

## **Permit Portfolios of Commercial Fishermen in the U.S. South Atlantic Region**

### **Portafolios de Permisos de Pescadores Comerciales en la Region del Atlantico Sur de los Estados Unidos**

### **Portefeuilles de Permis de Pêcheurs Commerciaux dans la Région L'Atlantique Sud des Etats-Unis**

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#### **EXTENDED ABSTRACT**

As in most areas in the Gulf and Caribbean, many commercial fishermen along the U.S. South Atlantic coast and Florida Keys hold a 'portfolio' of permits and harvest different species throughout the year or in different years. This characteristic of small-scale commercial fisheries presents a challenge in analysis of social and economic impacts of potential regulations, specifically how fishermen switch target species when harvest is limited or prohibited. Effects on permit portfolios are important considerations for regulators and management but are seldom addressed specifically in impact assessments for U.S. fisheries regulations.

One approach to examine fishing portfolios is a comparison to financial portfolio theory. Similar to a portfolio of stocks, bonds or other financial assets, diversity in a fisherman's options for participation would be expected to maximize benefits and minimize risk (Yang et al. 2008). The asset in the portfolio can be a fish stock (Yang et al. 2008), seafood product (Larkin et al. 2003), or the opportunity to harvest (Hanna 1998, Peruso et al. 2005). Greater diversification in a fishing portfolio would be expected to lower risk and uncertainty for fishing businesses (Sanchirico et al. 2005), and improve resilience for businesses when there is volatility due to changes in the fish stocks, regulations, or market (Larkin et al. 2003).

Fishing portfolios are also useful in the context of ecosystem-based fisheries management, including the social and economic components of fisheries systems and with considerations of the interactions between species (Pikitch et al. 2004, Sanchirico et al. 2007). Fish stocks exist within a larger system and interact with other target and non-target species. When single-species management does not incorporate these interactions and interdependencies, management agencies may not obtain objectives and maintain sustainable harvest (Edwards et al. 2004, Pikitch et al. 2004). A similar approach can be used for fishermen who target multiple species and in a case in which commercial harvest of a species or species group is managed through a permit system. A fisherman's decisions are linked to stock availability, market demand, ex-vessel prices, regulatory impacts, gas prices, local economies, available infrastructure, and many other factors, and changes in harvest patterns in one fishery will likely impact harvest patterns in another fishery.

In the U.S. South Atlantic region, there are fifteen commercial permits or endorsements that allow an individual to harvest over the recreational limit and sell the fish to a permitted dealer. It is also common for fishermen to hold charter permits, state commercial fishing permits, and federal commercial permits for other regions or for migratory species. Although a fisherman may not actively harvest under a permit on a regular basis, it is common to maintain a valid status in order to keep the opportunity to fish under the permit if needed. Several commercial permits in the region are under a limited entry program, which caps the number of permits when the program is implemented, requires new entrants to purchase permits from exiting fishermen, and imposes an annual fee to keep the permit valid. Even with limited entry permits, the fishermen will meet all requirements to keep the permit available in his/her portfolio regardless of participating in the fishery for a year or more. This illustrates the importance to South Atlantic commercial fishermen in maintaining the opportunity to actively fish in the future, even if participation is not incorporated into his or her current annual business plan.

This project uses permit records and two-mode network analysis to examine typical portfolios and groups of fishermen with similar portfolios. Permit records were obtained from NOAA Fisheries Southeast Regional Office and included information on the associated vessel and mailing address of the vessel owner to incorporate a spatial component to the analysis.

Social network analysis is a method to assess how people are linked together and any relationship or affiliation can define the tie between individuals. Using UCInet (social network analysis software package; Borgatti et al. 2002) this project analyzes the permit data as a two-mode network, also known as an affiliation network. Two-mode network analysis differs from one-mode analysis in that there are two sets of entities, each with ties to each other and with ties to the other set

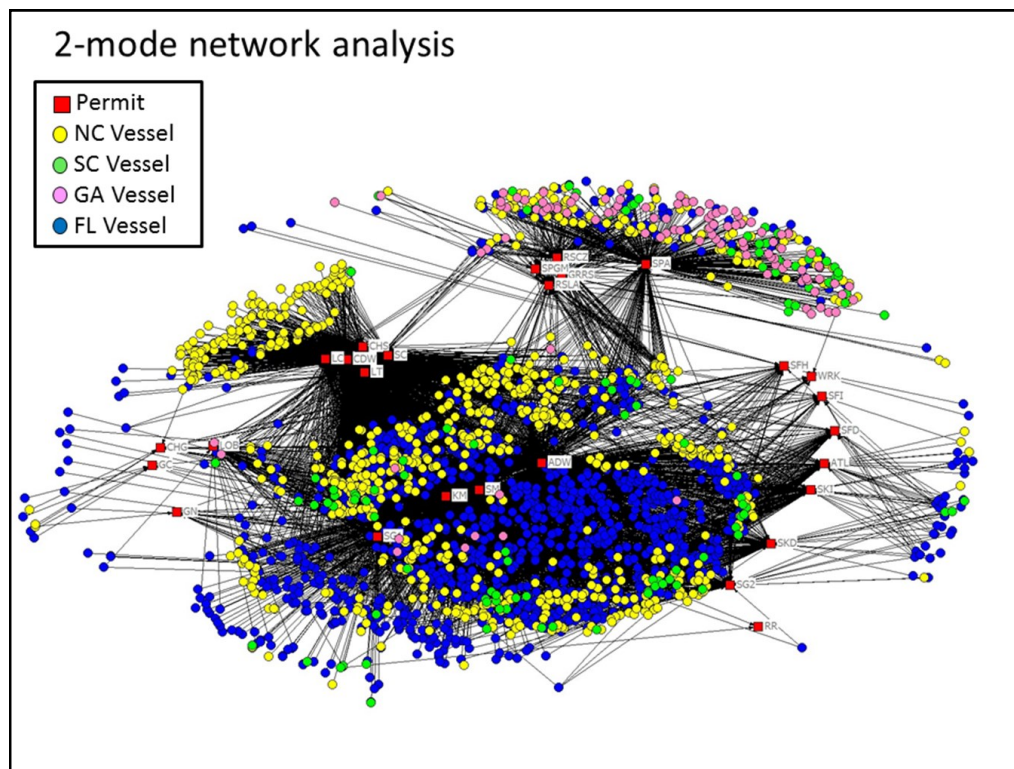
of entities (Borgatti 2005); for this project one set will be made up of the individual permit holders and the other set includes the individual permits. In two-mode network analysis, relationships among individuals can create the structures in the network but the structures can also constrain and define the individuals' ties (Breiger 1974). For the case of fishing permits in the U.S. South Atlantic region, the combinations of permits that will designate 'portfolios' will be defined by the individuals' permit holdings but the groups of fishermen may also be shaped by fishery characteristics associated with the portfolios, such as location, community infrastructure, vessel type, and other factors.

Because this project is in the exploratory phase, visualizations of the two-mode networks were used to get a generalized, birds-eye view of the possible patterns among portfolios and permit holders. Visualizations use algorithms to calculate distances and placement of the nodes, and are a useful way to present information about the networks in early stages of research (Freeman 2000, Perer and Shneiderman 2006). In a visualization (Figure 1), every node represents a permit holder (circle) or a permit (square). Every line between an indicates that an individual holds a specific permit (circle-square); an individual holds the same permit as another individual (circle-circle), or that a permit is hold in combination with

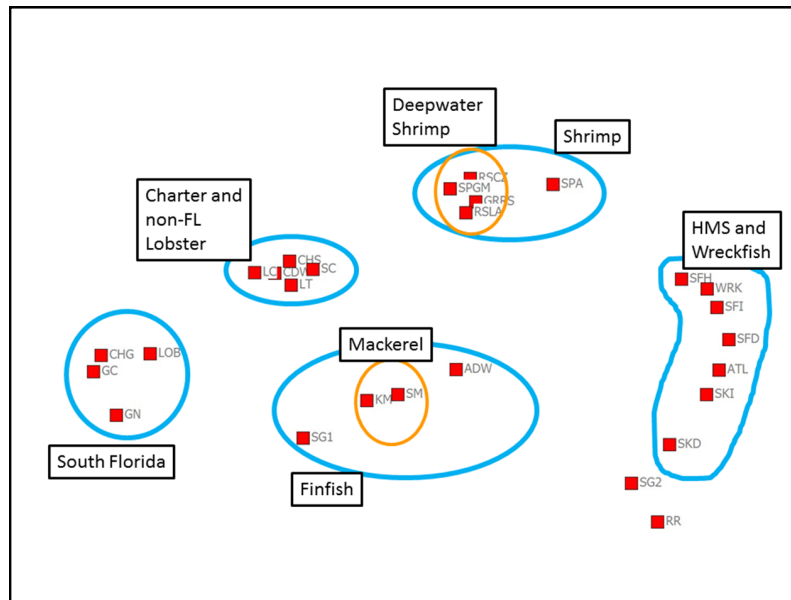
another permit (square-square). Color codes were added to indicate the state of residence for each permit holder.

The visualization in Figure 1 suggests that there are five common combinations of permits held by commercial fishermen, and multiple groups of permit holders who share common portfolios. The permit holders were removed for Figure 2 for an easier view of the permit combinations, and may indicate that there is a finfish portfolio (snapper-grouper, dolphin-wahoo, and mackerel); a shrimp portfolio (penaeid and deepwater shrimp); a specialty offshore portfolio (wreckfish, tuna, swordfish, and shark); charter permits and spiny lobster; and a specialty south Florida portfolio (spiny lobster, golden crab, and Gulf of Mexico permits). The visualization in Figure 1 suggests that some groups of fishermen with similar portfolios may have some spatial similarities.

The results of this initial analysis will be incorporated into a larger project to examine social, economic, geographic and fishery-based factors that correspond with similarities and changes in fishing patterns. The information will be useful in understanding impacts of regulations on fishing behavior and help guide management decisions based on the system of portfolios and multi-fishery participation.



**Figure 1.** Visualization of a two-mode network of permit holders (circles) and permits (squares), with color codes for vessel location.



**Figure 2.** Visualization of the two-mode network in Figure 1 with permit holder nodes removed. The circled groups represent potential permit portfolios based on common holdings of individual fishermen.

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