B5 - Summary of Social Network Analysis of Grouper-Tilefish Allocation Transfers

Using social network analysis (SNA), this project produced a series of visualizations of share and allocation transactions made by participants in the Gulf of Mexico IFQ programs. This summary focuses on the Grouper-Tilefish IFQ program component of the project.

During a prior contract with NMFS/SERO, the contractor created a relational database of logbook data. This database contains vessel attributes, vessel landings, and vessel homeport data (with U.S. Census GeoID) for all trip tickets 1990-2013. It allows the user to calculate the composition of landed species at both the vessel and community levels for various time scales. This database has now been updated to include 2014 logbook data, which will be linked to vessels participating in the IFQ programs for further analysis.

For the Grouper-Tilefish IFQ program, matrices were created for all share and allocation transactions, annually, from the program's inception through 2015. Various attribute data were incorporated, including shareholders with and without commercial permits and the amount of shares and pounds of allocation transferred. Related accounts (Section 2) were also identified and aggregated in order to focus on how shares and allocation were transferred among participants who do not co-own vessels or shareholdings. Node level attributes, including pounds of allocation sold, pounds of reported landings, and shareholder status, were added to the graphs for visualization purposes.

1. Grouper-Tilefish IFQ endorsement proxy analyses

One of the key questions of interest to non-economic social scientists deals with equity and the effects of fisheries policies on small shareholder fishermen. To this end, the Gulf Council requested a network analysis of the roles of various scales of fishermen in IFQ allocation transactions over time.

The Red Snapper IFQ endorsement analysis used Class 1 (2,000-lb trip limit) and Class 2 (200-lb trip limit) reef fish licenses prior to the IFQ program as the baseline for determining whether a fisherman could be classified as engaging in large or small-scale fishing practices, respectively. These IFQ accounts were then tracked through time (2007-2014) to determine whether large or small-scale fishermen were somehow advantaged later in the program's evolution, and whether new actors were gaining entry to the fishery. Because the Grouper-Tilefish IFQ program did not use similar licenses prior to implementation of the program, a proxy was developed for the purposes of this analysis: fishermen with a cumulative quota allocation in 2010 of greater or less than 8,000 lbs across all five categories of the Grouper-Tilefish IFQ program. These fishermen were then tracked over the length of the program (2010-2014). As can be seen in Figure 1, larger-scale fishermen (represented by blue nodes) played an important role in allocation transactions in 2010 and continued to do so in 2014. However, some fishermen who employed relatively small-scale fishing practices in 2010 (represented by yellow nodes) had become important actors by 2014. And, as in the Red Snapper analysis, new entrants to the fishery (represented by grey nodes) were also abundant, some of which transacted significant amounts of allocation.

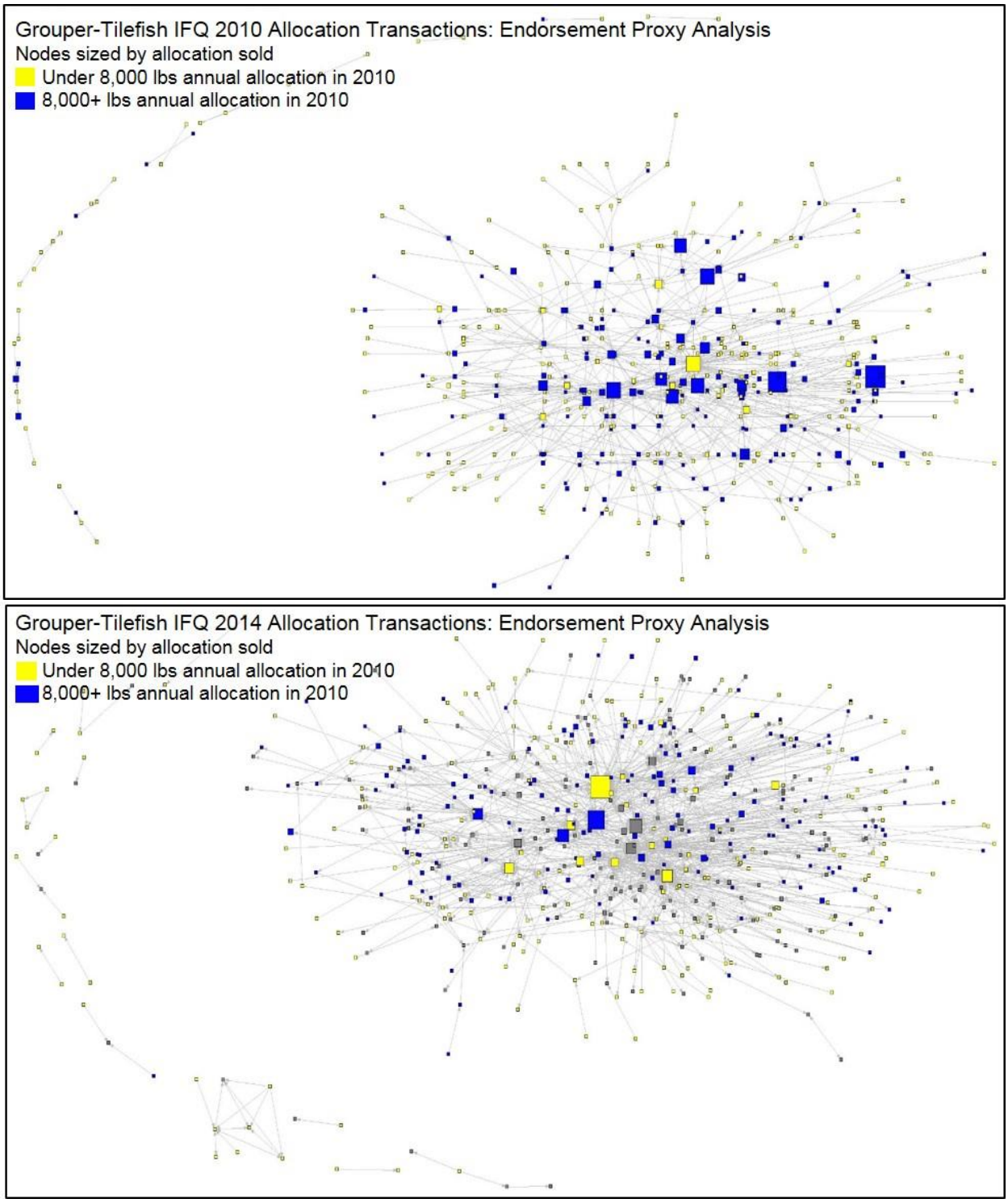
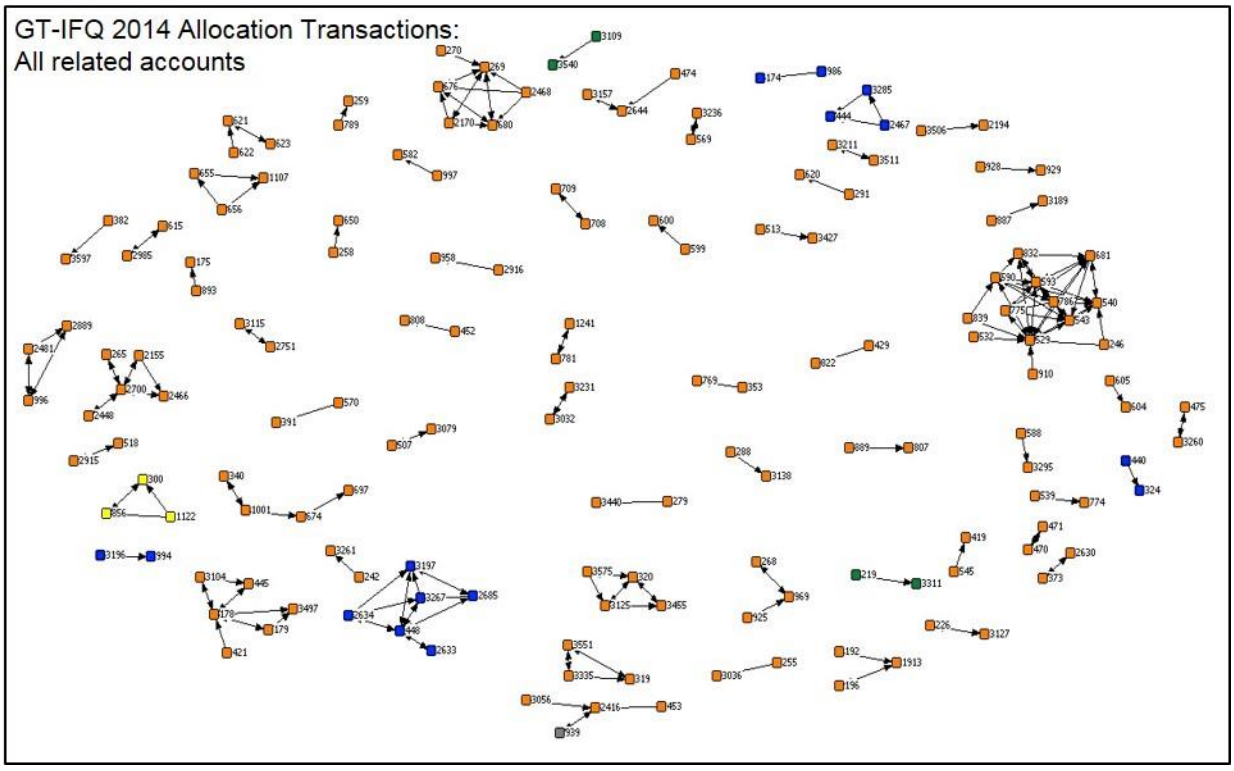


Figure 1. 2010 and 2014 Grouper-Tilefish IFQ allocation transaction networks with endorsement proxy data. Nodes are colored by cumulative allocation in 2010 (yellow = less than 8,000 lbs of cumulative allocation, blue = at least 8,000 lbs of cumulative allocation). Nodes are sized by pounds of allocation sold (larger nodes = more allocation sold, smaller nodes = less allocation sold). Similar visualizations were created for interim years (2011-2013), and with nodes sized by pounds of allocation landed and degree centrality.

2. Related accounts analysis

IFQ participants and NMFS staff have suggested that the behavior of IFQ participants has changed over time. In particular, there is anecdotal evidence that IFQ participants are increasingly expanding their business operations and affiliations with other IFQ participants, and may not be acting individually in both leasing transactions and fishing practices. Understanding more about "related accounts" in the IFQ programs is therefore important because it may shed light on how fishermen (and others) are negotiating and adapting their livelihood strategies to changing circumstances and opportunities. IFQ accounts are considered related if they have an entity in common, as recorded in the NMFS/SERO Permit Information Management System.

Figure 2 shows the networks of related accounts specific to Grouper-Tilefish IFQ allocation transactions. In the analysis, it is clear that the number of related accounts has increased over time as IFQ participants increasingly register multiple accounts or engage in business partnerships with other account holders. This trend is even more evident in the case of the Red Snapper IFQ program, which as the first IFQ program in the Gulf of Mexico, began with only a handful of related accounts in 2007. Due to the overlap of participants in both programs, when the Grouper-Tilefish program began in 2010, people had learned the benefits of registering multiple accounts for business purposes.



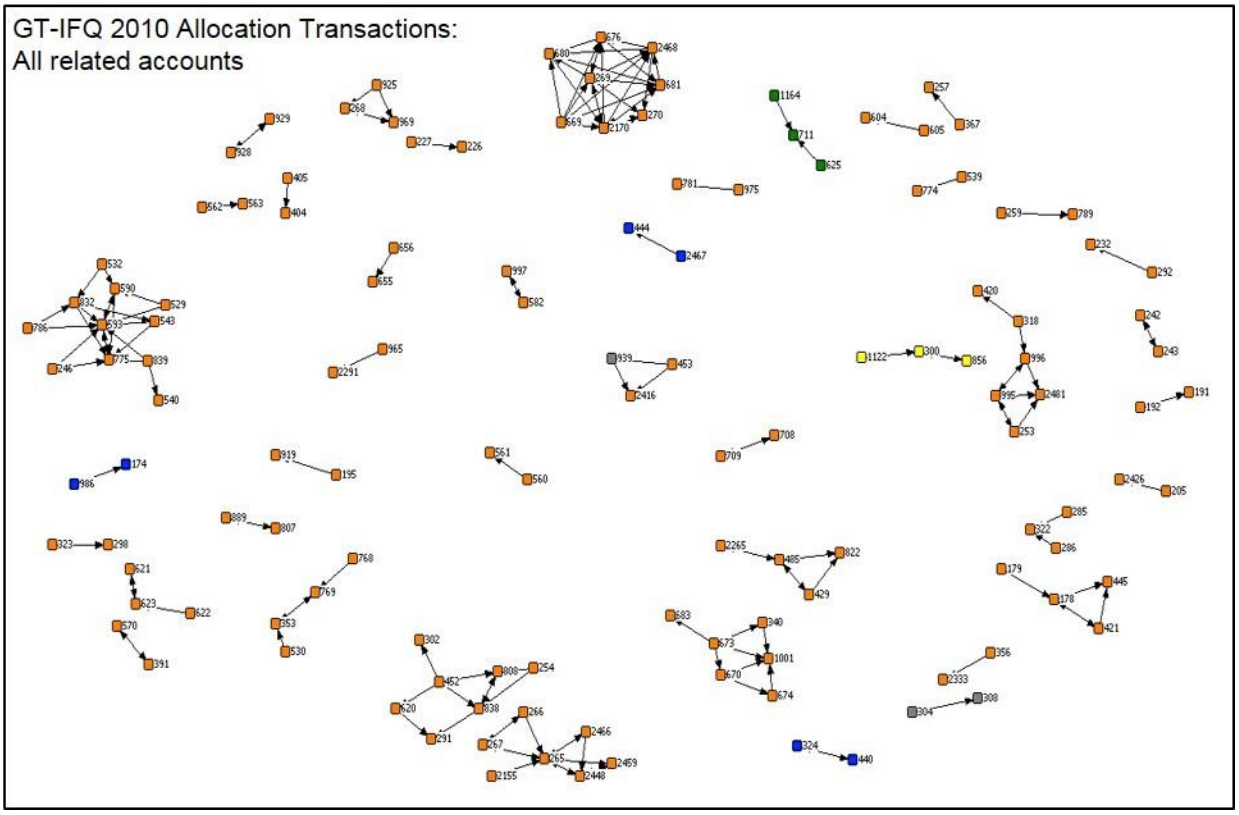


Figure 2. 2010 and 2014 Grouper-Tilefish IFQ related accounts networks. Nodes are colored by state (Florida = orange; Alabama = gray; Mississippi = yellow; Louisiana = green; Texas = blue).

3. Analysis of trading allocation in the Grouper-Tilefish IFQ program

One focus of the current network analysis project has been to examine the network for IFQ participants that transact large quantities of annual allocation but report little to no landings. For the purposes of this analysis, those who report little to no landings are operationalized as accounts or groups of related accounts that landed less than 50% of their annual cumulative allocation (i.e., allocation given based on shares plus allocation purchased from other program participants) in a given year. The network graphs in Figure 3, representing annual networks of allocation transactions in the Grouper-Tilefish IFQ Program, formed the basis for this analysis.

In each network graph, nodes represent IFQ account holders and lines represent allocation transactions. Related accounts are not aggregated in this analysis. Nodes are colored by shareholder status (blue nodes are shareholders; red nodes are not shareholders), sized by total allocation sold (the larger a node, the more allocation transferred), and shaped by reported landings (square nodes made landings; round nodes reported no landings). Thus, large, round blue nodes represent account holders that had significant outgoing transactions of allocation within a given year but reported no landings. Significantly, however, the composition of these networks changes from year to year, so an accountholder represented by a large, round blue node in 2010 may not appear the same way in a later visualization.

Among the allocation transactions in 2010 there were 459 shareholders and 51 non-shareholders. Landings were reported by 320 of these entities, with 120 reporting no landings. In 2013, the fourth year of the program, there were 409 shareholders and 128 non-shareholders that engaged in allocation transactions. Landings were reported by 347 of these entities, with 190 reporting no landings.

The two largest round blue nodes in 2010 are labeled Entity 1 and Entity 2. The three largest round blue nodes in 2014 are labeled Entity 3, 4, and 5. Entity 1 is related to several other IFQ accounts, including accounts holding shares and vessels incorporated as businesses, but without shares held in these accounts. Entity 1, then, is a shareholder who also owns more than one permitted reef fish vessel. It is unknown whether Entity 1 is a dealer, as a dealer permit is not held in a name that may be identified as an account related to Entity 1.

Entity 2 is an account in the name of an individual, which is related to Entity 5, an account in the name of a corporation. Both accounts continue to hold shares. Neither Entity 2 nor Entity 5 is associated with a permitted reef fish vessel, although it is possible that a vessel could be held in the name of an unidentified related account. It is unknown whether Entity 2 or 5 is a dealer, as a dealer permit is not held in a name that may be identified as an account related to either entity.

Entity 3 is an account in the name of an incorporated vessel, held by an individual who holds several other accounts. The relationship of this individual to the fishery is unknown, as this individual has opened and closed several accounts during the first five years of the program, and is related to several accounts. A dealer permit is not held in the name of Entity 3, although one could be held by a business associate. Although a dealer permit is not held in the same name as Entity 4, this individual is related to several other accounts and is a long-time manager of a fish house.

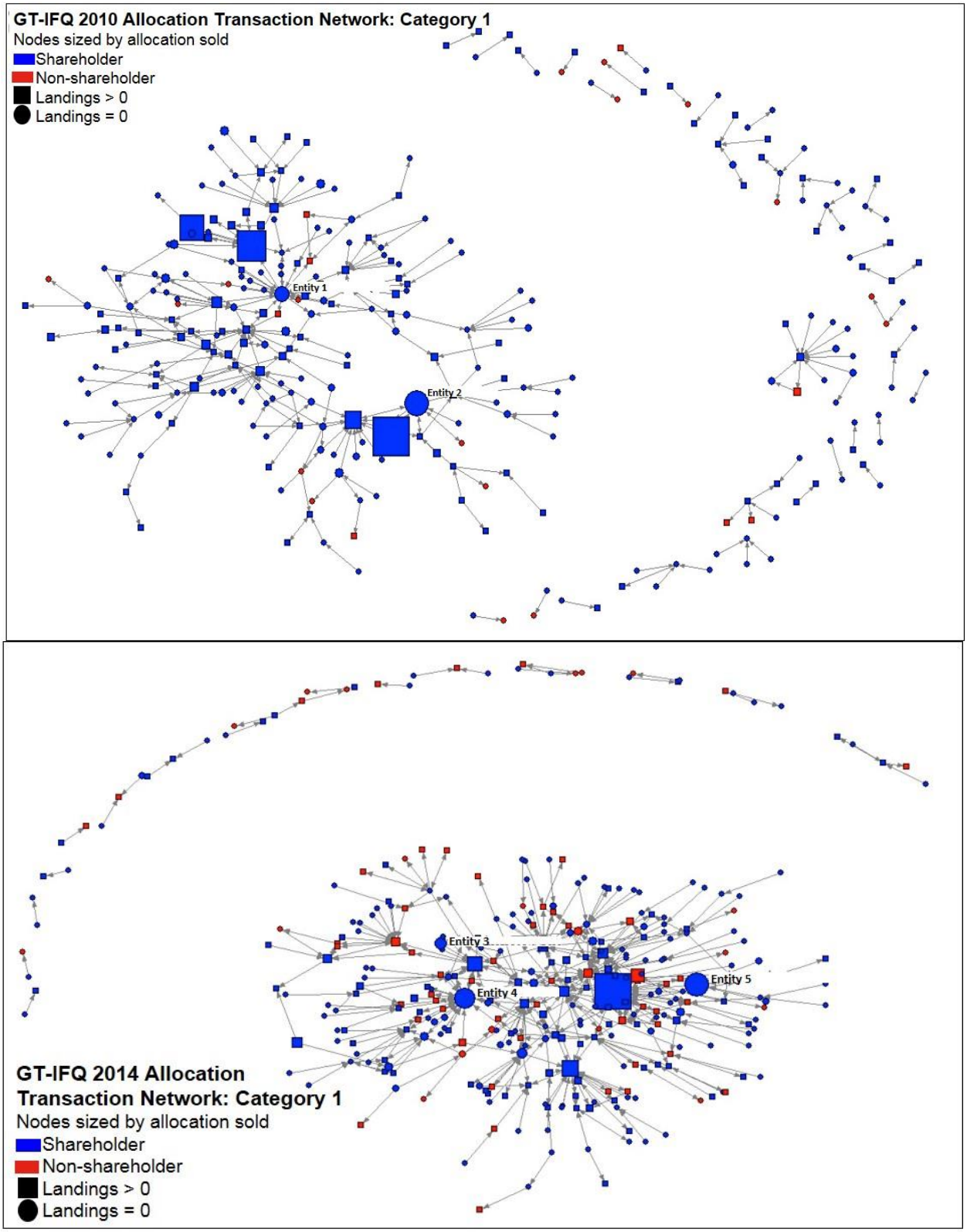


Figure 3. 2010 and 2014 Grouper-Tilefish IFQ Category 1 allocation transaction networks. Nodes are colored by shareholder status (blue = shareholder, red=non-shareholder), shaped by

reported landings (squares = landings >0, circles = landings = 0), and sized by allocation sold. Similar analyses were generated for years 2011-2013 and for Categories 2-5 for all years.

4. Analysis of trading allocation among related accounts in the Grouper-Tilefish IFQ program

This analysis is an extension of the analyses discussed in Section 2 (related accounts). Using related accounts data in combination with Grouper-Tilefish IFQ allocation transaction networks allows us to aggregate allocation transactions and landings for related nodes, thus reducing the complexity of the network graph and facilitating the identification of groups of nodes or individual nodes that may be transferring out a substantial amount of allocation without making a significant amount of landings. In the preceding section, the nodes in Figure 3 that are transferring out a substantial amount of allocation without making landings may be related to other accounts that are used for making landings.

This analysis occurred in two steps. First, as described in Section 2, network graphs of related accounts for each year of the Grouper-Tilefish IFQ program were generated. For each year, clusters of related accounts were identified with a unique ID number and their allocation transactions and landings were aggregated.

Second, the new clusters of related accounts were used to replace individual nodes in the networks of Grouper-Tilefish allocation transactions (Figure 3). Again, this allows for a clearer visualization of the larger actors in the networks. Figure 4 represents the Grouper-Tilefish 2010 and 2014 allocation transaction networks. In contrast with Figure 3, the shape of the node denotes whether the actor(s) associated with a node landed at least 50% of the cumulative amount of allocation held by that actor (square node), or less than 50% of the cumulative amount of allocation held by that actor (triangle node). Thus, participants who transfer out a substantial amount of allocation without making landings representing at least 50% of that transferred allocation are represented by large triangular nodes. These are either individual actors (red nodes) or clusters of related actors (blue nodes) who sold relatively large amounts of allocation to other account holders and who landed relatively little of their annual allocation.

In the red snapper network, there was a visible reduction in the number of individual nodes between 2007 and 2014 that transfer out a substantial amount of allocation without making landings. Such a reduction is not as apparent in the Grouper-Tilefish network (Figure 4). However, that could be because the number of related account clusters was high from the beginning of the Grouper-Tilefish IFQ program, likely due to the social learning that had occurred in the Red Snapper IFQ program during the prior three years.

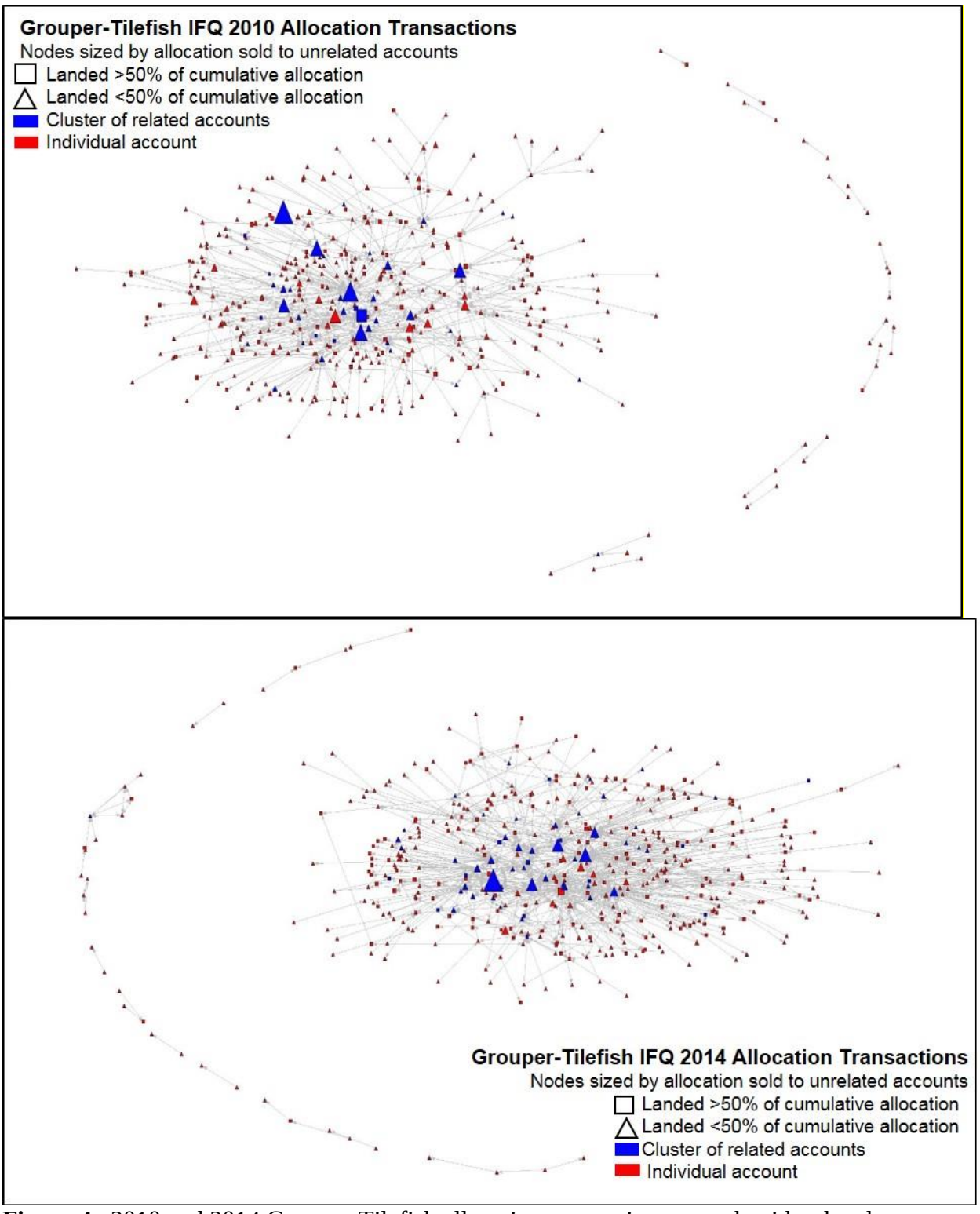


Figure 4. 2010 and 2014 Grouper-Tilefish allocation transaction network with related account clusters. Nodes are colored by related account status (blue = related account cluster, red=individual IFQ accounts), shaped by reported landings (squares = landed at least 50% of cumulative allocation, triangles = landed <50% of cumulative allocation), and sized by allocation sold to unrelated accounts.

Figure 5 shows the total pounds of grouper-tilefish allocation transferred each year among unrelated accounts and related accounts. The total pounds of allocation transferred is greater than the total quota, as a pound of allocation may be transferred more than one time. There are three categories of accounts: 1) "unrelated" refers to transactions between unrelated accounts that are not related to any other accounts; 2) "related-related/unrelated" refers to transactions between unrelated accounts by account holders that are in some way related to other accounts; and 3) "related" refers to transactions between related accounts. While the total pounds transferred among unrelated accounts are fairly steady over time, the total pounds transferred within the other two categories have increased substantially over the same time period. Related account transactions constitute a significant proportion of all allocation transactions.

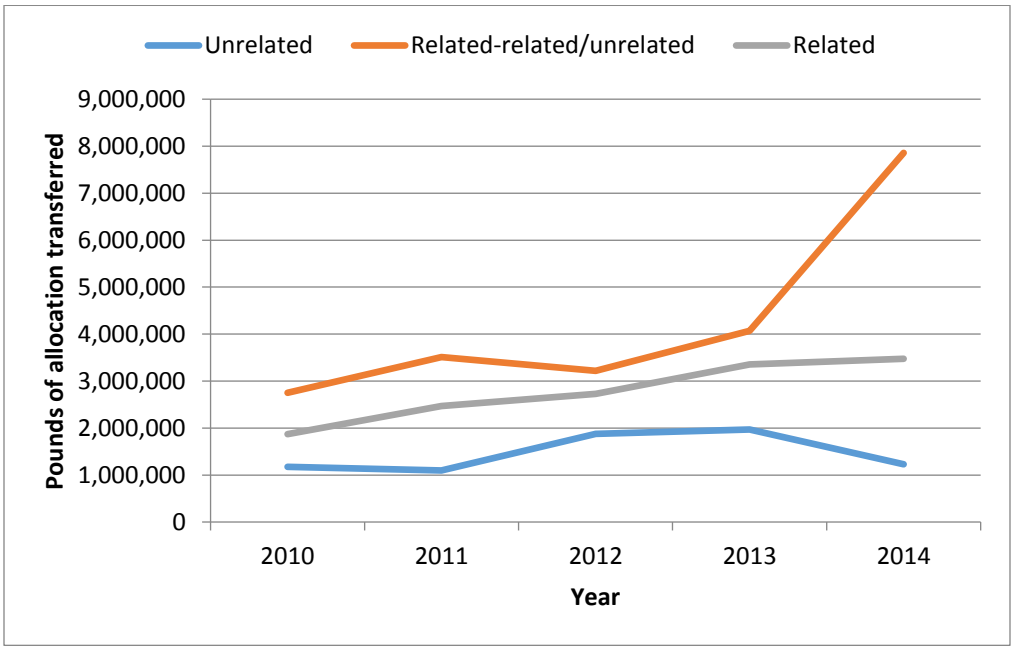


Figure 5. Pounds of allocation transactions by year among unrelated, related and unrelated, and related accounts.