NOAA FISHERIES

Shark Depredation Action Plan

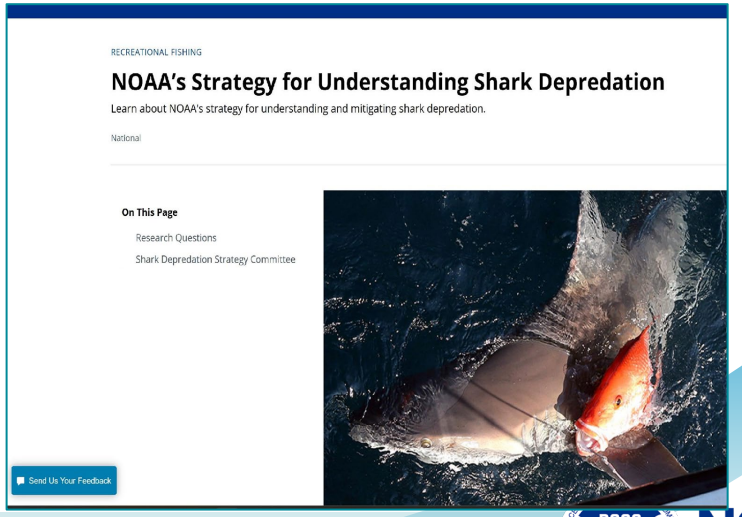
Gulf Council Meeting

October 2026

Goal of the Shark Depredation Action Plan

- Shark depredation consequences range from economic losses from lost or damaged catch, bait, and gear; increased mortality of released fish and degraded fishing experiences
  - NOAA has developed a Shark Depredation Action Plan to address many of these issues
- Actions and goals to currently address the shark depredation issue along the U.S. southeast coast and Gulf are consistent with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act and other applicable statutes



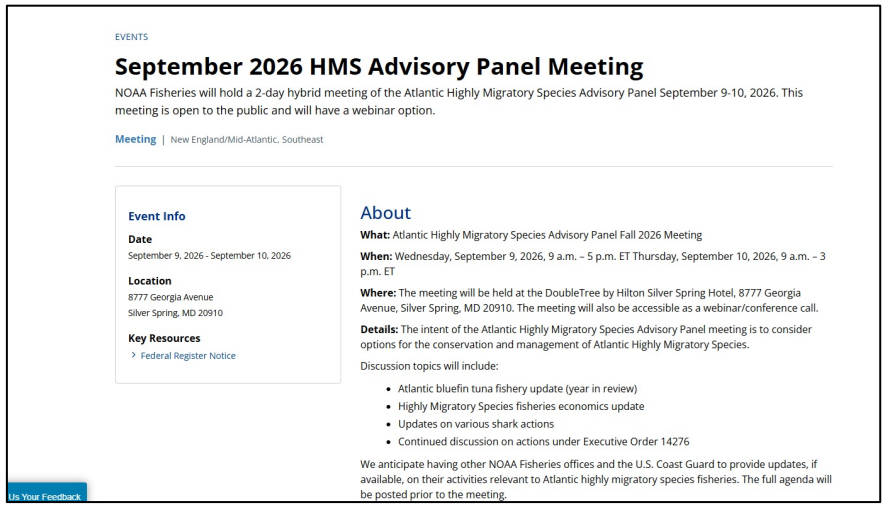


Actions in this plan may have applicability for use in other Ocean areas

https://www.fisheries.noaa.gov/national/recreational-fishing/noaas-strategy-understanding-shark-depredation

GOALS:

- STOCK ASSESSMENT AND DATA COLLECTION:
  - Goal 1: Sandbar shark stock assessment and scientific monitoring
  - Goal 2: Expand assessment and scientific monitoring to other species hypothesized to be a “high depredation” species (e.g. bull shark)
- RESEARCH:
  - Goal 1: Establish a scientific framework for characterizing/mitigating shark depredation
  - Goal 2: Advance tech innovations for bycatch mitigation/gear selectivity
- MANAGEMENT ACTION:
  - Goal 1. Optimize Sustainable Harvest Opportunities and Management Flexibility



EVENTS

September 2026 HMS Advisory Panel Meeting

NOAA Fisheries will hold a 2-day hybrid meeting of the Atlantic Highly Migratory Species Advisory Panel September 9-10, 2026. This meeting is open to the public and will have a webinar option.

Meeting | New England/Mid-Atlantic, Southeast

Event Info

Date
September 9, 2026 - September 10, 2026

Location
8777 Georgia Avenue
Silver Spring, MD 20910

Key Resources
› Federal Register Notice

About

What: Atlantic Highly Migratory Species Advisory Panel Fall 2026 Meeting

When: Wednesday, September 9, 2026, 9 a.m. – 5 p.m. ET Thursday, September 10, 2026, 9 a.m. – 3 p.m. ET

Where: The meeting will be held at the DoubleTree by Hilton Silver Spring Hotel, 8777 Georgia Avenue, Silver Spring, MD 20910. The meeting will also be accessible as a webinar/conference call.

Details: The intent of the Atlantic Highly Migratory Species Advisory Panel meeting is to consider options for the conservation and management of Atlantic Highly Migratory Species.

Discussion topics will include:

- Atlantic bluefin tuna fishery update (year in review)
- Highly Migratory Species fisheries economics update
- Updates on various shark actions
- Continued discussion on actions under Executive Order 14276

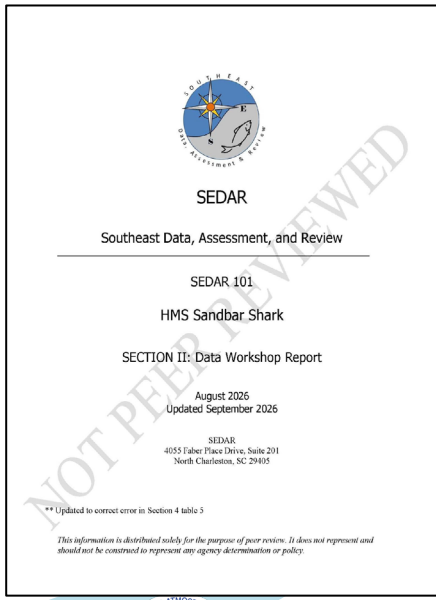
We anticipate having other NOAA Fisheries offices and the U.S. Coast Guard to provide updates, if available, on their activities relevant to Atlantic highly migratory species fisheries. The full agenda will be posted prior to the meeting.

Us Your Feedback

https://www.fisheries.noaa.gov/event/september-2026-hms-advisory-panel-meeting

Goal 1: Sandbar shark stock assessment

- Public comments, primarily recreational and commercial fisherman as well as some spearfishing groups, have suggested the stock of sandbar shark has recovered from the overfished status determined in 2018. Sandbar shark are one of the primary species associated with depredation events.
- Efforts underway to determine the status of sandbar shark through a stock assessment conducted under the SouthEast Data, Assessment, and Review (SEDAR)
  - Data Workshop held in April in Charleston, SC
    - Participants: ~55 scientists and representatives from organizations including NOAA Fisheries, FWC, SCDNR, VIMS, Mote Marine Lab, and University of Miami
    - Focus Areas: Reviewing catch statistics, abundance indices, life history parameters, and discard mortality
    - Next Steps: The assessment models are currently being conducted, with peer review via a Center for Independent Experts (CIE).
    - Final results anticipated in early 2027.


SEDAR

Southeast Data, Assessment, and Review

SEDAR 101

HMS Sandbar Shark

SECTION II: Data Workshop Report

August 2026
Updated September 2026

SEDAR
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

** Updated to correct error in Section 4 table 5

This information is distributed solely for the purpose of peer review. It does not represent and should not be construed to represent any agency determination or policy.

NOT PEER REVIEWED

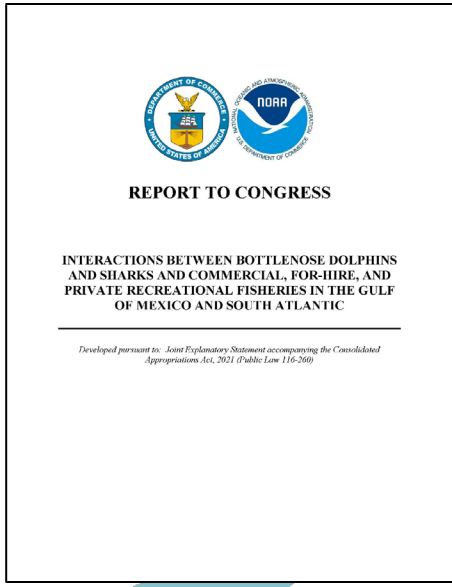
Goal 2: Expand assessment and scientific monitoring to other species hypothesized to be a "high depredation" species

- Potential application of a Management Strategy Evaluation (MSE) simulation approach to manage a stock based on a model-based or empirical harvest control rule or strategy
- The Sandbar MSE will allow NOAA Fisheries to adapt this process and these models for other species of sharks on a shorter timescale (e.g. bull shark)
  - Bull shark have not been assessed through a stock assessment
  - We expect issues with data to be similar across other species
    - Uncharacterized historical landings, life history uncertainty, population scale, etc.
- Work to develop other ways to estimate absolute abundance (e.g. Close Kin Mark Recapture, CKMR)
  - Empirical management procedures are likely to be the most appropriate way to provide management advice for these species

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RESEARCH

- Goal 1: Establish a scientific framework for characterizing/mitigating shark depredation
  - Is the trend in depredation increasing and are factors associated with this?
    - Perception vs quantitative evidence
  - Very few long-term data sets available
    - Only commercial data examined
    - Research currently underway from a scientific longline survey



REPORT TO CONGRESS

INTERACTIONS BETWEEN BOTTLENOSE DOLPHINS AND SHARKS AND COMMERCIAL, FOR-HIRE, AND PRIVATE RECREATIONAL FISHERIES IN THE GULF OF MEXICO AND SOUTH ATLANTIC

Developed pursuant to: Joint Explanatory Statement accompanying the Consolidated Appropriations Act, 2021 (Public Law 116-260)

NOAA FISHERIES

Are shark depredation rates increasing in pelagic longline fisheries?

Sarah Roberts (CIMAS/NMFS/SEFSC) , Marcus Drymon (MS State), Eric Orbesen (NOAA/NMFS/SEFSC), Tobey Curtis (NOAA/NMFS/HMS)



ICES Journal of Marine Science Advance Access published February 25, 2009

Page 1 of 12

Shark depredation rates in pelagic longline fisheries: a case study from the Northwest Atlantic

M. Aaron MacNeil, John K. Carlson, and Lawrence R. Beerkircher

MacNeil, M. A., Carlson, J. K., and Beerkircher, L. R. 2009. Shark depredation rates in pelagic longline fisheries: a case study from the Northwest Atlantic. – ICES Journal of Marine Science, 66: 000–000.

A suite of modelling approaches was employed to analyse shark depredation rates from the US Atlantic pelagic longline fishery. As depredation events are relatively rare, there are a large number of zeroes in pelagic longline data and conventional generalized linear models (GLMs) may be ineffective as tools for statistical inference. GLMs (Poisson and negative binomial), two-part (delta-lognormal and truncated negative binomial, T-NB), and mixture models (zero-inflated Poisson, ZIP, and zero-inflated negative binomial, ZINB) were used to understand the factors that contributed most to the occurrence of depredation events that included a small proportion of whale damage. Of the six distribution forms used, only the ZIP and T-NB models performed adequately in describing depredation data, and the T-NB and ZINB models outperformed the ZIP models in bootstrap cross-validation estimates of prediction error. Candidate T-NB and ZINB model results showed that encounter probabilities were more strongly related to large-scale covariates (space, season) and that depredation counts were correlated with small-scale characteristics of the fishery (crewmembers, catch composition). Moreover, there was little evidence of historical trends in depredation rates. The results show that the factors contributing to most depredation events are those already controlled by skipper captains and, beyond novel technologies to repel sharks, there may be little more to do to reduce depredation loss in the fishery within current economic and operational constraints.

Keywords: bycatch, fisheries, zero-inflated models.

Received 19 June 2008; accepted 24 January 2009.

M. A. MacNeil: National Research Council, Panama City Laboratory, 3500 Delwood Beach Road, Panama City Beach, FL 32408, USA. M. A. MacNeil and J. K. Carlson: NOAA National Marine Fisheries Service, Panama City Laboratory, 3500 Delwood Beach Road, Panama City Beach, FL 32408, USA. L. R. Beerkircher: NOAA National Marine Fisheries Service, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149, USA. Correspondence to M. A. MacNeil: Present address: Australian Institute of Marine Science, PMB 3 Townsville MC, Townsville, QLD, Australia: tel: +1 850 234 4143 ext. 252; fax: +1 850 235 3559; e-mail: macneil@aims.au.

Introduction

Sharks and cetaceans cause significant damage in pelagic longline operations worldwide, often as a consequence of bite-offs, loss of gear, catch displacement, reduced gear efficiency, and depredation of the catch (Gilman *et al.*, 2007). Depredation (when target species already captured are damaged by free-swimming predators) takes place in about half of all longline sets (Gilman *et al.*, 2007). At levels of 20% or more, economic losses from depredation can amount to thousands of dollars in lost revenue from a single set, so there is considerable motivation from fishers to avoid shark and cetacean interactions (Gilman *et al.*, 2008).

The dynamics of shark interactions in longline fisheries have generally been studied in terms of bycatch rates, where proportions of non-target species are modelled relative to suspected covariates of abundance (e.g. Francis *et al.*, 2001). In general, these models demonstrate notable bycatch rates of sharks, whales, and turtles attributable to both local (gear, temperature, depth) and regional (latitude, longitude, season) characteristics (Francis *et al.*, 2001; Beerkircher *et al.*, 2002; Gilman *et al.*, 2008). Some evidence has emerged to suggest that bycatch can be mitigated through changes in gear characteristics and fishing practices. Hook types, varying from previous use of "J" hooks to the now conventional use of "C" or circle hooks, have been altered in many fisheries in response to demands for reduced commercial bycatch (Watson *et al.*, 2005*b*). Although such changes benefit pelagic ecosystems, gear and behavioural changes to reduce bycatch may have few positive effects for fishers; in contrast, depredation has a direct impact.

Although almost certainly related to bycatch dynamics, depredation events are scarcer in longline fisheries than the catch of many species and may be manifest through different processes from those determining bycatch rates. Whereas bycatch occurs through the same fishing processes as the other components of the catch, depredation takes place when species that are not part of the catch encounter hooked fish and attack them, rather than swallowing hooked bait. In addition, the size difference between a pelagic longline bait (usually squid or mackerel of 0.001–0.5 kg) and a caught fish (usually between 10 and 100 kg) is substantial, leading to potentially different processes influencing depredation and catch.

One of the main difficulties in modelling rates of depredation is the high incidence of zeroes in the data. Many zeroes can render traditional approaches to modelling bycatch inappropriate, particularly because such models fail to deal with the extensive over-dispersion that can be present. Two-stage models, such as a delta-lognormal, have been used to handle the zero and count

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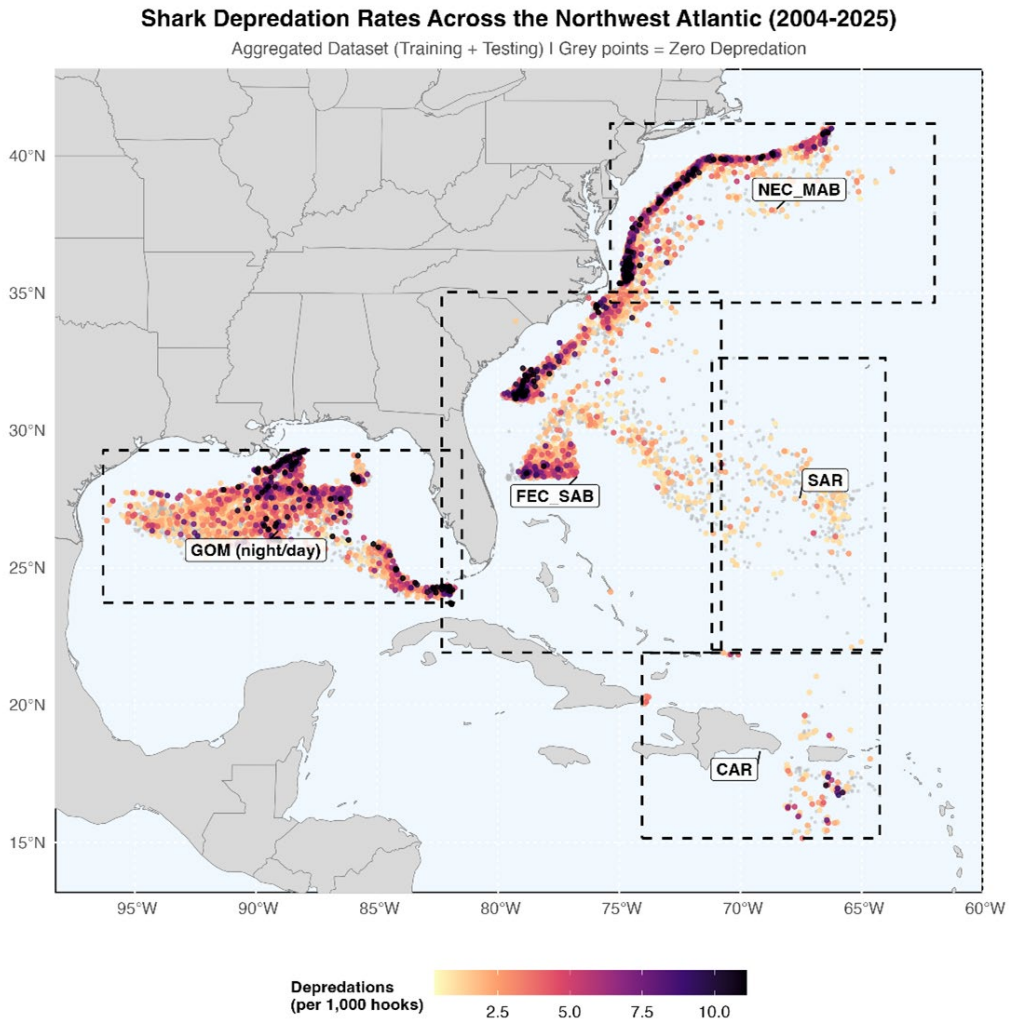
- What else, besides year, can explain regional shark depredation?
  - e.g. Environment, catch composition, location, gear. Can we use these relationships to help avoid depredation?

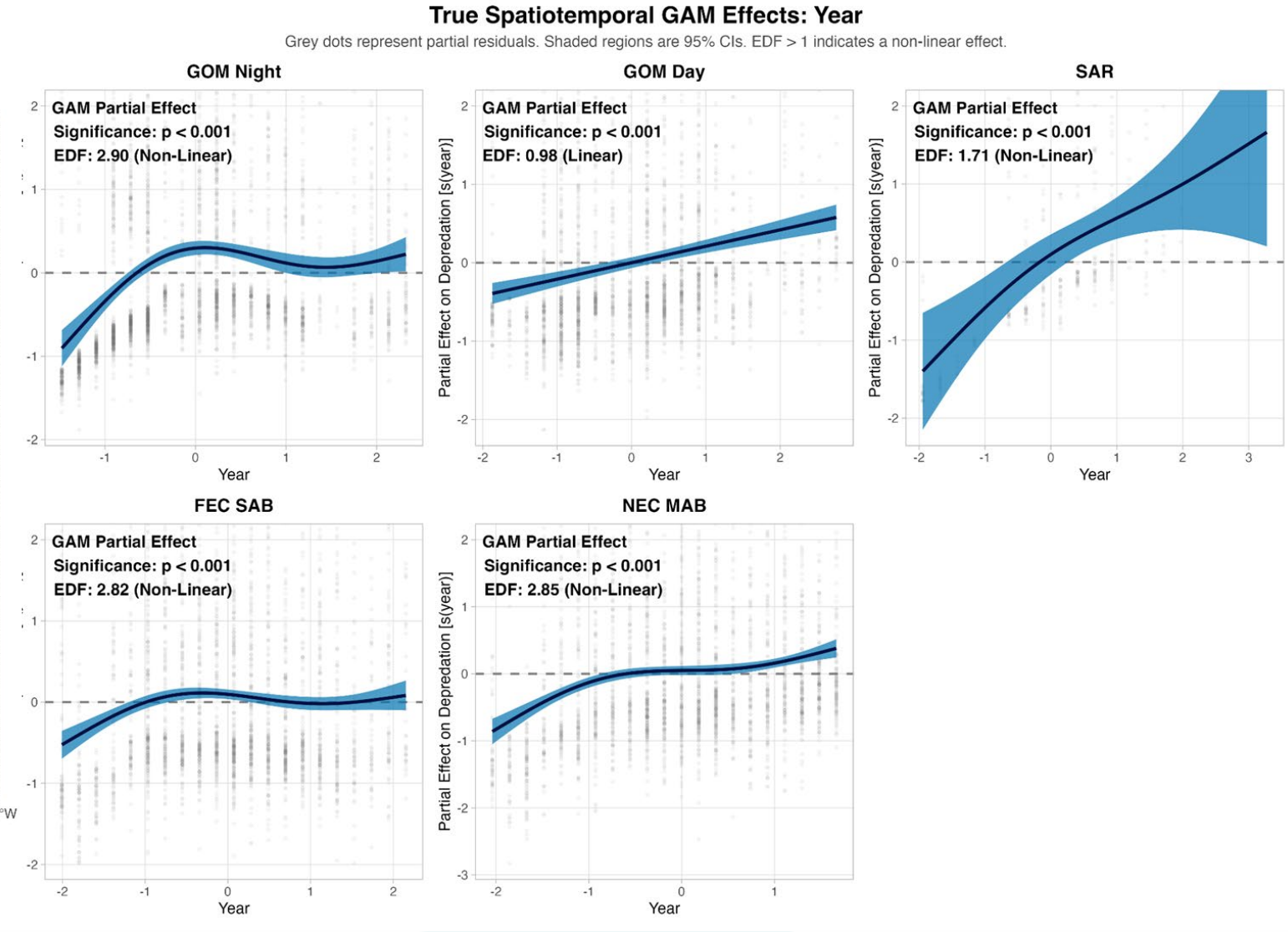
- Can we predict regional shark depredation in real time?
  - Build predictive models for inputs into mobile-based tool for fishermen to aid in avoiding depredation on the water

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Are shark depredation rates increasing?

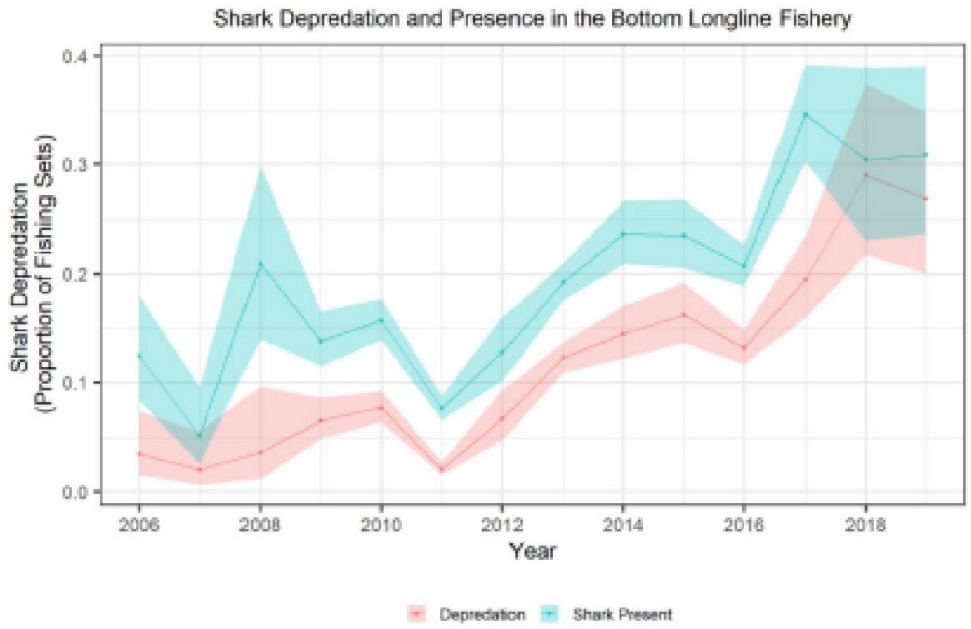
Yes, but it is regionally-dependent and sometimes non-linear





Are shark depredation rates increasing in Gulf reef fish bottom longline fishery?

Kyle King (CIMAS/NMFS/SEFSC)) , Daniel Coffey (TX A&M), John Carlson (NMFS/SEFSC)

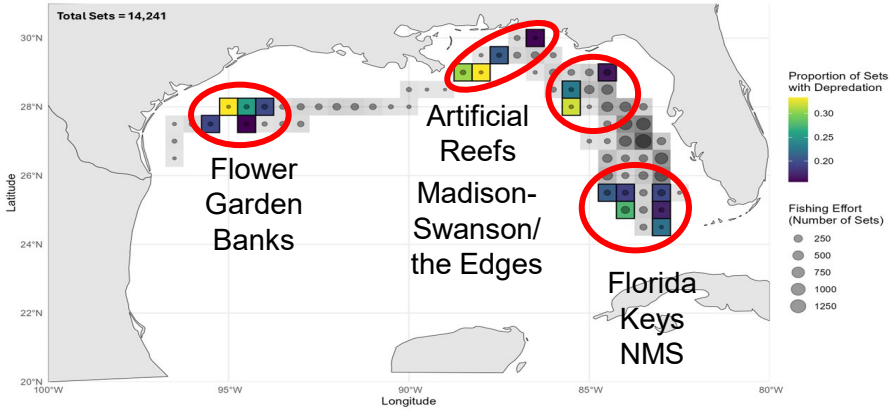


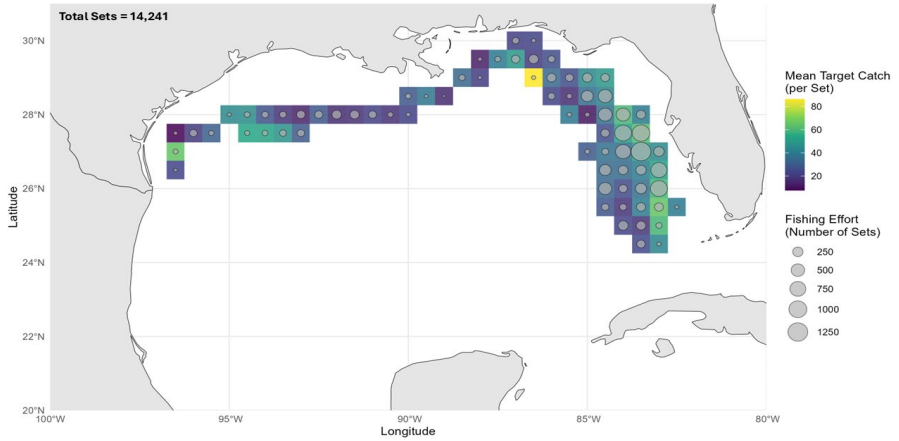
From Duffin et al. unpublished data.

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- Data were collected from the Gulf of America commercial bottom longline (BLL) observer program from 2006-2025, with 14,241 total sets.

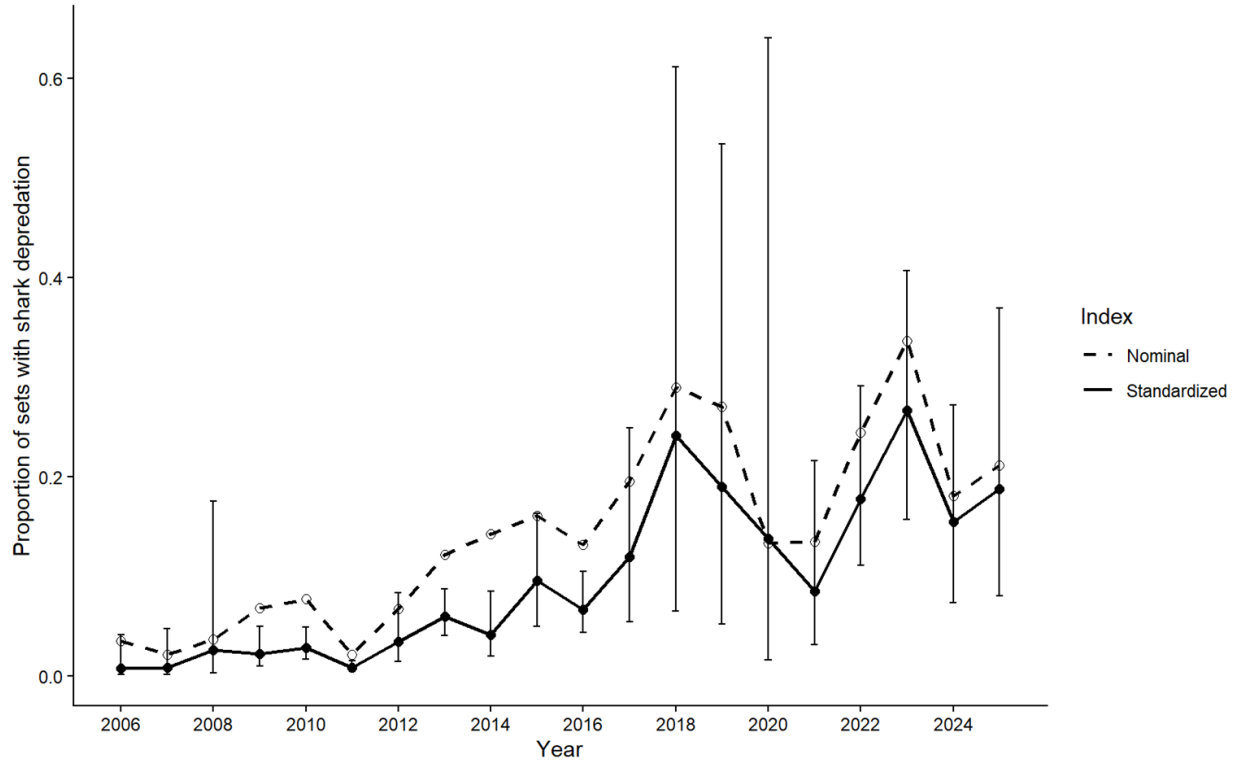
- Shark depredation was reported as present or absent on each set by observers. Sets ranged from the western Gulf, Brownsville, Texas, to Dry Tortugas, Florida, with variable effort across region and year





- A binomial generalized linear mixed model with a logit link was used to evaluate the probability of shark depredation while accounting for operational variables soak time, depth, season, and year

- Annual predictors were standardized by averaging predicted probabilities over the same pooled distribution of season, depth, and soak time, with the trip random effect



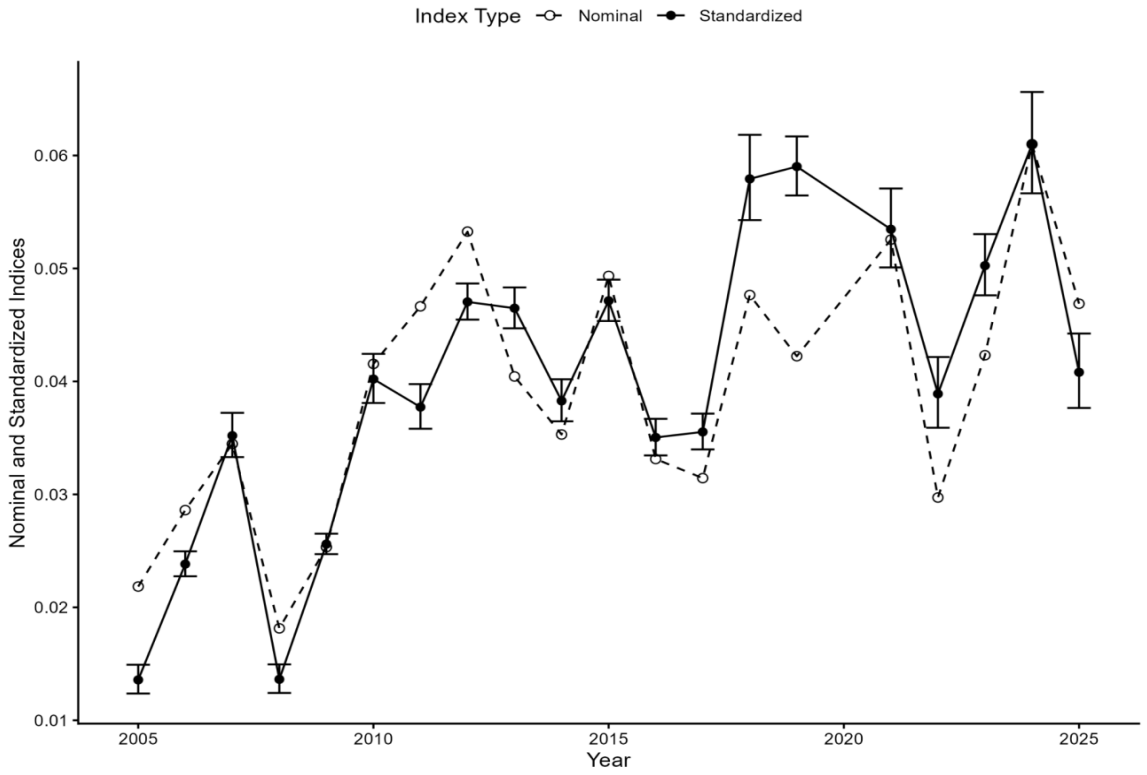
Increasing Shark Depredation in the Gulf of America: Evidence from a 20-Year Fisheries-Independent Time Series, 2005–2025

William B. Driggers III and G. Walter Ingram, Jr.
NMFS-SEFSC

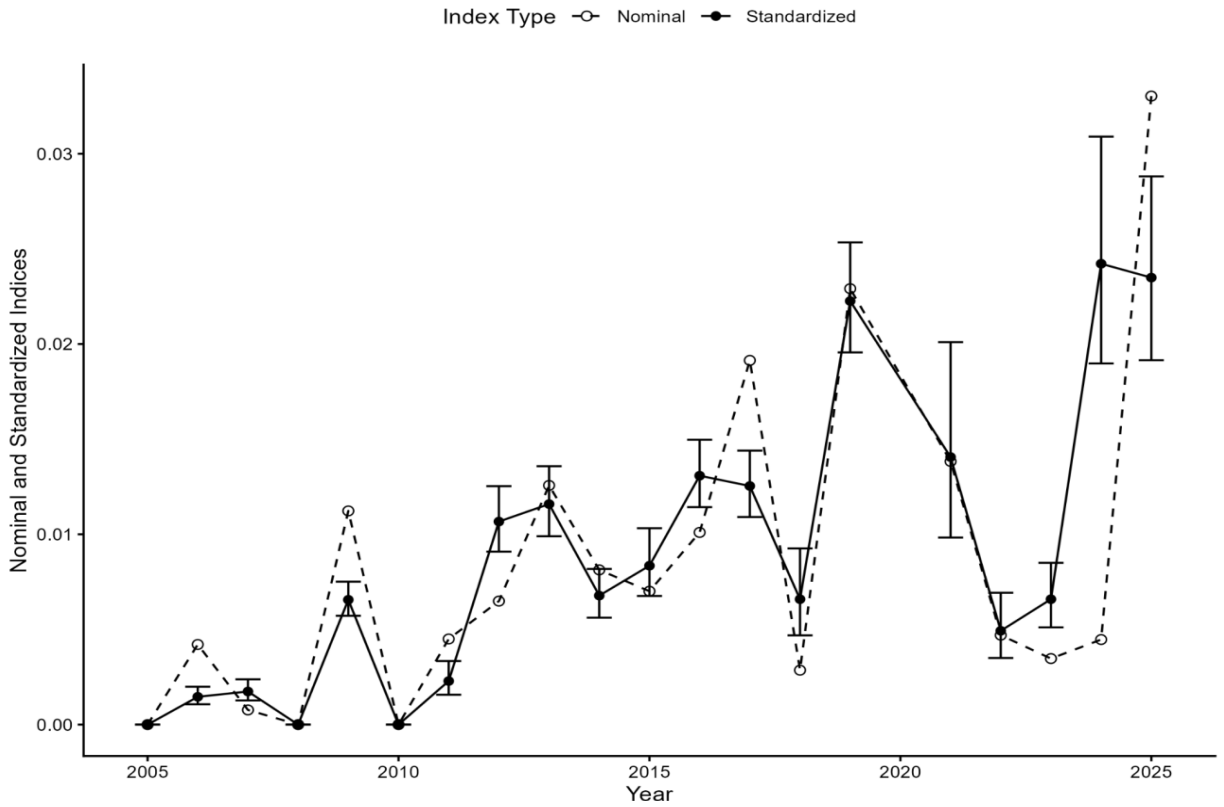
- Data includes 2,846 longline sets, 27,001 captured fish assessed for depredation, and 1,508 documented depredation events from 2005 through 2025.
- Survey targets red snapper and coastal sharks
- Depredation rates were analyzed using delta-generalized additive models that accounted for spatial, environmental, operational, and ecological factors

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- More than 99% of the predators were sharks
  - Sandbar, blacktip, bull, and tiger sharks being the most common offenders
- Model identified year, total gear deployment, duration, predator abundance, temperature, depth, salinity, and spatial effects as important explanatory variables



Standardized annual index of total depredation



Standardized annual index of red snapper depredation

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Evidence from 2 commercial fisheries and 1 scientific survey that depredation rates are increasing.

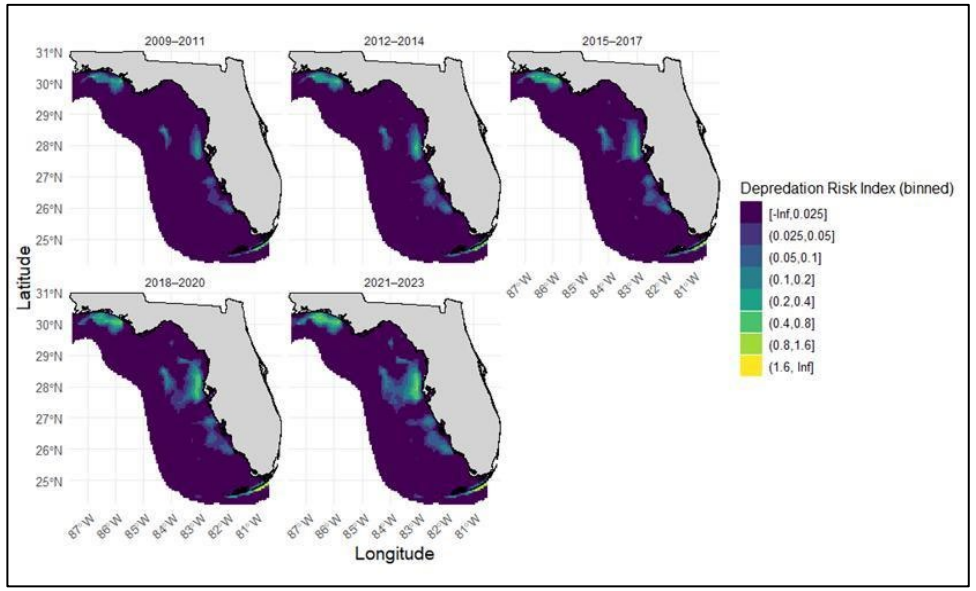
- Trends are highly variable
  - Could be related to the various factors identified that effect the rate
- More research is needed especially in recreational fisheries

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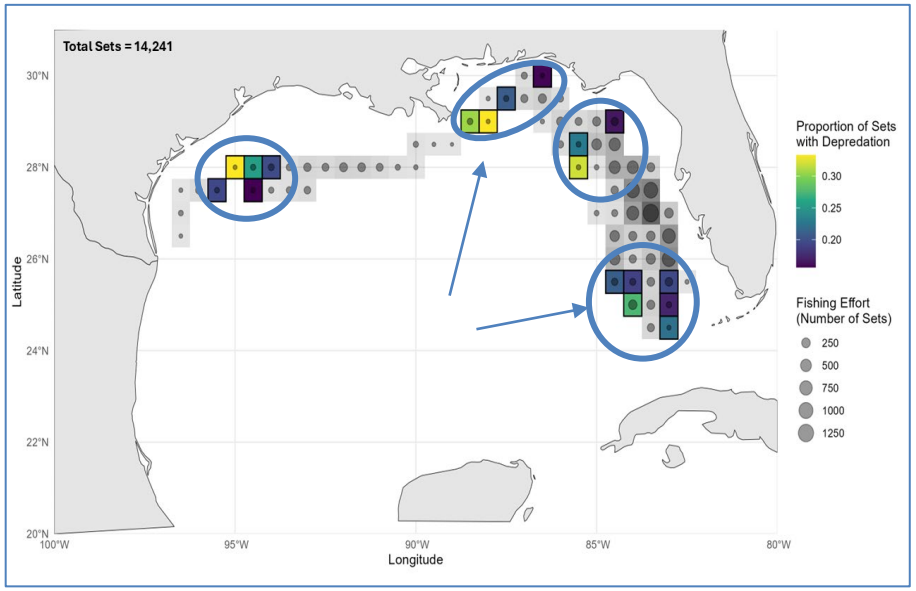
RESEARCH:

Goal 1: Establish a scientific framework for characterizing/mitigating shark depredation

Analysis of data from the reef fish bottom longline fishery suggests “high depredation risk areas”



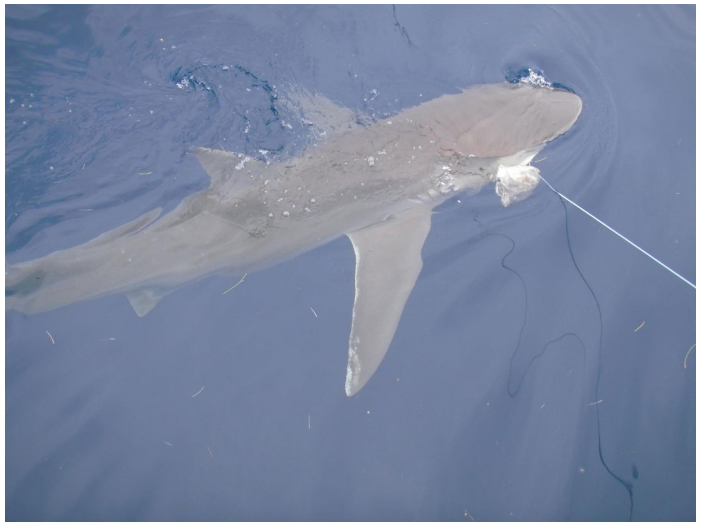
Aycock et al. 2025



King et al. 2026

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Research: Monitoring residency and movements of sandbar shark



- Is depredation localized or systemic?
- Are there individuals acclimated to depredation (i.e. campground bears)?
- If sharks are not resident, what cues are causing them to move to these areas?
  - Engine noise, struggling fish, discards
- Cooperation with commercial shark fishery and recreational reef fish fishery to monitor fishing activity and depredation rates
- Acoustic and satellite telemetry will be used to monitor shark residency/movement in these “depredation hotspots”. Mobile App development for data collection by recreational fisherman





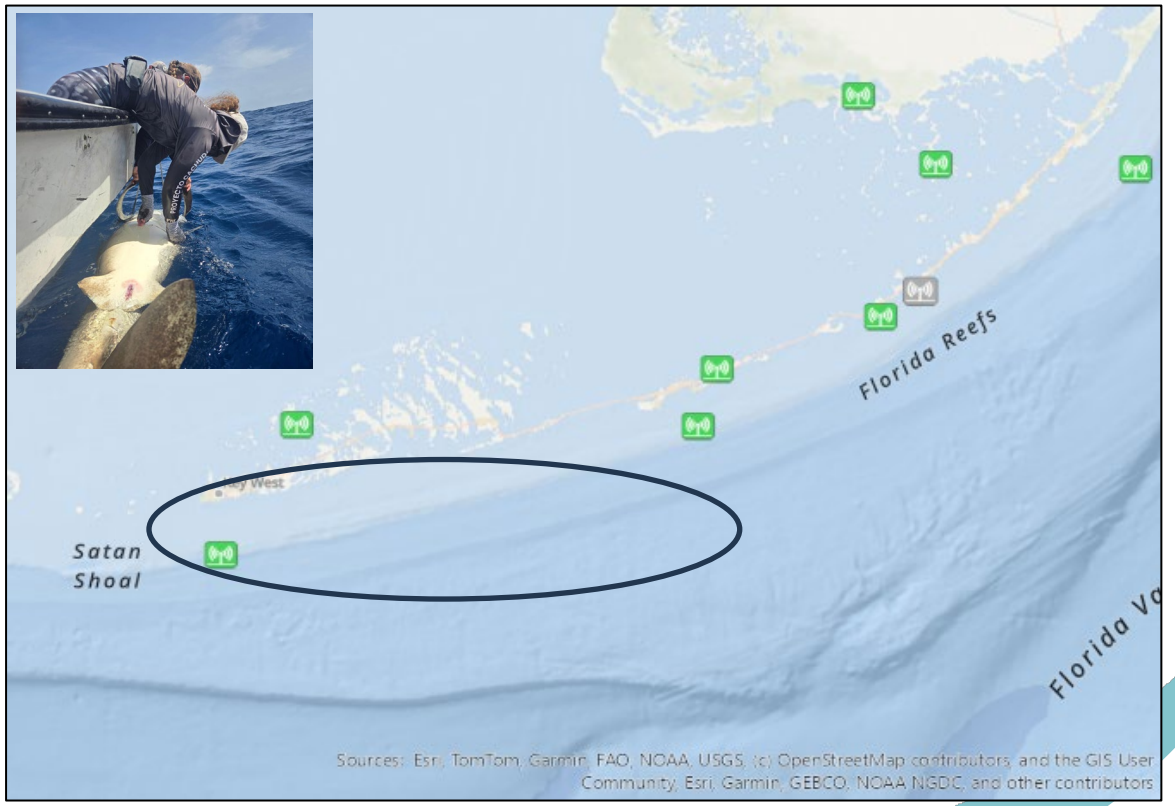


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Research: Monitoring residency and movements of sandbar shark

Proposed research areas



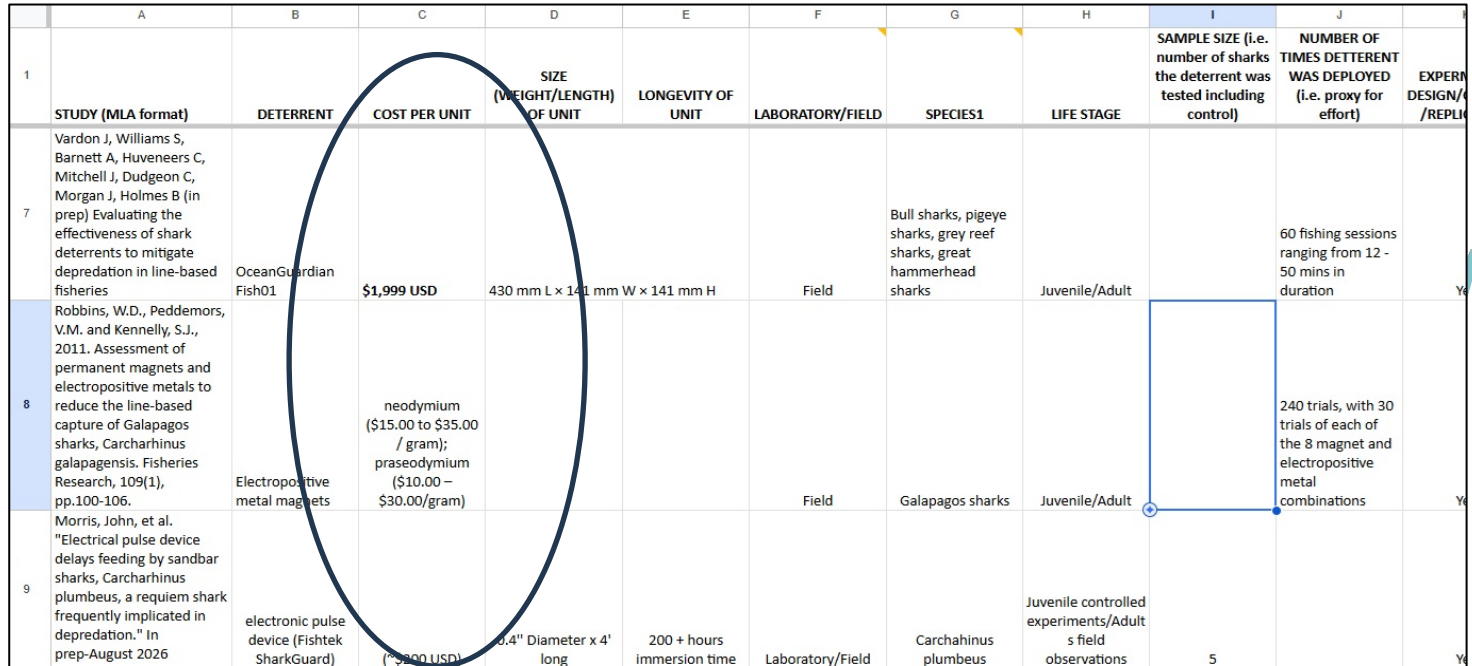


Interested participants: (NMFS.SEFSC.sharkdepredation@noaa.gov)

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Moving forward with the collaborative research

- Depredation issues in Florida Keys and Everglades National Park
  - Collaboration with Bonefish and Tarpon Trust to examine the status of lemon shark through relative abundance analysis
- Advance tech innovations for bycatch mitigation/gear selectivity
  - Compare and contrast the various “shark deterrents" as a method to reduce shark depredation (15 collaborators)
  - Complete meta-analysis of existing science on deterrents, especially considering economic impacts, and target most promising options for expanded testing and industry feedback
    - Build on existing meta-analysis studies



	A	B	C	D	E	F	G	H	I	J	K
1	STUDY (MLA format)	DETERRENT	COST PER UNIT	SIZE (WEIGHT/LENGTH) OF UNIT	LONGEVITY OF UNIT	LABORATORY/FIELD	SPECIES1	LIFE STAGE	SAMPLE SIZE (i.e. number of sharks the deterrent was tested including control)	NUMBER OF TIMES DETTERENT WAS DEPLOYED (i.e. proxy for effort)	EXPERN DESIGN/ /REPLI
7	Vardon J, Williams S, Barnett A, Huveneers C, Mitchell J, Dudgeon C, Morgan J, Holmes B (in prep) Evaluating the effectiveness of shark deterrents to mitigate depredation in line-based fisheries	OceanGuardian Fish01	$1,999 USD	430 mm L × 141 mm W × 141 mm H		Field	Bull sharks, pigeye sharks, grey reef sharks, great hammerhead sharks	Juvenile/Adult		60 fishing sessions ranging from 12 - 50 mins in duration	Ye
8	Robbins, W.D., Peddemors, V.M. and Kennelly, S.J., 2011. Assessment of permanent magnets and electropositive metals to reduce the line-based capture of Galapagos sharks, Carcharhinus galapagensis. Fisheries Research, 109(1), pp.100-106.	Electropositive metal magnets	neodymium ($15.00 to $35.00 / gram); praseodymium ($10.00 – $30.00/gram)			Field	Galapagos sharks	Juvenile/Adult		240 trials, with 30 trials of each of the 8 magnet and electropositive metal combinations	Ye
9	Morris, John, et al. "Electrical pulse device delays feeding by sandbar sharks, Carcharhinus plumbeus, a requiem shark frequently implicated in depredation." In prep-August 2026	electronic pulse device (Fishtek SharkGuard)	(~$300 USD)	0.4" Diameter x 4' long	200 + hours immersion time	Laboratory/Field	Carchahinus plumbeus	Juvenile controlled experiments/Adults field observations	5		Ye

QUESTIONS?





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