could accelerate decline of the industry, whereas the LAPP could slow the decline.

The effects of the grouper-tilefish IFQ program on communities are both positive and worrisome. The positive effects are seen in the two largest fishing communities, Madeira Beach and Cortez, where increased value of grouper, now available year round and touted as a major tourist dining experience, has enabled expansion and new investment in fish houses and associated restaurants (Overbey, 2016). Moreover, as Griffith et al. (2016) discuss for the Florida Panhandle region, successful IFQ fisheries help sustain the often elaborate and interdependent network of support services found in the major coastal communities, serving commercial, for-hire, and recreational fisheries: goods and services for vessels and fishing trips, for seafood marketing, for cultural amenities like festivals and museums, and for government and education. However, smaller and more remote coastal and inland communities with fewer economic alternatives, more poverty, and grouper-tilefish fishers with very small allocations are highly vulnerable to further consolidation of the fishery (Overbey, 2016). Similar studies and findings were done in other communities in the Gulf (Griffith et al., 2016).

Bluefin Tuna (Secretary of Commerce/NOAA)

The 5-year review for Atlantic bluefin tuna's IBQ listed no "social impacts" beyond the issue of cost recovery (NMFS, 2019). Community profiles are available in Stock Assessment and Fishery Evaluation (SAFE) reports for the highly migratory species, but the bluefin tuna IBQ was not included in the Colburn et al. (2017) study of community participation in catch share programs, meaning that the SICC data have not been fine tuned to refer specifically to the highly migratory species pelagic longline fleet.

The available community profiles, from the SAFE reports for highly migratory species, show that the homeports with highest measures of engagement in and/or dependence on the pelagic longline fisheries in recent years are Montauk, New York; Barnegat Light, New Jersey; Cape May, New Jersey; and Grand Isle, Louisiana. Others with significant engagement are Beaufort, North Carolina, and Panama City, Florida, which like most coastal ports have diverse economies, reducing reliance on the fisheries. Of that group, only Grand Isle and Panama City had high measures of social vulnerability, meaning they would encounter more obstacles when recovering from economic hardships caused by changes in the commercial and recreational fisheries. Others with signs of vulnerability, but with low measures of engagement with bluefin tuna, were Fort Pierce, Florida; New Bedford, Massachusetts; Pompano Beach, Florida; Port Salerno, Florida; Freeport, Texas; Beaufort, North Carolina; Morehead City, North Carolina; and Apalachicola, Florida.

An extensive social impact analysis of the effects of regulations on fishing communities involved in bluefin tuna fishing and other highly migratory species took place prior to IBQs (Wilson and McCay, 1998). Its scope and depth create a valuable blueprint for future community studies, among which is found otherwise unusual discussions of recreational as well as commercial fisheries for those species. Moreover, it shows that there has been significant change in the highly migratory species fisheries since 1998 but some patterns remain, including continued decline, which is relevant to the more recent, post-IBQ period.

The 1998 study showed that the pelagic longline fishery and its suppliers had become tightly linked to global markets and that many longline fishers had emigrated to other nations to continue the fishery. In most ports, the longline fishery was relatively small and isolated, although there may be historic and kinship ties with other fisheries, including recreational fisheries. In the Gulf of Mexico, yellowfin tuna and shark have been more important to pelagic longliners; in Louisiana, the longline fleet was more of a commuter fishery, mainly Vietnamese, with tight kinship networks. In Florida, longliners had become more isolated from the rest of the fishing communities, which experienced rapid development of tourism and recreational fishing. In the South Atlantic, longliners tended to be smaller, but there is a proud heritage in Pompano Beach. Major longliner supply companies there served global markets, but the fishing communities had become overwhelmingly recreational.

In the Mid-Atlantic region, Wanchese and Hatteras, North Carolina, and Barnegat Light, New Jersey, were the major pelagic longlining ports. The larger boats targeted yellowfin and bigeye tuna and swordfish, but many of these vessels had left for fishing in other waters, and the larger fish houses in these

places had also become more global. Finding and keeping crew was a major problem for the larger vessels that stay out longer and require more crew. These places were and are fishing-dependent tourist centers, with charter boat fishing and tourist-related construction offering some alternatives to longlining and other forms of commercial fishing. All of these places identified as both commercial and recreational fishing communities, with families often participating in both commercial and recreational sectors, and individuals crossing back and forth.

In New England, New Bedford was highlighted as the center of the distant water longline fleet and like Gloucester, Massachusetts, was home for the small purse seine bluefin tuna fleet (which continues to get a large portion of the quota even though it has been inactive since 2015). The distant water longline fleet, mainly targeting swordfish, was very migratory, and in the 1990s many had moved to Hawaii. The captains and crew were highly skilled and able to find longliner work elsewhere; crew were sometimes recruited from the West Indies. The owners, captains, and crew lived highly dispersed along the coast and were fairly isolated from the communities in which they live, even in highly integrated communities like New Bedford. The small purse seine fleet fished for bluefin tuna only a few weeks per year in the 1990s, those involved doing other fishing or work the rest of the year but maintaining strong kinship ties to the local fishing communities.

Finally, the 1998 report discussed recreational bluefin tuna communities: Hatteras, North Carolina; Brielle, New Jersey; and Gloucester, Massachusetts. The “general category” bluefin tuna permit holders were treated as recreational fishers, even though using that permit allows one to sell the fish, a feature of this fishery that remains today. By and large, the “general category” fished from small private boats and were not dependent on bluefin tuna for a living. “For the majority of boats, the social effect of the sale of a bluefin tuna is much closer to that of winning a prize in a fishing tournament than making a living from selling a fish” (Wilson and McCay, 1998). The recreational fishing community was itself highly diverse, with different groups seeking different experiences. Those targeting bluefin tuna tended to be wealthier people, mostly men, seeking adventure and trophies. Recreational fishing drives a large economy of marine trades (tackle, boats, engines, etc.), fishing supplies (bait and ice), and general tourist services such as restaurants and hotels. Bluefin tuna were key attractions for these communities, which compete with other tourist destinations. The wealthier people attracted by the bluefin tuna also provided some buffering for communities against decline in the overall economy. In these communities there was considerable community support for having both recreational and commercial fisheries. At the time of the research, the mid to late 1990s, people interviewed were concerned about greater tension between commercial and recreational sectors, but at that time communities appeared able to work together to respond to changes (Wilson and McCay, 1998).

The Wilson and McCay (1998) report provides further information on the recreational and commercial dimensions of the major communities in an extensive section on community profiles. Unfortunately, the information is not fully commensurate with the community profiles used in the SAFE reports and the Colburn et al. (2017) report, constraining the committee’s ability to assess a before-and-after picture of the IBQ program, and other changes in the fisheries, in relation to the communities.

Wreckfish (South Atlantic) as of 2019 LAPP Review

The wreckfish fishery is highly specialized and very small, involving a handful of vessels homeported in a wide range of places, with shareholders and fishers and dealers involved in an even wider range. The six shareholders and the fishers, dealers, and fish houses that work with them are scattered between the Carolinas and the east coast of Florida. The wreckfish fishery is embedded in others, as participants move in and out of targeting wreckfish and may be catching other fish on their trips. There is, in effect, no recreational fishery for wreckfish despite a small allocation.

Social indicators show that most of the homeport communities appear to have significant dependence on the fishery; they show few social vulnerabilities, except high poverty levels in Daytona Beach and Marathon, Florida (Colburn et al., 2017). The small size of the fishery and the small number of

dealers and harvesters in any given year restrict further analysis because of the issue of confidentiality, which constrains the types of information that can be presented to the public. As the LAPP review says,

As is often the case with other social environments, in order to meet National Standard (NS) 8, a summary of communities involved and their dependence upon fishing is often presented. Because of the small footprint of the wreckfish fishery that type of description is not possible. Both the number of vessels and dealers are so few that little description is possible without revealing confidential information. (South Atlantic Fishery Management Council, 2018)

Golden Tilefish (Mid-Atlantic)

The golden tilefish commercial fishery is embedded in and important to specific place-based fishing communities, namely Montauk, New York (and neighboring Hampton Bays), and Barnegat Light, New Jersey, although open access vessels that catch tilefish as incidental catches are found in a far larger number of places in the Mid-Atlantic and New England areas. The fishery is one that could be studied in terms of “communities at sea” (St. Martin et al., 2007). The fishing grounds, on the edge of the continental shelf, are mainly in two relatively small NOAA statistical areas, and almost all tilefish are caught from baited longlines. Thus, the small number of boats that target tilefish share technology, port, and fishing grounds, the basis for the social ties that make up this community.

Moreover, the communities have been sites for important collaboration among fishers and dealers, in terms of developing markets for golden tilefish, initially in Barnegat Light, which led to the creation of a successful dock, retail market, and restaurant complex, Viking Village. When limited access management began, fishers in Montauk, who by that time had replaced those of Barnegat Light as the major tilefish harvesters, cooperated in a program of self-regulation to keep within the quota and optimize marketing (Kitts et al., 2007; Pinto da Silva and Kitts, 2006), and their leadership was instrumental in creating the IFQ program (Colburn et al., 2017).

The structure of the fishery is one of a very few major IFQ harvesters (6 or 7) and shareholders (11-13), almost all located in one community, Montauk, New York, and a large number of harvesters not in the IFQ program who catch tilefish as an incidental catch to fisheries targeting other species (averaging 2,068 vessels from 2010 to 2015) (Mid-Atlantic Fishery Management Council, 2017). This general structure had emerged prior to IFQs, when a tiered limited access system was imposed and sharply reduced participation. It was reinforced in the initial allocation of the quota share and has remained more or less the same since.

There was a large decline in participation from the premanagement phase through the tiered limited access period, but to a lesser degree with IFQs. Moreover, Barnegat Light’s fishers and dealers were effectively shut out of the fishery while Montauk thrived. However, both ports continued to function as important commercial (and recreational) fishing centers, engaged in a variety of other fisheries. Although involved in tilefish fishing in the 1970s to 1990s, the Barnegat Light fishers had mainly switched to other species by the eligibility period in the 2000s, despite the fact that some had started the fishery in 1971 and done much to develop the markets (Moore, 2020). The LAPP review for golden tilefish noted that because fleet consolidation involved an “orderly and slow reduction in the number of vessels participating in the fishery ... it is likely that the capacity reduction has not had significant adverse social impacts on fishing communities” (Mid-Atlantic Fishery Management Council, 2017).

Recreational fisheries, private angler and for hire, are based in Montauk and Barnegat Light as well as other coastal ports in the region. The Snapshots of Human Communities and Fisheries in the Northeast database (NOAA Northeast Fisheries Science Center, 2019) shows a far higher degree of engagement with and reliance on recreational fisheries than commercial fisheries.

In both places, the longliners targeting tilefish are parts of a diversified fishing community—commercial, for hire, and recreational—within a larger coastal community marked by residential and tourist development. Colburn et al. (2017) showed that Montauk, the only community meeting criteria of being “highly engaged” in this IFQ fishery and hence the only one studied in that report, accounted for 70-75%

of the poundage caught between 2007 and 2009 baseline through 2013. However, the IFQ for golden tilefish accounted for only 7-10% of the total pounds and 15-20% of the total value landed in Montauk during that period. Montauk ranked low on indices for social vulnerability (personal disruption, population composition, poverty, and housing characteristics) (Colburn et al., 2017); the “Snapshots” data show a large highly educated, professional population. It is coded as highly vulnerable to indices of gentrification on housing disruption and urban sprawl, and moderately vulnerable for the retiree migration index (Colburn et al., 2017).

A brief summary is possible for Barnegat Light as well, based on the “Snapshots” database, which is another source of information about fishing communities, and is referenced here to point to the variety of sources of descriptive information, although, as with other current sources, it has limitations in assessing community-level impacts of changes in the fisheries. In terms of value, scallops have become the dominant species landed, but like Montauk it hosts a number of smaller vessels fishing for a wide range of species, including fluke, scup, black seabass, and monkfish. Barnegat Light is perhaps more fishery centered than most, in that fishing (coded in the census as agriculture/fishing) represents almost 15% of the occupations, balanced against professional, arts/entertainment, and construction. It has an exceptionally high level of both commercial and recreational fishing reliance. It is a much older population (average 60.3).

Fishery Performance Indicators and NOAA Social Indicators

One dataset that speaks to social outcomes in fisheries is the Fishery Performance Indicators (FPIs). The FPIs quantitatively code a large number of factors in a global sample of fisheries with heterogeneous forms of management (Anderson et al., 2015). Each fishery is coded by an expert with detailed rubrics for the individual factors. The indicators can then be aggregated into broad categories measuring performance in terms of economic, ecological, and social outcomes. An advantage of the FPIs is that these broad categories are linked transparently to the detailed metrics. For example, some of the social metrics are harvester participation in industry organizations, harvester participation in management, measures of community and social cohesion, and four separate gender-based metrics to capture women’s influence on business management, influence on fishery management, participation in the harvest sector, and participation in the post-harvest sector. This transparency means that if a particular fishery is scoring high or low on the social scale, it is possible to see which underlying metrics are driving that aggregate. Another advantage of the FPIs is that the same approach can be applied consistently to expand the database and to characterize operations in the aquaculture sector.

Because management types are coded as well, one can examine statistical associations between, for instance, whether a fishery is managed with a LAPP and social, ecological, or economic outcomes. Indeed, in one analysis of performance indicators, social, ecological, and economic outcomes are all positively associated in LAPP fisheries (Asche et al., 2018). Positive outcomes along social, economic, and ecological dimensions are not associated in fisheries that do not limit access. Testing for associations of underlying metrics of the FPIs with management features is still nascent and has not been fully explored in published research.

There are several limitations of the FPIs. First, the data are currently cross sectional. This feature limits the ability to apply quasi-experimental designs for causal inference about specific management styles. Second, expanding the database to become longitudinal in the long run will have to confront the reality that future coders of the same fishery will be different individuals and may not make the same judgments. Third, there are nuances in human experience and perceptions of change that are not well captured by quantitative metrics. In that sense, FPIs are not a substitute for survey and ethnographic data but should be viewed as complementary.

Another dataset for considering social impacts of management and LAPPs in particular is the NOAA SICC data, which are used for some of the descriptions of the communities above. Although SICC has some similarity to the FPIs in that they attempt to code social vulnerability and other features quantitatively, the datasets are very different in most respects. First, the data are U.S. only, not global. Second, the unit of observation is a coastal community, not a fishery. This is a strength in that there are

many communities in the database (large sample size, or “n”), far more than the number of fisheries coded in the FPIs (and the number was further enhanced by the decision to include all coastal communities in each coastal county, whether or not fishing was involved). This feature is also a weakness for understanding impacts of fishery management because such impacts may be diffuse in the broader community and thus difficult to resolve quantitatively from the SICC. Third, the data are longitudinal, so communities are followed over time. The SICC data span 2009 through 2018.

This feature is a pronounced strength and introduces the possibility of using the SICC in quasi-experimental designs to evaluate policy impacts or impacts of major disruptions like natural disasters. Fourth, the indicators are not as transparent as the FPIs. The exact processing of raw data is not specified, and some indicators may rely on confidential data. Other problems using similar social vulnerability indicators are discussed by Spielman et al. (2020).

Analysis of Labor in Florida Communities with and Without Exposure to LAPPs

Despite the limitations of the SICC, the committee conducted data analysis to illustrate how these data might be used to assess the causal impacts of LAPPs on social outcomes in affected communities. The committee specifically analyzed the labor force metric (*labor*) for which “a high rank means likely fewer employment opportunities and a more vulnerable population.” The null hypothesis is that implementation of LAPPs has no effect on the *labor* metric. As such, the committee seeks to compare *labor* in communities that were treated with LAPPs before and after the treatment date with communities that were not treated with LAPPs before and after the treatment date. Ideally, the control units would be otherwise similar to the treated units.

To this end, the committee used just Florida communities to exploit a natural experiment. The premise is that Gulf communities were treated with LAPPs in 2010 (the grouper-tilefish LAPP), but communities on Florida’s Atlantic coast were not. Here -81.6° was used as the longitude cutoff to approximate “Gulf” and divide the communities in Florida. This is imperfect because of the shape of Florida, but it is a reasonable starting point for illustrative preliminary analysis. Then all communities that did not have complete data with 10 observations were filtered out (to eliminate ones that had no baseline observation in 2009 prior to the LAPPs or other missing observations). Then 2011-2018 averages were computed to represent after treatment (or the after period for the control). The data in 2010 were dropped to avoid timing issues associated with SICC measurement and the implementation of the LAPP. The average was then differenced with the 2009 baseline observation (before the LAPP). In economics and other quantitative social sciences, this approach is referred to as a difference-in-differences design. Ecologists would refer to it as a before-after-control-impact design.

It was found that LAPPs had no effect on *labor* (no statistically significant findings). The analysis was conducted both using all of the communities with full observations ($n = 507$) and restricting the sample to communities with high fishery dependence ($n = 29$). The point estimates for the difference-in-differences coefficients are both positive, despite findings of no statistical significance. It is possible that the SICC are not measured with sufficient precision to resolve effects statistically or the quasi-experiment is not sufficiently refined. Still, if there were a substantial effect, one would expect that it would come out in one of these analyses. Figures 7.2 and 7.3 illustrate the difference-in-differences score.

In terms of confounders, it is difficult to argue that the Atlantic coast experienced as many negative external shocks as the Gulf. Consider the experience of hurricanes and other disasters. There were five such shocks in the “after” period: *Deepwater Horizon* (2010), Hurricane Hermine (2016, category 1), Hurricane Matthew (2016, category 2), Hurricane Irma (2017, category 4), and Hurricane Michael (2018, category 5). Of these five, four were in the Gulf and only Matthew affected the Atlantic coast. Had negative effects of LAPPs on employment been found, the negative effects plausibly might have reflected these shocks. However, a finding of no effect suggests either a true null effect or a positive effect of the LAPPs that was obscured by the negative shocks. A small effect size is not surprising in light of the fact that fishing is just one of many industries contributing to the local coastal economies in Florida.

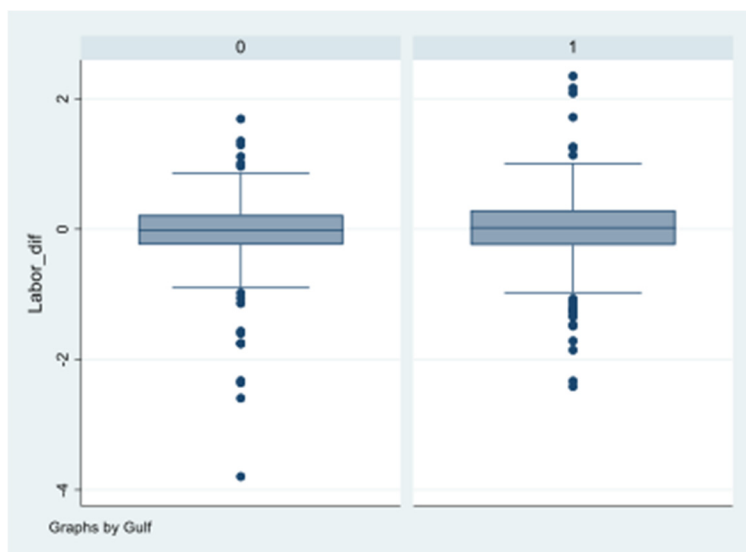


FIGURE 7.2 Labor score difference. Average 2011-2018 labor vulnerability less 2009 labor vulnerability separated by Gulf (1) and Atlantic coast (0) of Florida. Higher score indicates more vulnerable (n = 507).

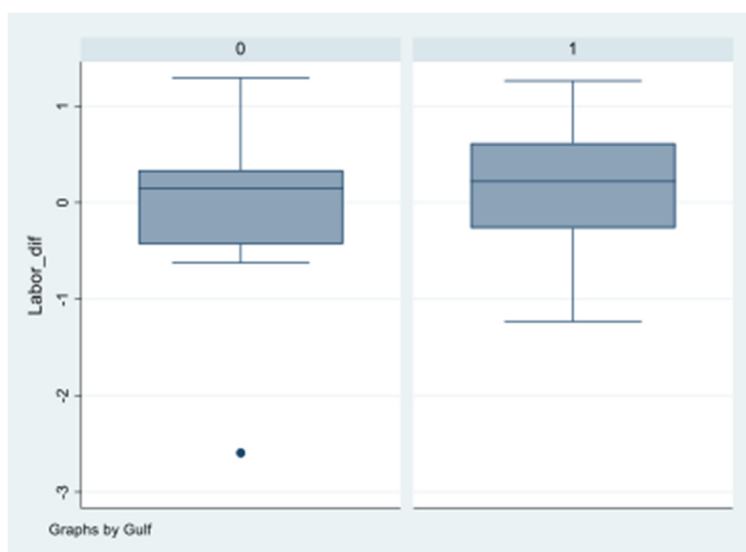


FIGURE 7.3 Labor score difference. Average 2011-2018 labor vulnerability less 2009 labor vulnerability separated by Gulf (1) and Atlantic coast (0) of Florida. Drop all observations where 2009 commercial reliance < 0. Higher score indicates more vulnerable (n = 29 remaining).

Overall Findings and Conclusions

The coastal communities within which the fisheries of study have been located are ones where fishing is a small part of the local economy and society compared with tourism, retirement and second homes, and other sectors. In addition, the LAPP fisheries are typically part of diverse mixes of fisheries in these places. The data are not available to assess the extent to which LAPPs have contributed to increased specialization as against broad patterns of diverse, flexible, opportunistic fishing in the Gulf, South Atlantic, and Mid-Atlantic, but there is a general understanding among fishery participants and observers that this has happened. Interviews and surveys show widespread concern about the future of the fisheries and hence fishing communities, of which the LAPPs are only part of the picture. Ethnographic studies and surveys in

the Gulf of Mexico showed that people who had not benefited greatly from the LAPPs were critical of the programs, but even those who benefited and appreciated some of the features of the programs were concerned about the future of the fisheries and fishing communities (Griffith et al., 2016; Overbey, 2016).

Congress intended that LAPPs take into consideration fishery-dependent communities and vulnerable groups within them, including the smaller-scale fishers who might not compete successfully with others in the markets for quota share. NOAA's effort to develop systematic data on coastal communities that engage in commercial and recreational fishing is an important contribution to assessing community needs and the success of fisheries management programs in meeting them. The committee sees potential for the further refinement and use of the social indicators for causal analysis, as done above in a preliminary study of employment indicators in communities that did and did not have LAPP fisheries in Florida, with the recognition that rigorous ethnographic research remains critically important for community assessment. Furthermore, smaller-scale fishers or those in underserved communities could benefit most from providing training in support of transfer markets such as finding trading partners, how to value assets (e.g., future fishing conditions, estimate costs and prices, assess risk preferences, and their time value of money; Ropicki, 2013), and expansion of loan programs that can help sustain fishing in the local community.

8

Addressing the Impacts of LAPPs in Mixed-Use Fisheries

This chapter provides a series of recommendations designed to address the economic, social, and ecological impacts of Limited Access Privilege Programs (LAPPs) noted in Chapters 4-7 for the mixed-use fisheries reviewed in this study, as well as for any future LAPPs in mixed-use fisheries. While the committee has prioritized recommendations that pertain specifically to fisheries with multiple sectors (i.e., by addressing intersectoral spillovers), LAPPs in mixed-use fisheries are a special case of LAPPs in general, and hence many of the recommendations have broad applicability. In addition to providing specific policy recommendations, the committee also provides recommendations for how additional data and research, or greater synthesis of existing data and research and stakeholder and community engagement, could enhance the decision-making capacity of the National Marine Fisheries Service (NMFS) and the Councils when designing, establishing, or maintaining a LAPP in a mixed-use fishery.

The first section of this chapter summarizes the nature of the complexities and trade-offs faced by policy makers as they contemplate the design, implementation, or adaptive improvement of a mixed-use fishery LAPP and offers some high-level principles that are foundational to subsequent arguments. Having established this “big picture,” the next section briefly outlines a set of more specific criteria that undergird the recommendations. The committee then recommends potential policy changes that could be implemented by Congress, the NMFS, or individual Councils to mitigate negative impacts, while promoting the positive functioning of the LAPPs considered in this study as well as any future LAPPs that may be considered. Finally, recommendations are provided for data collection, research, and outreach that are important to improve the functioning of existing LAPPs as well as contribute to improved designs of new LAPPs.

Synopsis of Committee Findings

Overall, the outcomes of LAPPs in these mixed-use fisheries are similar to experiences in LAPPs that lack mixed-use components. In terms of economic impacts, the committee finds very strong evidence showing that LAPPs mediate the race to fish and strong evidence for increased profitability of the LAPP fisheries. The committee finds some evidence that LAPPs have modestly reduced economically wasteful overcapacity, but for most LAPPs they find no evidence that associated consolidation has contributed to market power in the quota market; however, stakeholder concerns about fairness and access were central in several of the study fisheries. The committee finds strong evidence of ecological benefits of the tuna IBQ LAPP. Although they find only weak evidence of very modest ecological benefits of other LAPPs, the committee finds no evidence of ecological harms.

With respect to social impacts, the committee finds strong evidence that LAPPs have led to improvements in safety at sea. They find mixed and largely inconclusive effects of LAPPs on labor with indications that some participants are better off and others are worse off. The committee finds no direct evidence of negative or positive effects of the LAPPs in our study on communities; however, they note a significant lack of data to assess social and community impacts. Many of the potential negative effects of LAPPs on communities that they identify are rooted in studies of different geographies, regional economies, histories of coastal development, and cultures of fishing (e.g., Alaska, Iceland, New Zealand, Newfoundland, and Norway). The disruptiveness of LAPPs in these rural, resource-dependent, and sparsely populated areas could be quite different than in the U.S. Mid-Atlantic, South Atlantic, and the Gulf of Mexico where complex coastal economies are often dominated by tourism and have substantial recreational fishing.

With respect to the mixed-use components of the fisheries in our study, the committee finds no evidence for direct effects of LAPPs on private recreational anglers or recreational for-hire providers. LAPPs plausibly increased the political power of the commercial sector in terms of its allocation claims. The greater accountability of the commercial sector, due to LAPPs, may be leading to pressures to attain greater accountability on the part of the recreational sector. While this is speculative, the greater political power of the commercial sector is a reasonable observation. However, given the particular history of power relations of the fisheries in our study, this change may result in greater parity in the political power of recreational versus commercial stakeholders in the Council process. The committee notes that studies of the political and power dimensions of fishery management systems, taking into account wide diversity within sectors, is necessary to properly assess these possible shifts. Taken as a whole, the evidence base in the committee's study of mixed-use LAPPs affirms a number of positive outcomes cataloged elsewhere in the literature while failing to provide a clear picture of many of the associated negative outcomes. Nevertheless, substantial data shortages limit the committee's ability to robustly exclude the potential for some negative social and community effects. The committee's recommendations for the knowledge base and other matters are aimed at improving a management system that in many respects appears to be working well.

Context for Recommendations

Before providing specific recommendations, it is important to first address some persistent shortcomings in the overall conceptualization and ongoing policy discourse surrounding LAPPs, both at the level of individual Councils as well as in the national conversation, whether or not they are in mixed-use fisheries. Differences in the conceptual models that are often used to understand and discuss LAPPs within policy processes may promote divergent and often overly simplified narratives about the scope of their effects and their appropriate role within fishery management. Full agreement on these conceptual models is not to be expected given the heterogeneous impacts of LAPPs across stakeholders and divergent normative stances on the proper functioning of fishery systems. Nevertheless, grounding the policy discourse in some shared understandings may help to support a more constructive, creative, and less acrimonious policy process, as well as promote outcomes that foster economic prosperity for fishers and fishing communities, promote social equity, and ensure sustainable fisheries. Each of the specific recommendations is grounded in the following overarching principles.

First, it is important to keep in mind that LAPPs are fundamentally economically targeted policy instruments, with complex and potentially wide-ranging social and economic effects. As summarized in Chapter 4, the vessel-level accountability and associated enforcement mechanisms associated with LAPPs can make them unusually effective relative to traditional input controls in achieving management targets. However, there is abundant global evidence from scientifically managed fisheries that LAPPs, while very helpful for achieving ecologically sustainable fisheries, are not necessary for this end. Therefore, the dominant justifications for and concerns with LAPPs lie in the social and economic sphere. This reality has implications for the practice of fishery management when focusing on LAPPs and similar policies. The conceptual frameworks used to understand fisheries system states and feedbacks, and to organize policy, may be constrained by the deference to National Standard 1 and case law supporting the priority of biological conservation. These frameworks should also go beyond recognizing humans as an important component of marine ecosystems (as seen in many instantiations of ecosystem-based fisheries management at the Council level) to explicitly place people at the center of these systems. Doing so would not only recognize the role of human values and behavior as the primary leverage points of "fisheries management" (Fulton et al., 2011) but also acknowledge the importance of individual and collective human goals, welfare, and perceptions as central normative dimensions of fisheries policy. While aspects of LAPP design may have repercussions within the traditional biological confines of fisheries management, for the most part LAPPs and their alternatives are a tool of social and economic policy. Elevating the role of human actors and institutions within the management system may be facilitated by adoption of new interdisciplinary and integrated frameworks, such as socioecological systems (Ostrom, 2009). However, continued

organizational and cultural change to foster such interdisciplinarity and integration within the Councils and the NMFS, backed by commensurate funding, is also needed.

Second, it is important for the fishery management community, including managers and scientists, to more openly and explicitly acknowledge and address trade-offs in the objectives of LAPPs. As noted in previous chapters, the Councils often specify a large number of social, economic, and ecological objectives when designing a LAPP, but only as they relate to the commercial sector for which the program is implemented. Moreover, each of these goals is often individually sensible, but collectively some goals cannot be simultaneously achieved to their fullest extent. For example, goals of enhancing efficiency, lengthening seasons, and reducing capacity may be complementary, but may be very difficult to achieve if another objective of the LAPP is also to preserve historic geographic patterns of fisheries employment or landings. Indeed, some objectives may be mutually exclusive (as can be the achievement of all 10 National Standards for the Magnuson-Stevens Fishery Conservation and Management Act [the MSA]). Rather than maintaining a fiction that all LAPP objectives are equally important and achievable, proactive work to identify trade-offs where they exist and provide some guidance for how to evaluate and prioritize conflicting objectives in a way that fosters transparency and stakeholder confidence by the Councils would be beneficial. Failure to do so does not avoid the trade-offs; rather it “kicks the can” to future Councils to arbitrate these trade-offs, raising the risk that entrenched power dynamics (constrained by the legal process) have undue influence over outcomes. Failure to anticipate these complexities at the outset of a LAPP can engender considerable acrimony and a case of “buyers’ remorse” in the adoption of particular LAPP mechanisms.

Third, while trade-offs in objectives are to be expected, there may be cases where the *perceptions* of the steepness of these trade-offs among managers and many stakeholders may be far more exaggerated than is truly the case. These perceptions are likely to arise when potentially viable policy options are explicitly or implicitly removed from consideration, thereby constraining the policy process and removing creative options that may minimize trade-offs or even allow for “win-win” outcomes. In some cases these constraints are formally entrenched and would require high-level legal action to address (e.g., the MSA’s prohibition on levying royalties on quota shares ([1853a(e)(2) and 1885(h)(5)(B)] or that the Councils no longer have to have equal commercial and recreational representation). In other cases the constraints may be informal, lying in real or imagined political constraints or reflecting a risk-averse bureaucratic dependence on the templates embodied in previous policies. In the latter case, it is incumbent on the Councils and the NMFS to resist these tendencies, while stakeholder groups and nongovernmental organizations can play an important role as “policy entrepreneurs” (Anderson and Parker, 2013) to provide bottom-up suggestions for innovative approaches and encourage policy experimentation. It is also the case that stakeholders are not simply, or should not simply, be categorized or perceived as commercial versus recreational as some individuals participate in both and some sectors are more integrated, especially in fishing-based communities.

An example that is replicated across most LAPPs is the tension between the goals of fostering economic efficiency and the achievement of equitable outcomes for members of fishing communities. In theory the wealth-maximizing incentives under LAPPs generate the *potential* in many settings for all members of the community to be better off, or at least no worse off, than under the previous management—at least in a material sense. However, the ubiquitous practice of grandfathering allocation exclusively to vessel owners inherently concentrates wealth in the first generation of capital owners. While grandfathering in overcapitalized fisheries may be justified because a reduction in fleet size is the goal, or based on pragmatic political grounds, fairness to those who developed a fishery, and efforts to retain fishing opportunities in dependent communities—alternative approaches exist to distribute benefits to a broader group of stakeholders. A partial accounting might include auctions or rent recovery; separate allocations to captains, crew, or shoreside sectors (e.g., processors); or the explicit allocation of quota to community groups (i.e., community development quota) or to quota pools for new entrants (Ropicki et al., 2018). In fact, some programs have redistributed catch shares from forfeitures and when annual catch limits are increased.

While none of the aforementioned approaches is a panacea for the simultaneous achievement of economic and social objectives, their exclusion in favor of the dominant practice of grandfathering of most quota to capital owners with no rent recovery limits the ability for a broader group of stakeholders to have a shared stake in the economic profitability and dynamism of the fishery, exacerbating the trade-off between efficiency and distributional objectives and contributing to “us versus them” dynamics in the Council process. Indeed, the very perception by noncapital stakeholders that no portion of the economic benefits of a LAPP will flow to them may influence the ways social equity objectives are defined and expressed in the policy process. Where opportunities for mutual benefit are forestalled, it is only natural for social objectives to be redefined in defensive and backward-looking terms (e.g., “preserving historic patterns”). However, these objectives are far more likely to be inconsistent with the expressed economic objectives of the LAPP, exacerbating the tendency toward conflicting objectives.

Finally, while improved policy design may help to mitigate some of the social impacts of LAPPs and foster less acrimony in the Council process, it is important to acknowledge that LAPPs are likely to remain controversial among a number of stakeholders because they change both the economic and social aspects of fisheries, with differing impacts within a community. This process of transition can be unsettling to many members of fishing communities in ways that extend beyond material impacts, creating spillovers to the nature of work and a way of life for captains, crew, and participants in fisheries-dependent sectors (Pinkerton, 2014, 2015; Ringer et al., 2018; Steiner et al., 2018). A well-defined communications and engagement strategy specifically for such communities may be warranted for those affected by current LAPPs and as new LAPPs are considered.

Some stakeholders, including recreational fishers in mixed-use fisheries, may also oppose LAPPs due to fundamental philosophical positions, such as objections to privatization of public trust resources (even though they are revocable privileges and not property rights) or the free grandfathering of quota to commercial interests (if privileges are distributed for free). These objections may even undermine seemingly mutually beneficial trading of quota between recreational and commercial fishers (Chan et al., 2018), especially if trading markets are decentralized. As with any large-scale management change, LAPPs are not value neutral, even if only applied to one sector of a fishery; rather, they embody a prioritization of economic efficiency and safety at sea. Creative policy making, grounded in a co-management approach, may help to weaken dichotomies between efficiency goals in some sectors and other normative priorities, but philosophical objections may remain for some stakeholders.

Criteria for Evaluation

In choosing the impacts to address, and in crafting recommendations for possible mitigation strategies for existing LAPPs and for the design of future LAPPs in mixed-use fisheries, the committee relied on the following criteria:

- *Magnitude*: Is the LAPP impact in question of sufficiently large magnitude as to call for a potential policy response?
- *Certainty*: Is the impact in question sufficiently linked to the LAPP itself, as opposed to other ongoing developments in the fishery or its broader socioecological context, to suggest that LAPP-focused remedies could mitigate the impact?
- *Efficacy*: Are legal or policy approaches available that could effectively mitigate the negative impact and improve the functionality of the LAPP as defined by its social, economic, and ecological objectives?
- *Side effects*: What is the likelihood that the policy “cure” may create significant spillovers or side effects that could substantially undermine the value of the LAPP-based mitigation?
- *Feasibility*: Given the legal framework and policies underlying the LAPP, are the policies to mitigate negative impacts technically, institutionally, and politically feasible?

Recommendations for Existing and Future LAPPs

Part A: Impacts to Recreational Stakeholders

As noted in Chapter 6 there is weak evidence for direct spillovers, either positive or negative, to recreational stakeholders as a result of the establishment of a commercial LAPP in a mixed-use fishery. While several theoretical pathways have been identified by which such spillovers *might* exist, the weight of evidence and structure of causal links between recreational and commercial fishing provide little evidence for direct impacts. There are, however, two possible areas of indirect impact that deserve some consideration from regulators.

Leakage

The implementation of LAPPs in the commercial component of a mixed-use fishery may lead to an indirect shifting of fishing effort out of the commercial sector into the recreational sector through the repurposing of commercial fishing vessels for recreational for-hire fishing. The tendency for this cross-sector “leakage” will depend on the attractiveness of for-hire fishing in terms of its economic return and quality of life characteristics to displaced commercial vessel owners as well as the regulatory barriers to entry in place for the for-hire sector.

In many cases, as in Gulf of Mexico reef fish, limited entry programs block a direct increase in vessel capacity within the for-hire sector from the implementation of a commercial LAPP. However, as noted in Chapter 6, the high value ascribed to landings by some recreational anglers has led to the phenomenon of “catch share experience” trips in which active vessels under the commercial LAPP bring on passengers from the general public that operate as unpaid crew for the trip while paying for the experience through the purchase of the catch from a dealer. These “dude trips” represent a distinct form of leakage, whereby some harvest that would otherwise be destined for commercial markets is instead reallocated toward ostensibly recreational harvesters.

The weight of evidence suggests that catch share experience trips are limited to the Gulf of Mexico reef fish fishery and represent a very small number of trips targeting a limited niche market in a manner that, while perhaps unanticipated by the Council, is legal. Furthermore, it is an open question for policy makers as to whether this form of quasi-recreational fishing within a commercial LAPP should be encouraged or not. Nevertheless, the committee provides the following recommendations to enhance the Councils’ capacity to monitor and control cross-sector leakage in existing LAPPs in mixed-use fisheries:

Recommendation A-1: The Councils should review the policies regarding entry into the for-hire sector for potential loopholes that would allow expanded capacity in the for-hire sector and revise the policies accordingly. This should be done for fisheries directly linked through a LAPP in a mixed-use fishery as well as those in other fisheries that may provide a viable source of alternative employment for displaced commercial fishers and their vessels.

Depending on whether the for-hire sector is considered fully capitalized, these loopholes may need to be closed. Note that a lack of evidence of current leakage is not sufficient to rule out future issues; negative shocks to the commercial sector (due to total allowable catch reductions or shocks to output prices or costs) or growth in demand in the recreational sector may expose previously unseen vulnerabilities.

Recommendation A-2: The Councils should closely monitor the evidence for the establishment and growth of “catch share experience” and similar quasi-recreational trips occurring under the structure of commercial LAPPs. In cases where these trips are already well established (e.g., the Gulf of Mexico reef fish fishery), the Councils should develop regularized reporting programs for monitoring the extent and characteristics of these trips.

Allocation

As detailed in Chapter 6, the allocation of landings between recreational and commercial sectors is often the largest source of contention between recreational and commercial fishers. Conflict over allocations is common in mixed-use fisheries, regardless of the presence of LAPPs. Nevertheless, the creation of a LAPP in the commercial component has the potential to alter the terms of this conflict, through the creation of a class of shareholders whose ability to organize potentially alters the political economy of allocation decision making in ways that may be consequential to allocation outcomes as well as the contentiousness of the policy process.

As previously noted, the creation of a commercial LAPP often creates a well-defined group of owners with a stake in maintaining, and potentially expanding, the commercial fleet's share of the overall harvest. While it is unclear that these changes represent an unfair balance in power between the sectors—as recreational stakeholders are often over represented in the Council process by national and regional interest groups—they may nevertheless create inertia in any reallocation of harvest from commercial fishers to recreational anglers. It is also important to consider how these shifts in political power affect customary, subsistence, and other underrepresented groups of fishers who are often not well represented in decision-making processes.

Conflict may also be exacerbated by the simultaneous existence of a LAPP on the commercial side of the fishery along with regulated open access management in the recreational component of the fishery. Efficiency gains from commercial LAPPs will tend to raise the value of additional allocation within the commercial sector. Therefore, any perceived erosion of the commercial allocation due to the inability of regulators to contain recreational anglers' harvest to their formal allocation using bag limits and seasonal closures (see Figure 6.1) may lead to calls from commercial fishers to more tightly regulate the “unaccountable” recreational sector. At the same time, recreational anglers, accustomed to pre-LAPP commercial seasons under “derby” conditions that are roughly similar to their own recreational seasons, may react unfavorably to the much longer commercial seasons that follow the LAPP—calling for increases in allocation and other reforms in the hope of extending fishing opportunities for recreational anglers. This has been especially prominent in the Gulf of Mexico red snapper fishery, which saw its recreational seasons fall to weeks or days, despite a consistent allocation of harvest, even as commercial fishers under the LAPP extended their season over months (see Figure 6.2).

The Councils charged with the governance of LAPPs in mixed-use fisheries have primarily addressed calls for reallocation through the development of procedural and evaluative criteria to apply in the case of reallocation (Gulf of Mexico Fishery Management Council, n.d.) and significant input from recreational and commercial stakeholders through *ad hoc* plan team panels and similar co-management structures. This process has often drawn heavily on principles of economic efficiency (Agar and Carter, 2014; Agar et al., 2014; Plummer et al., 2012). However, as mandated by the MSA, the Councils may not allocate based on economic principles alone, with considerable weight being given to “fair and equitable” allocations (Gulf of Mexico Fishery Management Council, n.d.).

While these steps have fostered greater transparency and stakeholder involvement, the zero-sum nature of regulatory reallocation has created a situation where one sector's gain is perceived as another's loss—so that agreement on what is “fair and equitable” is highly unlikely. Furthermore, the open access nature of recreational fisheries means that there is not a well-defined group that can legitimately represent anglers' interests (although a number of prominent recreationally oriented advocacy organizations exist). Taken together, these measures make reallocation extremely difficult. Indeed, only one major reallocation between commercial and recreational sectors for a LAPP in a mixed-use fishery in this study has occurred subsequent to the implementation of the commercial LAPP. In this case 2.5% of the allocation of Gulf red snapper was transferred from the commercial sector to the recreational sector. However, the reallocation was based on data suggesting that previous methods of measuring recreational harvest had underestimated recreational harvest (and hence stock productivity)—so that this “reallocation” merely formalized the longstanding *de facto* division of harvest between the sectors as opposed to the formal process of allocation

(Gulf of Mexico Fishery Management Council, 2015). In other words, the reallocation decision, while ostensibly altering the formal division of harvest, enshrined the status quo.

Given these difficulties, the committee recommends that the Councils investigate policies that shift the emphasis away from the zero-sum game of uncompensated reallocation between sectors to one that allows for the possibility of mutual benefit, either through negotiation between appropriate representatives of each sector or by compensated transfer of allocation between individuals or groups in each sector. Indeed, the Gulf of Mexico Fishery Management Council currently lists “negotiation-based allocation” and quota purchases between commercial and recreational sectors as suggested methods for reallocation (Gulf of Mexico Fishery Management Council, n.d.). However, the primary impediment to such an approach is the open access nature of the recreational fishing sector (although access may be limited for for-hire vessels). Therefore, whereas owners of quota share under a commercial LAPP are individually accountable for covering their harvest with quota share, individual anglers cannot acquire or dispose of harvest rights, since all such rights are subject to claim by right of capture. Furthermore, any group that purports to represent anglers cannot do so in a way that is binding on individual anglers’ decision making.

One way to resolve this conundrum is to explicitly allocate recreational quota to one or more nongovernmental entities while also devolving some management rights to these groups. In particular, each entity must determine rules of access and implement accountability measures to remain within its allocation. This concept has been advanced in the literature in the form of an angler management organization (AMO) (Sutinen and Johnston, 2003) and has features in common with the sectoral management program for New England groundfish (e.g., Holland et al., 2013). Under Sutinen and Johnston’s (2003) formulation, AMOs are formed as for-profit organizations with shareholders, who may directly participate in the governance of the AMO or delegate this governance to officers and a board as in a corporation. Importantly, shareholding in the AMO is distinct from the holding of harvest quota itself. The managers of an AMO can then devise rules, subject to Council approval, that are satisfactory to angler “customers” and that maximize the value of the AMO to its shareholders—essentially identifying goals and objectives for the recreational sector—while maintaining harvest within the AMO’s allocation. Critically, while the AMO itself receives its allocation as a revocable and transferable privilege (as commercial fishers receive under a LAPP), individual AMOs need not devolve these rights to individual anglers as in a recreational LAPP. Instead, AMO managers may select from a wide array of approaches to allocate catch among anglers in an accountable manner—from conventional bag limits to incentive-based approaches such as harvest tags.

AMOs may be defined geographically. For example, given the adoption of state-based management for red snapper in the Gulf of Mexico, individual states could create one or more AMOs to govern recreational fishing in their state waters or appurtenant federal waters. This approach could allow for customization of management to reflect the local context and allow for policy experimentation. Importantly, AMOs would have the ability to transfer their annual allocation to other AMOs or even to commercial fishers as well as purchase or lease quota from the commercial sector. This right of transferability, bundled with the management rights and responsibilities, provides the mechanism for allocations to be resolved through negotiated contracts or arms-length transactions rather than via regulation.

AMOs would represent a major transformation of the governance of recreational fisheries. Given the lack of real-world applications of this management concept, innumerable questions remain concerning how to best design AMOs to ensure compliance with harvest limits, provide high-quality fishing opportunities to anglers, and facilitate compensated reallocation between sectors. One possible modification to Sutinen and Johnston’s (2003) original formulation would be to limit shareholder status in the AMO to anglers that remain bona fide participants in the fishery, so that rather than functioning as a for-profit corporation with shareholding and management severed from its customer base, the AMO instead operates as a consumer cooperative, as commonly seen in rural electric cooperatives or food co-ops. This institutional structure may help to align the management of the AMO with the provision of sustained benefits to anglers. It may also provide a mechanism for anglers to collectively invest in habitat enhancement and other public goods as well as provide constructive representation of anglers’ interests at the Council level that might differ from those of the “recreational industry” (Hervás Ávila, 2018). The challenges to be faced by moving toward such a system are analogous to that faced by the imposition of

LAPPs, such as the need to address issues associated with grandfathering that would be inevitable as only bona fide participants would remain. Nevertheless, this proposal represents but one of many potential AMO structures and ways of allocating shareholdership between active anglers and the general public that could be explored and fostered through outreach and engagement. Despite the many unanswered questions about their effects and proper design, AMOs have significant promise to facilitate self-governance within a co-management structure, while also providing the necessary institutional infrastructure to facilitate win-win solutions to allocation problems.

Recommendation A-3: The NMFS, in partnership with the relevant Councils, should conduct research into innovative institutional structures, such as AMOs, to partially devolve management of marine recreational fisheries to anglers and the associated fishing communities, improve accountability of anglers for their harvest, and facilitate mutually agreeable reallocation between the recreational and commercial sectors. Given the significant knowledge gaps and lack of real-world analogs, this research should be broad in focus, consisting both of internal NMFS research leading to the production of technical memoranda as well as external research funded through channels such as the Marine Fisheries Initiative Program or Saltonstall-Kennedy awards with the goal of bringing government and academic scientists together with the angling community for the joint production of actionable knowledge. The Councils, together with NOAA outreach programs, could then begin to communicate to anglers the potential benefits of the new system and any required data collection systems.

The reforms proposed in the previous recommendation will require substantial research and unprecedented levels of cooperation between the Councils and recreational angling stakeholders to successfully implement. In some cases, this cooperation may be infeasible or entail a long and uncertain path forward. Accordingly, there may be a need for the consideration of more incremental policy reforms for the management of the recreational and for-hire sectors to facilitate fishing opportunities, enhance the value of the recreational fishing experience, and facilitate profitable livelihoods for for-hire providers and other members of the recreational fishing community—all while enhancing accountability under regulatorily defined allocations. The charge of this committee is not directly concerned with the management of the recreational component of LAPPs in mixed-use fisheries. Nevertheless, tensions over allocations between the recreational and commercial sectors in a fishery with a LAPP are demonstrably heightened by policies in the recreational sector that undermine angler welfare and unnecessarily constrain fishing opportunities, while also failing to adequately contain recreational fishing mortality (Abbott et al., 2018). Therefore, developing improved policies for the management of the recreational sector can be important to the overall functionality of a LAPP in a mixed-use fishery.

Recommendation A-4: The Councils, or their state partners in the case of “state-based management,” should conduct reviews of their management of both private recreational and for-hire fisheries for species shared under LAPPs in mixed-use fisheries (or proposed LAPPs in mixed-use fisheries) and propose and implement reforms (including, but not limited to, individual fishing quotas [IFQs] or cooperatives for for-hire vessels and harvest tags or day passes for private anglers) that foster accountability while enhancing fishing experiences and opportunities to heterogeneous groups of anglers. To foster comparison between sectors, review guidelines, like those that exist for the commercial sector, should be established for each sector (e.g., including goals, objectives, and measurable outcomes).

These policy changes should be conducted through a process that seeks input and cooperation from the recreational sector and that attempts to capture the spectrum of heterogeneous values (e.g., consumptive versus “catch and release” anglers), modes of access (e.g., private vessel versus for-hire vessel), and patterns

of use (e.g., locals with year-round access versus winter “snowbirds” versus summer vacationers) reflected in the fishery.

Given this heterogeneity, variations in regulatory capacity from setting to setting, and the level of buy-in from recreational fishing stakeholders, the appropriate reforms will likely differ significantly from fishery to fishery. In some cases, relatively modest reforms—such as integration of “now casting” approaches to improve accountability and limit over- and underfishing of quota, or the division of a single derby season into subseasons to facilitate access by heterogeneous anglers—may be all that is feasible. In others, there may be a compelling case for more extensive reforms, such as the implementation of quantity-limited harvest tags (Johnston et al., 2007) or short-term fishing passes (Abbott, 2015) in the private recreational sector. Where supported by the industry and facilitated by the availability of adequate data to support the process of initial allocation, it may be feasible to introduce LAPPs into the for-hire sector, as was done successfully for red snapper and gag on an experimental basis in the Gulf of Mexico (Abbott and Willard, 2017). Regardless of the particular policies that are adopted, the most important aspect of the committee’s recommendation is to adopt an overall stance to the management of recreational fisheries that acknowledges the heterogeneity of anglers through policies that foster diverse and valuable fishing experiences, while curbing open access incentives that tend to undermine these opportunities (Arlinghaus et al., 2019).

Part B: Impacts to Commercial Participants

The committee’s findings from Chapter 5 on the impacts of LAPPs in mixed-use fisheries on commercial participants demonstrate that these impacts are the same as for LAPPs in non-mixed-use fisheries. Therefore, while the following recommendations do not directly pertain to the mixed-use dimension that forms the unique basis of this study, they are nonetheless pertinent to current and future LAPPs in mixed-use fisheries. As reviewed in Chapter 5, barriers to entry are the most commonly discussed negative social impacts of many LAPPs, and this appears to apply to LAPPs in mixed-use fisheries as much as to others. A major issue is the failure to recognize crew and hired captain contributions to production in determining initial allocation. A related concern is the desire to have a program in which fishers can work their way up (from crew to captain to vessel owner) within the fishery without having to accumulate a large financial investment. Intergenerational equity is another: when initial allocations are handled as windfalls to the current generation, the second generation has a much higher cost of entry, and the generational turnover in fishing that once was commonplace may be delayed under LAPPs.

To address these concerns, mechanisms are needed that facilitate entry into, and upward mobility within, LAPP fisheries without excessively undermining potentially conflicting goals of reducing overcapitalization and enhancing profitability. These would allow for new entrants who are already engaged in the fishery itself but who did not experience the windfall gain of initial allocation. Most attention has been given to subsidized loan programs. The committee’s recommendation focuses on existing participants in the fisheries who did not participate in the initial allocation. While subsidized loan programs can help facilitate new entrants, or help disenfranchised existing participants, the benefits of this intervention need to be weighed against the negative effects of subsidizing fisheries, including counterbalancing the global push toward reducing capacity overall (Smith, 2019). The committee also notes support in the literature for nonmarket mechanisms such as student licenses and apprenticeship programs to help facilitate entry (Cullenberg et al., 2017; Eythórsson, 2016).

A variety of methods to counter inequities from initial allocation and subsequent transfers are available if not addressed through the initial appeals process. One is to consider a redistribution of shares, either retroactively or based on future trading activity, and either by “use-it or lose-it” or “lease-to-own” provisions; these options were discussed by Ropicki et al. (2018) for red snapper. Retroactive redistributions would be criticized as unjust and counter to the benefits that leasing was intended to address, namely, improving efficiency and reducing discards. Future redistributions, on the other hand, could allow time for planning if a control date were set into the future but success would depend on forfeiture rates. Given that the goal of the LAPP was to address overcapacity and derby fishing, most fundamentally, these

policies would change ownership but would likely not affect fishing effort; the goals of the program would have to be modified to implement such a change. An additional challenge is that a substantial number of current participants depend on the allocation market. If the goal is to increase owner-fishers then those benefiting from the flexibility of the allocation market could be adversely affected by the smaller market for, and availability of, allocation, which could drive up price. This is but one example of the indirect effects that could occur through the markets in the red snapper LAPP (Ropicki et al., 2018). In sum, whether one owns shares or a reef fish permit, one fishes, one leases, or one is a dealer—and to what extent—should be considered with respect to changing the structure of the program; no change is going to benefit everyone, or even everyone of a particular participant type of which there are at least six in this fishery (i.e., investor, investor fisher, share fisher, supplementer, allocation-dependent fisher, or allocation broker; Ropicki et al., 2018).

Another concern about LAPPs is the rise of a class of share owners who do not fish even though the initial allocation was granted to fishing vessel owners. They are sometimes called “investors,” “sea lords,” or “armchair captains” by those critical of the wealth they accumulate and their alleged power to affect share and lease prices, and/or by those who believe that shares should only go to those working in the fishery, a widespread notion in the moral economy of fisheries. Initial allocation issues aside, in an established quota share program the size of this subsector in the commercial fishery will increase (*ceteris paribus*) simply due to retirement. Whether it is unacceptable to the public or others in the fishery that retired fishers—or others who simply invest in the quota shares—remain in the LAPP as nonfishers who profit off the fishery is a key issue for management Councils to consider. If aging shareholders can continue to reap the benefits of a well-managed fishery, perhaps even one that they had helped develop through resources of their own, is it in the best interest of a fishery to remove the participant? If so, what message will that send to those currently involved? Proposed changes to current LAPP regulations should be evaluated with a view of (1) how current participants will rationally and legally circumvent them, (2) potential spillover impacts that may undermine stated goals (Ropicki et al., 2018), and (3) whether a perception that policy makers will keep shifting the goalposts undermines the quota security and cooperative spirit of LAPP regimes; moreover, the nonfishing shareholders provide fluid lease markets, making more fishing opportunities available to more people compared to their experience pre-LAPP. Their experiences are not so far removed from “the fishery,” and they continue as active participants in management planning. Some communities may view this arrangement as preferable to one with limited entry and even steeper barriers to entry.

It is important that new LAPPs in mixed-use fisheries address perceived inequities in the initial allocation of quota shares, which lead to perceptions of unfairness from all sectors in the fishery. Grandfathered allocations preserve and retain traditional and historical participation but can create windfall gains for initial claimants, which may or may not be justifiable. However, the distribution of these gains between existing stakeholder groups and the public (via auction or rent recovery measures) should be broadly viewed as to whether they are procedurally just and defensible in terms of their consequences. Allocating quota solely to owners of vessels with fishing history may ignore longstanding contributions from captains and crew who have also contributed to the development and productive utilization of a fishery and that have shared as “co-venturers” in the financial risk of doing so given that many fishery workers are paid under a share system. Broadening allocations to include captain and crew may decouple the link between quota and vessels that is important if overcapitalization is an issue, and may complicate the measure of effort that is tied to the stock assessments, but may be warranted in these situations. However, doing so will likely require substantial changes to data collection (i.e., crew permit registries and vessel-level reporting on crew) to facilitate allocations. An increased focus on equity is consistent with national and international commitments, including the Food and Agriculture Organization (FAO) of the United Nations’ Small Scale Fishery Guidelines, which state: “States should where appropriate grant preferential access of small-scale fisheries to fish in waters under national jurisdiction, with a view to achieving equitable outcomes for different groups of people, in particular vulnerable groups” (FAO, 2015).

Recommendation B-1: The Councils and the NMFS, in planning new LAPPs in mixed-use fisheries, should develop a broad range of options for the initial allocation of quota, including but going beyond the practice of limiting eligibility to existing vessel owners or permit holders with historic records (especially if overcapitalization is not a goal and shares are to be given for free). Where available, data on the contributions of hired captains and crew to the historic performance of vessels should be collected and used to assess the potential of awarding shares to them as well as vessel owners. If such data are not available, the Councils should consider delaying the creation of a LAPP for a limited time to conduct a rapid assessment of crew contributions and preferences that would inform initial allocations.

In a mixed-use fishery, it may also be deemed appropriate to maintain data on for-hire captains and crew members in case there is movement toward individual allocations in the for-hire sector. Such changes should occur soon so that they are in place when new LAPPs arrive. Finally, the potential consequences of broadening the base for allocations to help foster program designs that mitigate negative unintended consequences is needed.

Recommendation B-2: The Councils should set aside a portion of the total quota shares for new entrants or assess a fee (on the transfer or lease of shares or allocation, 2-5%, for example) that could be reallocated.

This recommendation may be feasible for existing LAPPs but is especially important to consider up front for future LAPPs because of difficulty making changes such as this once the program has begun. There are a number of ways to configure such a program. One possibility is to allow crew and hired captain work experience (i.e., hours fishing) to accumulate toward thresholds that vest into quota shares over time. Such a mechanism is unusual in a market economy, but LAPPs are assigning public trust resources to private entities, albeit nonpermanently. Such a program would simply share the resource with a larger segment of the population. Because LAPPs are by statute considered nonpermanent, carving out this setaside from existing shares would be possible.

Recommendation B-3: The Councils should consider intergenerational equity at the outset of program consideration and design. Any new LAPP should explicitly address in its design any mechanisms to address objectives related to facilitating entry of second-generation fishers and the potentially undesirable effects of wealth primarily accruing only to the first generation.

Ways to implement Recommendation B-3 are numerous in theory but poorly explored in practice (e.g., formal quota banks with commensurate funding, graduated phase-outs of rights over time, and so on). The key is that these issues must be considered from the start. Otherwise, virtually any adjustment to the program that will meaningfully address these issues will dilute the privileges of incumbents, creating fierce resistance. Most importantly, the consideration of such unfamiliar program elements would need to be supported by sufficient outreach and engagement that addressed needs of fishing-dependent and underserved communities.

Recommendation B-4: Because of perceptions that “investors” or “armchair captains” should not control quota shares, the Councils that consider new LAPPs in mixed-use fisheries, as well as others, should address this question up front, in initial scoping and draft amendment processes, and research whether and how such shareholding would affect the market for quota and its availability to active fishers. To assist the Councils in addressing this question, the NMFS should sponsor a study of the direct and indirect consequences of moving from LAPPs that require holding active fishing permits or other measures of active participation in fishing, to the “public” scope of eligibility to own quota shares. Such a study,

likely focused on the experience of the two Gulf of Mexico LAPPs but informed by other programs, should offer a stronger basis for decision making about eligibility.

Recommendation B-5: The NMFS and the Councils should encourage full transparency of LAPP ownership, transfers, and leasing, making these data publicly accessible and part of the policy process. This effort, which is well under way in most current LAPPs, should include developing the capacity to provide real-time information on trades in order to foster well-functioning markets for quota shares and leasing. This can help achieve social objectives of equity by ensuring fishers are not disadvantaged in the transfer markets. In addition, inefficiencies and inequities caused by incomplete or inaccurate transfer data and uncentralized markets should be examined.

Part C: Impacts to Fishing Communities

Congress specified that LAPPs should take into consideration the needs of fishing communities and small-scale fishing enterprises. This issue of scale of operation received no attention in the LAPP reviews and management documents, possibly because the smaller-scale operations in these regions are thought to be mainly participating in inshore, state water fisheries; however, fishing communities, including some measures of their ties to recreational fishing, are now systematically characterized by the National Oceanic and Atmospheric Administration (NOAA). The place-based notion of fishing community under the MSA is inadequate for understanding the social and community aspects of recreational angling, which usually involves people from highly dispersed places, but it can reflect the importance of marinas, bait and supply shops, restaurants and hotels, and other businesses that depend on and serve the needs of recreational anglers. However, the committee found that the present systems for managing and monitoring LAPPs in these mixed-use fisheries do not allow for assessment of the effects of LAPPs on either small-scale fisheries or fishing communities.

Recommendation C-1: The NMFS and the Councils should develop explicit measures to associate LAPP fishing activity, as well as fishing activities of the for-hire and recreational sectors, with fishing communities represented in the NOAA Social Indicators data, both in the baseline period (pre-LAPP) and in subsequent periods. These measures should capture multiple community connections (e.g., residency, vessel homeport, landings, and support services for recreational and commercial fisheries).

Recommendation C-2: The NMFS and the Councils should create a process for determining what constitutes small-scale fishing in the context of different regions and fisheries and whether they see enough presence in federal fisheries to warrant its inclusion as such in data collection, decision making, and reviews. Scale can be a consideration for recreational as well as commercial fisheries; for example, do the policies and practices in the mixed-use fishery favor those with larger or more costly vessels and gear, whether recreational or commercial? Are small-scale fishers who lose out in LAPP allocations likely to move into for-hire or recreational fishing?

Recommendation C-3: In situations where fishing communities are significantly involved with and major components of a fishery where LAPPs are being considered, the provisions in the MSA (16 U.S.C. § 1853a(c)(3)(A)) that allow for assignment of quota shares to fishing communities, as well as regional fishery associations, should be included as among alternatives being considered by the Councils. These provisions appear to apply only to commercial fisheries. The recommendation for AMOs in the recreational section above better captures the reality of the recreational sectors in mixed-use fisheries, where participants are often highly dispersed.

Potential inequities in distributional consequences in terms of ethnicity, race, and socioeconomic class are largely invisible in current fisheries management programs. In the committee's review, the lack of information about different social groups who participate in these fisheries (e.g., socioeconomic class, ethnicity, race, and education) was a serious barrier to assessing social impacts. This is due in part to lack of record-keeping on the matter and difficulty collecting personal information in a voluntary survey. The visibility problem also may be the consequence of longer-term processes that have made participation in commercial and for-hire fisheries difficult for members of minority groups. We found no information on LAPPs for mixed-use fisheries that would allow assessment of the degree to which the LAPPs have systematized the exclusion of minority population participation in these programs. Indeed, as the 2021 Executive Order on Racial Equity (White House, 2021) states: "many Federal datasets are not disaggregated by race, ethnicity, gender, disability, income, veteran status, or other key demographic variables. This lack of data has cascading effects and impedes efforts to measure and advance equity."

Recommendation C-4: The NMFS should make implementing the human dimensions section of the NOAA Fisheries research strategy for 2021-2025 (NOAA Fisheries, 2021) a high priority.

The human dimensions section of the NOAA Fisheries research strategy discusses the importance and need to "describe and understand diverse communities and to respond to environmental justice goals and mandates" and "examine diversity and address inequalities in community impacts [and] management outcomes" (e.g., Executive Order 12898).

Part D: Recommendations for Data Collection and Future Research

The committee's analysis of possible ways that LAPPs might affect the ecological status of mixed-use fisheries hypothesized that some LAPPs, depending on circumstances of fisheries that are interconnected, might induce additional concern regarding the adherence to allocations and other conservation requirements in other sectors targeting the same species or other species in mixed-species aggregations. The committee termed this process "serial conservation" (as opposed to the well-known "serial depletion" of stocks), or a process whereby improvement in conservation in one sector can affect improved conservation in other sectors and/or overall.

Recommendation D-1: The concept of "serial conservation" in mixed-use fisheries should be explored in more detail through partnerships of federal, academic, and state agency scientists, supported through funding initiatives at the federal or regional level. Under what conditions and through what mechanisms might LAPPs create leverage for improvements in rates of bycatch and discards and keeping within fishing mortality rate targets for complexes of stocks? To the extent that LAPPs result in elimination of overfishing and stocks are no longer overfished, will there be more resiliency in the overall ecological system that benefits all sectors?

The committee's analysis of LAPPs in mixed-use fisheries has made it abundantly clear that most programs have been implemented without sufficient investments in the data required to adequately assess their social, economic, and ecological impacts on all sectors.

Recommendation D-2: For fisheries where LAPPs may be contemplated, the Councils and the NMFS should establish longitudinal data collection protocols for additional economic and social information, including pre-implementation baselines. These protocols should collect ongoing and, where possible, retrospective data prior to LAPP implementation and continue thereafter, with minimal disruptions to the survey protocols. At a minimum these data collection efforts should focus on social and economic data at the vessel level (e.g., revenues, input use, costs, ownership, community affiliation), including detailed demographic and

economic data on crew, captains, vessel owners, and shareholders. Possible models are the Bering Sea and Aleutian Islands crab rationalization program and the data collection efforts of the Northwest Region for groundfish rationalization. These data collection efforts would ideally branch out beyond surveying only capital owners, but also regularly survey other immediate fishery stakeholders such as captains and crew (acknowledging difficulties here). These efforts would be complementary to plans to broaden the base of initial allocations. Additionally, all datasets should cross reference each other to facilitate linking by including the appropriate identifiers.

Assessment of ongoing LAPPs is made difficult both by the lack of pre-post data for most LAPPs as well as any ability to compare their trends with those of non-LAPP fisheries.

Recommendation D-3: The Councils should collectively institute a baseline level of longitudinal economic and social data reporting for *all* major fisheries in order to facilitate the comparative and causal analysis of policy changes or natural shocks in one fishery.

In going through the five LAPP reviews done by the Councils (see Chapter 3), the committee found the need for improvements that would help in future reviews of existing LAPPs but also in designing future LAPPs. In most cases the program reviews found little empirical evidence that would enable evaluating social and community aspects of the programs, reflecting the underdevelopment of data collection for social impact analysis, a problem already discussed in this report. Beyond that, the committee observed the need in program design to have quantitative targets for specific major objectives, and clearer definition of what is meant and the appropriate metrics in objectives such as “viability” or “overcapitalization.” In addition, and building on the committee’s discussion in Chapter 1 about the problem of assigning causation, the program reviews should be encouraged to include counterfactuals and the impacts of concurrent and confounding events.

Recommendation D-4: The NMFS and the Councils should reexamine the guidelines for LAPP review (including minimum data requirements for analysis) and expand their scope in light of the efforts of this committee to use them as sources of information about the social, economic, and biological effects of LAPPs in general and in mixed-use fisheries. Future reviews of LAPPs in mixed-use fisheries should examine their relationships to other sectors of the fisheries, and their goals and objectives, and be informed by the efforts of this committee to hypothesize and in some instances substantiate interactions and side effects.

A number of community impacts of LAPPs are documented in ethnographic studies, but the committee found little information about the recreational fisheries at the community level. The above recommendation may help. In addition, there is little corroboration of ethnographic findings from other research approaches, perhaps due to a lack of data.

A finding in Chapter 7, based on the committee’s exploratory analysis of NOAA Social Indicators data, was that LAPPs had no statistically significant effect on a measure of labor in the Gulf of Mexico grouper fishery. Though not statistically significant, the results highlighted possible ways that these data could be used and enhanced in future analysis.

Recommendation D-5: The NMFS and the Councils should conduct more thorough analysis of the NOAA Social Indicators for Coastal Communities (SICC) data to explore whether they can provide information about causal effects of LAPPs on communities. The committee recommends three specific steps: (1) refine the geographical definitions of treated and control units to more carefully match communities affected by LAPPs with ones that are similar but unaffected, (2) conduct more analyses to explore other indicators and other ways of exploiting natural policy experiments in the SICC, and (3) test the efficacy of quasi-experimental analysis of the SICC data by examining effects of hurricanes or other shocks with well-known

geographic specificity for consistency with well-understood effects of social and economic disruption. If not, they should expand the data collected to allow for such analysis.

Changes to within-sector distribution of quota shares that allow crew or hired captains to vest into share ownership (as discussed above in Recommendation B-2) would require new tracking of fishery participants. At the same time, one of the major gaps in understanding of LAPPs in mixed-use fisheries is the diversity of fishery participants. There are no comprehensive data available on captains and crew who are not also permit holders. Given the rising importance of mixed-use fisheries, this data gap is pertinent to the for-hire recreational fishing crew as well.

Recommendation D-6: The NMFS and the Councils should develop ways to expand captain and crew data collection such that it can comprehensively track people participating in federal fisheries. Such a system could facilitate ways to address concerns about fairness in quota share distributions as well as contribute to a richer understanding of social, economic, and community impacts of LAPPs and other sectors of mixed-use fisheries. It could also potentially discourage hiring crew off the books and enhance fairness for fishers who do not engage in that practice, especially if tied to the ability to vest into quota.

Some stakeholders express concerns about LAPPs creating new roles in the commercial fishery such as quota brokers. Others suggest that brokers are needed to make trades and for the quota program to function effectively. It may be possible to improve the functionality of quota markets in ways that are complementary to the presence of brokers through greater data transparency. Currently, quota trades are not easily available to fishery participants.

Recommendation D-7: The NMFS and the Councils should make quota share and allocation data more transparent, comprehensive, and widely available, and encourage data presentation and analysis on these dimensions so they can inform the policy formation processes. Such activities would also serve to show that accurate and complete data reporting is critical as it can also help potential buyers and sellers make transaction decisions.

Reducing tensions between the recreational and commercial components of a fishery with a LAPP requires that ample consideration be given to the policies that allocate fish and fishing opportunities across anglers within the recreational sector (see Recommendation B-4), to ensure that these policies serve the needs of heterogeneous anglers and for-hire providers to foster high-value fishing opportunities. However, data and research to inform managers of important dimensions of angler preferences and angler heterogeneity in preferences and decision constraints (e.g., modes of access, seasonality of demand, etc.) are frequently limited for most saltwater species (NRC, 2006). Recurrent survey products (e.g., the Marine Recreational Information Program) are limited in their ability to provide these data across geographies and species, as well as by their primary focus on quantifying fishing effort and harvest.

Recommendation D-8: The NMFS and the Councils should develop prioritized, targeted human dimensions recreational data as well as commercial and for-hire data collection programs for species or species complexes of particular interest either due to ongoing or anticipated allocation tensions between sectors in existing LAPPs in mixed-use fisheries or in anticipation of new LAPPs in mixed-use fisheries.

Recommendation D-9: Congress and the administration should fully fund data collection and analysis programs consistent with the priorities identified above.

These efforts should build on well-established survey approaches in recreational demand modeling, but should expand beyond the often narrow focus of most studies on recovering preferences for marginal adaptations to current policies. Rather, these studies should seek to recover anglers' preferences for (and

likely behavior under) a broader suite of policy-influenced attributes of fishing opportunities and novel policy tools. These quantitative data should be supplemented by complementary efforts to gather qualitative social science data from anglers through ethnographic interviews or surveys. Participatory research approaches (e.g., focus groups) in cooperation with recreational fishing stakeholder groups would be critical at an early stage in these research efforts to help design more effective survey instruments and to ensure that the research is viewed as valid and of value to recreational stakeholders. Moreover, such an effort can be a step toward a more integrated approach to understanding and managing mixed-use fisheries insofar as it may allow for comparison among the recreational, for-hire, and commercial sectors, at least at the level of qualitative data on social, economic, and community dimensions.

A note of caution: trying to design in a myriad of policy constraints on LAPPs to address legitimate social concerns may limit their ability to address what turn out to be even greater economic and social issues stemming from problems like climate change. The existence of IFQs combined with greater transparency of quota trades and data may facilitate the development of other financial instruments. For example, in agricultural markets, futures and options are important for hedging risk. These instruments are not currently available to fishers but could be available if quota markets functioned sufficiently well.

Part E: Recommendation for Interdisciplinary Impact Assessment

A large part of the committee's task centered on economic and social issues for which data were not always adequate and available but were also of different kinds, leading to challenges in assessing which qualified as evidence and how to weigh differences in the report. Expecting that efforts to evaluate LAPPs and other policies in mixed-use fisheries will continue, the committee offers a recommendation about future interdisciplinary impact assessments done or commissioned by the NMFS and the Councils.

A significant challenge is integrating types of data that are based on distinct, discipline-driven methodologies and theories. Important to the development of effective impact analyses is the ability to integrate qualitative, interview-based data with datasets like the SICCR, and to integrate stakeholder perceptions of economic phenomena revealed in interviews or surveys with quantitative economic data. The quantitative data may not capture all of the nuance available in qualitative data, but the qualitative data may lack features such as representativeness. Finding ways to integrate qualitative and quantitative data more effectively could lead to new insights and inform new hypotheses. That is, there are potentially substantial gains in understanding from cross-fertilization among disciplinary fields, particularly if done with knowledge and respect for differences, and similarities, in how knowledge is created and the criteria for plausibility (e.g., Moon et al., 2021). More generally, all researchers can benefit from clearer appreciation of the epistemological differences across disciplines, which is essential for interdisciplinary work.

It is important to find ways to compare and integrate social and economic analyses, without questioning the importance of both. For example, some stakeholders assert that LAPPs create large entities that effectively control access to the fishery through market power. However, for the mixed-use fisheries in this study, objective measures of market concentration such as the Herfindahl-Hirschman index suggest that these perceptions are at odds with economic reality. This divergence has at least two important implications. First, a policy response to curtail market power is not warranted. Second, divergent perceptions raise the question of why these views are being expressed. Are stakeholders simply uninformed? Are these views deliberate attempts to influence the political process in regulating the fishery or securing more access to the resource? Or are these views expressive of frustration tied to concerns about access, power relations, and policy? While all three factors could be at play, crafting an appropriate policy response (including the possibility of no policy response) requires a richer understanding than either research approach alone can inform, and perhaps a deeper investment in engagement to address.

Accordingly, better integration is needed for future assessments of the economic and social impacts of fisheries policy. For example, Birkenbach et al. (2017) find that LAPPs slow the race to fish on average and in most fisheries analyzed, but there are counterexamples in which fishing sped up. A modeling study provides a potential explanation (Birkenbach et al., 2020), but ethnographic research could shed additional

light on how the LAPP changed fishing behavior and incentives. Similarly, findings of quantitative studies, including difficult-to-explain results, can inform future qualitative data collection to help explain why certain outcomes materialize.

Recommendation E-1: The NMFS and the Councils should encourage interdisciplinarity and better integrate qualitative and quantitative data to generate hypotheses and discern and test policy impacts. These activities and discussions can happen within the multidisciplinary Scientific and Statistical Committees of the regional Councils as well as within the regional science centers of the NMFS.

This recommendation includes ways to assess the use of qualitative data on perceptions and values in social and economic impact analysis. Ideally, these assessments can be conducted in tandem with quantitative approaches like randomized sampling or taking a census of the population. To this end, the Councils and NOAA can expand the social and cultural methodologies used, including cultural models, cultural consensus analysis, and network analysis (e.g., Paolisso, 2007), which can be helpful in assessing the fisheries connectivity and possible spillover effects to other sectors or other fisheries (e.g., Addicott et al., 2018). These are among a range of methods used by the social sciences to assess people's behavior, values, and attitudes in ways that are representative of larger populations and that can be useful for linking qualitative and quantitative fisheries data as shown in a recent NMFS handbook on methods for fisheries social science (Clay and Coburn, 2020). They are among other well-known adjuncts to in-depth interviews, participant observation, social surveys, and social indicators work. However, they have not been routinely applied to social impact assessments within the NMFS. Ultimately, a stronger commitment of NOAA and the Councils to interdisciplinarity and a broader set of social science data collection and research approaches will strengthen the representation of human dimensions in integrated and ecosystem-based fisheries assessments (Szymkowiak, 2021), as well as more limited assessments such as the effects of a LAPP in a mixed-use fishery.

Conclusions

The committee's task of studying LAPPs in mixed-use fisheries led to a series of recommendations for existing and future cases, mindful of the potentials to meet the goals of economic efficiency, social equity, and biological sustainability but also the realities of significant trade-offs that may be required. The federal fisheries management system is realized in large part through collaborations among regional science centers, regional and national offices, and the regional fishery management councils, with the oversight of the Secretary of Commerce. It has evolved since its inception in the late 1970s toward a far more balanced system that recognizes the importance of human behavior and institutions in fisheries. Fisheries management does not manage fish; it manages people, on behalf of the fish, which in turn gain value through people. To that end, efforts have been made by NOAA and the Councils to collect and incorporate analyses of economic and social data pertinent to management decisions. Our recommendations thus build on strong foundations that, if properly funded and appropriately modified, can contribute to an even stronger and more effective representation of human dimensions in the management enterprise.

Our appraisal of the place of LAPPs in mixed-use fisheries is constrained by the scarcity of seminal data and studies that would enable a clearer picture of how the commercial, for-hire, and recreational fisheries for particular species or species complexes interact. The existence of LAPPs in the mixed-use fisheries in the Gulf of Mexico and the Atlantic coasts is new, really only begun in the mid-2000s (discounting wreckfish, which can be argued as a specialized, totally commercial component of the larger, mixed-use reef fish fisheries of the South Atlantic). Moreover, beyond LAPPs, research on mixed-use fisheries as such appears to be limited to analyses done for purposes of allocating allowable catches among the sectors with little attention to other possible relationships.

The general question of this study is how a LAPP affects a mixed-use fishery. The committee's finding is that there is weak, if any, evidence for direct relationships between commercial fishing with IFQs

and the recreational fisheries, which are open access and managed under overall nonbinding quotas. The committee considered indirect impacts and raised the possibility of cross-sector movement of fishers displaced from a LAPP into the for-hire sector, but no data are available on the matter.

Not surprisingly, allocation between sectors—and conflict over reallocation—emerges as the one clear relationship among the sectors in this study, but even there, the committee can only hypothesize the effects the LAPPs might have had on allocation decisions in any of the cases of the study. The committee's conjecture, based largely on comments from stakeholder and expert participants in meetings and committee members' observations of the workings of fishery management councils and similar groups, is that a major feature of LAPPs within a mixed-use fishery is political. Such a program, quasi-privatizing the right to capture a portion of an annual quota, creates a clearly defined group of stakeholders who hold a newly valuable asset. They are thus motivated and equipped to form an interest group, even a formal association, to represent their interests. In some circumstances, this can counteract other well-organized interest groups which are found representing recreational anglers in regions where recreational fishing is important, as well as environmental nongovernmental organizations. It can have other effects, too, where the shareholders contribute more support for industry-run or cooperative research leading to improved stock assessment or other biological goals, become more fully engaged in co-management with the Councils, or work together to improve markets. These are only conjectures for the cases of this study; as committees such as this are often forced by the evidence to say, much more research needs to be done.

The committee felt, nonetheless, that the challenge of coming up with fair and equitable reallocations across sectors is important, but noted that the zero-sum nature of allocation decisions to the relevant sectors, and the challenges of ensuring sufficient accountability in the presence of open access incentives in the recreational sector make top-down allocation through decisions by the Councils inherently fraught and politically contentious. The committee therefore recommends that the NMFS and the Councils more thoroughly investigate institutional innovations such as co-managed "angler management organizations," which provide a platform for representing the interests of recreational anglers in facilitating negotiated transfers of harvest quota between recreational and commercial sectors, while devolving management in a manner that facilitates anglers' investment in their own governance and ensuring accountable harvest within the allocation. Finding ways to devolve management to better customize it to regional and user-group features, facilitate reallocation when situations measurably change, and, above all, improve accountability are worthwhile goals for all participants in a mixed-use fishery.

Even if sweeping co-management reforms, such as AMOs, are not deemed feasible or desirable, the committee nevertheless recommends that the NMFS and the Councils, and the state agencies with which they cooperate, reassess the management of the recreational component of LAPPs in mixed-use fisheries to ensure that anglers and for-hire vessels are held accountable within their allocations and that angling opportunities are allocated in an equitable manner that enhances the welfare of heterogeneous anglers. Tensions over allocations between the recreational and commercial sectors in a fishery with a LAPP are exacerbated by policies in the recreational sector that leave anglers collectively (if not individually) unaccountable for their harvest while undermining angler welfare and unnecessarily constraining fishing opportunities. Therefore, developing improved policies for the management of the recreational sector can be important to the long-run functionality of a LAPP in a mixed-use fishery.

The committee was also tasked with evaluating the ecological, economic, and social impacts of LAPPs on the commercial sector itself. Central to the committee's recommendations is the importance of explicit and transparent consideration of trade-offs, particularly with respect to economic objectives of efficiency and their potential collision with objectives pertaining to fairness, distributional and procedural justice, and social justice. The committee issued several recommendations for ways the social objectives could be explicitly prioritized in the initial design of new LAPPs as well as furthered within the confines of existing LAPP structures. These included proposals to broaden the base for initial allocation to embrace bona fide captains and crew, policies to address perceived inequities in quota access and rent distribution in existing LAPP programs, and the development of methods to mitigate cross-generational distributional impacts. However, the analysis also revealed a number of fundamental informational gaps that hamper the Councils' ability to seriously grapple with social and economic trade-offs and that make evidence-based

approaches to addressing these trade-offs challenging. The committee's recommendations identify these missing data and provide suggestions for how these gaps may be remedied.

Social justice and distributional issues loom large in formal and informal deliberations and much of the literature about LAPPs. The committee tried to assess claims about inequity and unfairness of the various design features of LAPPs and about allocative aspects of mixed-use fisheries in ways that respect and value the sentiments of people interviewed in social research. At the same time, the committee aimed to seek and properly interpret quantitative data that may or may not support those views. This was a genuinely interdisciplinary endeavor, and the committee urges the NMFS and the Councils to take seriously the recommendation to find ways to better link, and where possible integrate, social and economic research methods. This is particularly important where the programs being designed and evaluated have multiple, disparate, and potentially conflicting goals. LAPPs are exemplary but not unique cases.

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Appendix

Committee Biographies

Bonnie J. McCay (NAS) (*Chair*) is a Distinguished Professor Emerita from Rutgers University in New Brunswick, New Jersey. Dr. McCay earned a Ph.D. from Columbia University in ecological anthropology. Her expertise is in the cultural anthropology of coastal fishing communities and mariner fisheries; interplay of law, culture, and environmental change; roles of cooperatives in fisheries businesses; history and socio-economic dimensions of Limited Access Privilege Programs and other forms of quasi-privatization in marine fisheries; and adaptations to climate change in fisheries. She is a member of the National Academy of Sciences and has served on numerous National Research Council committees, including the Committee on Ecosystem Management and Sustaining Marine Fisheries and the Committee to Review Individual Fishing Quotas.

Joshua K. Abbott is an Associate Professor of environmental and resource economics in the School of Sustainability at Arizona State University in Tempe, Arizona. Dr. Abbott earned an M.A. in economics from the University of Washington and a Ph.D. in agricultural and resource economics from the University of California, Davis. His expertise is in resource economics, including the management of commercial and recreational fisheries.

Lee G. Anderson is the Maxwell P. and Mildred H. Harrington Professor Emeritus of Marine Studies and Economics at the University of Delaware. He earned a Ph.D. in economics from the University of Washington in 1970. Dr. Anderson has written or edited 6 books and more than 60 scientific papers on fisheries economics and the economics of fisheries management. He is a past member of the Ocean Studies Board of the National Academies, and the Executive Board of the Law of the Sea Institute past member and past chairman of the Mid-Atlantic Fishery Management Council, and past Board Member and President of the International Institute of Fisheries Economics and Trade and the North American Association of Fisheries Economics. He has acted in an advisory capacity to National Marine Fisheries Service, and other Fishery Management Councils, the Atlantic States Marine Fisheries Commission, the U.S. Department of State, the Great Lakes Fishery Commission, the U.S. General Accounting Office, the National Academy of Sciences, the World Bank, the Food and Agriculture Organization of the United Nations, the European Union, and the governments of New Zealand, Australia, Oman, Morocco, and Chile with respect to fisheries management and development. He has also received grants from the National Science Foundation, the Sea Grant, the National Marine Fisheries Service, the Food and Agriculture Organization of the United Nations, the United States Agency for International Development, and the Inter-American Development Bank. In 1993 he was awarded the University of Miami Rosenstiel Award for Contribution to Ocean Science for his theoretical and applied work on individual transferable quotas. In 2014, he was made a Fellow of the International Institute of Fisheries Economics and Trade.

Courtney Carothers is a Professor of fisheries at the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks. Dr. Carothers earned her Ph.D. in environmental anthropology from the University of Washington. Her research explores the social and cultural dimensions of fishery and environmental systems, especially in the context of enclosure and privatization processes.

James H. Cowan, Jr., is a Full Professor at the Louisiana State University (LSU) in the Department of Oceanography and Coastal Sciences, the E.I. Abraham Distinguished Professor in Louisiana Environmental Studies, and the Director of Fisheries Science and Assessment Graduate Certificate Program. Dr. Cowan

obtained both a Ph.D. (marine science), and a master's degree (experimental statistics) while at LSU. He previously served on the 1999 Committee to Review Individual Fishing Quotas and the 2006 Committee on Ecosystem Effects of Fishing: Phase II—Assessments of the Extent of Ecosystem Change and the Implications for Policy. He has published more than 150 papers in the academic literature and is member of the American Fisheries Society, having served in multiple leadership positions for the organization. His professional interests include fisheries ecology, estuary-offshore coupling and predation, experimental statistics and design, biometrics, and natural and artificial reefs in the Gulf of Mexico.

Josh Eagle is the Solomon Blatt Professor of Law and the Director of the Coastal Law Field Lab at the University of South Carolina. He is a graduate of Johns Hopkins University (B.A., humanities), Colorado State University (M.S., forest sciences), and Georgetown University (J.D.), and he began his legal career at the U.S. Department of Justice. Professor Eagle has published on a wide range of topics, including coastal land use, fisheries, public lands, conservation easements, and endangered species. He has been named an Atlantic Fellow in Public Policy, a Fulbright Scholar, and an international research scholar at the Peter Wall Institute for Advanced Studies. Professor Eagle has previously served on a National Research Council committee focused on techniques for measuring natural resource damages resulting from the 2010 BP *Deepwater Horizon* oil spill.

Timothy Essington is currently a Professor at the University of Washington School of Aquatic and Fishery Sciences and serves as the Director of the university's quantitative ecology and resource management interdisciplinary graduate program. Dr. Essington earned a Ph.D. from the University of Wisconsin–Madison in zoology. His expertise is quantitative modeling and statistics, fisheries ecology, and application of ecological principles to management relevant questions. He has published multiple peer-reviewed papers examining the ecological responses of fishery systems to the implementation of catch share programs.

Sherry L. Larkin is currently the interim Director of the Florida Sea Grant College Program, the Associate Dean for Research, and a Professor in the Food and Resource Economics Department at the University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS). Dr. Larkin earned a Ph.D. from Oregon State University in agricultural and resource economics. Her expertise is in natural resource economics, especially using stated and revealed preference analysis (including non-market valuation and marketing applications to labeling of wild caught fish) and using bioeconomic modelling to evaluate fisheries management regimes and policies.

Steven A. Murawski is a Professor and the Peter Betzer Endowed Chair of Biological Oceanography in the College of Marine Science at the University of South Florida. His research group aims to understand the impacts of human activities on the sustainability of ocean ecosystems. He has developed approaches for understanding the impacts of fishing on marine fish complexes exploited in mixed-species aggregations, with the goal to help inform investments to rebuild the Gulf of Mexico from effects of the *Deepwater Horizon* oil spill, loss of nursery areas, nutrient enrichment, and overfishing. Dr. Murawski serves as the Director of the Center for Integrated Analysis and Modeling of Gulf Ecosystems, is a USA Delegate of the International Council for the Exploration of the Sea, and is a member of the National Academies' Ocean Studies Board, in addition to being appointed to serve on the committee for Decadal Survey of Ocean Sciences 2015. He received a B.S. and an M.S. in fisheries biology and a Ph.D. in fisheries and wildlife biology from the University of Massachusetts Amherst.

Sean P. Powers is a Professor and the Chair of marine sciences at the University of South Alabama and a Senior Marine Scientist at the Dauphin Island Sea Lab. He currently serves on the Gulf of Mexico Fishery Management Council's Standing Science and Statistical Committee having previously served as the Vice-Chair and the Chair of the Committee. He also serves on the board of the State of Alabama's Forever Wild, the Alabama Land Trust. In 2012, Dr. Powers was named the Chair of the Department of Marine Sciences and in 2017 the Angelia and Steven Stokes Endowed Chair in Environmental Resiliency. During the

damage assessment process after *Deepwater Horizon*, he served as a lead Principal Investigator for the nearshore environment. Dr. Powers served on both the National Academies' Committee on U.S. Army Corps of Engineers Water Resources, Science, Engineering, and Planning: Coastal Risk Reduction, and the Committee on the Review of Marine Recreational Information Program (MRIP). Currently, he is serving on the Committee on Data and Management Strategies for Recreational Fisheries with Annual Catch Limits. The majority of Dr. Powers's research is focused on demersal fishes and benthic invertebrates in coastal and estuarine systems, particularly those that support commercial and recreational fisheries, with a primary focus on the interface of ecology, fisheries and socioeconomics. Dr. Powers completed a SeaGrant John Knauss Marine Policy Fellowship at the National Science Foundation (1997-1998) and a post-doc at the University of North Carolina at Chapel Hill (1999-2002). He attended Loyola University (B.S. with Honors, 1990) and the University of New Orleans (M.S., 1992), and received his Ph.D. in zoology from Texas A&M University in 1997.

Martin D. Smith is the George M. Woodwell Distinguished Professor of Environmental Economics in the Nicholas School of the Environment at Duke University. He earned a Ph.D. at the University of California, Davis, in agricultural and resource economics (2001) and a B.A. at Stanford University in public policy (1992). Dr. Smith studies the economics of the oceans and has published research on fisheries and aquaculture, ecosystem-based management, genetically modified foods, the global seafood trade, and coastal climate change adaptation. He has served on the Scientific and Statistical Committee of the Mid-Atlantic Fishery Management Council, as the Editor-in-Chief of the journal *Marine Resource Economics*, and as a member of the National Academies' Ocean Studies Board for two 3-year terms. He also served on the National Academies' Committee on Understanding the Long-Term Evolution of the Coupled Natural-Human Coastal System: The Future of the U.S. Gulf Coast. He is currently a Features Editor for *Review of Environmental Economics and Policy* and serves on the editorial boards of the *Journal of Environmental Economics and Management* and the *Journal of the Association of Environmental and Resource Economists*. Dr. Smith has published extensively, including works in *The American Economic Review*, *Nature*, *Science*, and the *Proceedings of the National Academy of Sciences*. Dr. Smith has made appearances on NPR and BBC Radio to discuss seafood issues and has received national and international awards, including an Aldo Leopold Leadership Fellowship. His research has been funded by the National Science Foundation and the National Oceanic and Atmospheric Administration.

Tracey Yandle is an Associate Professor of environmental sciences at Emory University in Atlanta, Georgia. She also serves on the Scientific and Statistical Committee and the Socio-Economic Panel for the South Atlantic Fisheries Management Council. Dr. Yandle earned a Ph.D. in public policy (joint degree with the School of Public and Environmental Affairs and the Political Science Department). Her research focuses on the interaction of property rights and governance arrangements in order to understand how policy to changes individuals' incentives and thus their behavior. This is Dr. Yandle's first interaction with the National Academy of Sciences.