

# Fishery Management and Local Communities: The Case of Madeira Beach, Florida

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## Introduction

National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (as amended by the Sustainable Fisheries Act of 1996) requires that regulatory impacts on fishery-dependent communities be assessed. The MSFCMA defines a 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, crew, and United States fish processors that are based in such communities (MSFCMA, Section 3). In addition, the National Standard guidelines (1 May 1998; 63 FR 24211) define a fishing community as a social or economic group whose members reside in a specific location and share a common dependence on commercial, recreational, or subsistence fishing, or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops). Sustained participation is defined to mean continued access to the fishery within the constraint of the condition of the resource (50 CFR 600.345).

Literature in sociology and in anthropology use various methodologies such as cultural mapping, social and cultural impact assessment, and development of classification systems to identify fishing-dependent communities. These methods are used to measure potential alteration to the relationships with the natural resource, with the local historical and cultural traditions, and to the sense of identity with the place. This literature only indirectly measures the potential alteration to economic relationships.

This research introduces the methods of industrial organization to the study of fishing-dependent communities. Industrial organization, a subfield in economics, is the study of the structure of firms and markets and their interactions within an industry. An industry is comprised of firms and employees at various levels of production and is usually defined along both product and place lines, e.g. the industry in the United States for shrimp. A market includes both demanders and sup-

pliers and is defined along both product and place lines as well, e.g. the market in the United States for shrimp. By looking at the industry as a whole, this research attempts to measure the potential alteration to economic relationships within the market. The measures are loss of employment and income. These measures add economic relationships to the literature which includes social and anthropological relationships.

## Literature Review

This section provides a brief review of the literature in sociology and anthropology which discusses fishery or natural resource related communities and methods for assessing impacts on those communities. The studies introduce various means to identify the community and various methods to assess alterations to the relationships within the communities that might result from regulations.

Kusel (1996) defines a forest-dependent community as a place with a traditional geographical sense and a measure of place identity. That is, he asks, How do people in that place relate to the natural resource base beyond economic or social measures found in the U.S. Census (e.g. population, educational achievement, poverty)? To test this approach, Doak and Kusel (1996) examined six forestry regions in California. They used community workshops to involve local expert knowledge. They began with census block groups, built up to the county level, and then they explored the levels of identity that these various groups had with particular definitions of community. One of their major findings was that socioeconomic groupings were not good predictors of community place identity.

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*ABSTRACT—This paper uses an industrial organization approach to trace the impact on Madeira Beach, Fla., and surrounding areas of a 1-month closure of the grouper fishery from 15 February 2001 to 15 March 2001. A proposed 2-month closure is also evaluated. This approach identifies the economic relationships in the industry based on both product and place. The empirical analysis measures the losses in employment and income, information that enriches social and anthropological research on fishery-dependent communities. The 1-month closure is estimated to have reduced annual catches landed in Madeira Beach by 9.7–10.1% and annual revenues by 9.3–11.5%. These reductions are associated with a direct loss of about 33 full-time (annualized) jobs and personal income losses between \$8 and 12 million in Madeira Beach and Pinellas County over a 10-year period. If the closure occurs for 2 months, annual landings and revenues will be reduced an estimated 17–21% and 20–23%, respectively.*

The Pacific Fishery Management Council's website<sup>1</sup> presents some baseline fishery descriptions of U.S. west coast marine fishing communities. The Council defines these communities as counties where any activity occurs which is related to Council-regulated fisheries in California, Oregon, and Washington. Community data include recent and projected populations, age structure, ethnic and racial characteristics, educational attainment, employment characteristics, labor and proprietor income information, export bases, landings data, and ex-vessel revenue information.

Dyer and Griffith<sup>2</sup> drew on the concept of Natural Resource Community (NRC) as a basis for their definition of a fishery-dependent community. NRC's exist where individuals have dependence on a "renewable natural resource and . . . are rooted in local history and local traditions, deriving social and cultural identity from a sense of place whose life rhythms rise and fall with populations of fish, seasonal conditions at sea and the increasingly complex regulatory environment entangling their traditions."

They conducted a baseline study of New England and the Mid-Atlantic communities dependent on the multispecies groundfish fishery (MGF). The study examined the alteration of social, human, and cultural capital that would occur with a complete collapse of the MGF. Their research areas were selected using licensing data, vessel tonnage listings, permit data, and information from key informants such as state enforcement personnel, NMFS port agents, and local industry members. Additional social and economic data were collected during community visits.

To measure fishery dependence, Dyer and Griffith<sup>2</sup> developed a Fishery Dependence Index using measures of infrastructure and support related to fishing such as numbers of repair and supply facilities and fish dealers and processors; the presence or absence of religious and

secular art and architecture dedicated to fishing; and numbers of MGF permits and vessels.

Variation in fishery dependency both between and within ports was also measured. Ports that were found to be more isolated and less flexible in terms of ability to move to other fish stocks and gear types were more fishery dependent; ports where particular classes of fishermen within the industry were not well integrated into other fisheries or economic entities (e.g. tourism) were ranked more dependent on the MGF fishery. Ports with historical and cultural indicators of reliance on fishing (mariner museums etc.) were ranked more dependent. Competition and conflict amongst participants reflected perceptions that the resource was scarce and, therefore, that the participants were more dependent on it.

Griffith (1996) categorized fishermen's dependence on resources in North Carolina by examining 1) motivation for fishing (e.g. income, recreation, subsistence), 2) percentage of income derived from fishing, 3) time commitment (months per year and total years of experience), 4) flexibility index, from low to high, measuring the numbers of gears, fisheries, and species with which the fisherman is engaged, 5) number of different kinds of vessels, 6) number of crew involved in fishing operation, 7) relationship to the seafood marketing/processing sector, 8) principal social problems, 9) principal biological issues, 10) most desired regulations, and 11) most disruptive regulations.

Using this system, fishermen were grouped into seven categories on a continuum from full-time, owner/operator commercial fisherman to affiliated recreational fisherman (angler). This classification scheme goes beyond simple ranking by income earned from the fishery and introduces economic relationships with crew and market variables. Ethnographic data such as investigations of fishermen's main social and biological concerns related to fishing contributed to an evaluation of how the various categories of fishermen would be affected by a range of proposed licensing systems. Griffith used cultural mapping of fishing locales throughout North Carolina, questionnaires, in-depth interviewing, and

focus groups to identify communities. Secondary sources also were consulted, such as fishery organization membership lists and data collected by the N.C. Department of Marine Fisheries.

Wilson et al. (1998) conducted a social and cultural impact assessment of the Highly Migratory Species (HMS) Fishery Management Plan (FMP) and the amendment to the Atlantic Billfish FMP. They combined baseline descriptions of affected fishing communities with an analysis of potential impacts—both quantifiable and qualitative—on these communities. The communities were selected partly by examining landings data, but with a recognition that the fishing fleets employing particular gears are dispersed geographically.

The existence of previous studies and the suggestions of HMS and Atlantic Billfish Advisory Panels also influenced the choice of which communities were studied. The study analyzed locations in Puerto Rico, Louisiana, Florida, North Carolina, New Jersey, and Massachusetts to illustrate the range of potential impacts of the proposed regulatory changes.

Wilson et al. (1998) outlined three categories of impacts on their selected communities: 1) those which "affect the volume of money that is going through the community," 2) those which "affect the flexibility of the fishing operations," and 3) those which "impose direct costs on fishing operations." To measure social and cultural impacts, they referred to the "economic vulnerability" of the fishery in terms of competition faced in supply and marketing and the extent of social capital or community networks available. Social capital includes those aspects of a community's social structure which allow people with little financial capital "to accumulate the symbolic and material means to participate successfully in an economic activity" (Dyer and Griffith<sup>2</sup>). Social capital consists of trust, relationships, and support institutions such as churches and other means that enable economic capital to make necessary connections (Wilson et al., 1998).

Wilson et. al (1998) measured fishery dependence by examining demographic variables, percentage of employment in fishery related industries, income for those industries, landings by species,

<sup>1</sup><http://www.pcouncil.org>.

<sup>2</sup>Dyer, C., and D. Griffith. 1996. An appraisal of the social and cultural aspects of the multispecies groundfish fishery in the northeast and the mid-Atlantic regions. A report submitted by Aquirre International to NOAA/NMFS contract 50-GNF-5-00008.

and fishing related businesses (marinas, boat rental shops, dive shops, boat dockage and repair facilities, tackle and bait shops, tourism related to fishing). They also documented the social capital of the fishing community by counting numbers of recreational or commercial fishing associations and fisherman participation in each. Wilson's study identified several fishing dependent communities along the Gulf of Mexico coast. These communities were designated as dependent on the billfish fishery.

McCay<sup>3</sup> suggested that assessments of regulatory impacts on fishing-dependent communities consider not only geographic definitions of communities and economic characteristics therein, but also the level of vulnerability or resilience of fishing communities and operations. That is, questions of fishing dependence and "sustained participation" in fisheries must consider how able participants in a given fishery are to move among fishery sectors, and how able they are to move out of the fishery altogether and into other employment opportunities.

In summary, many of these studies used economic data such as landings, numbers of vessels, license information, and employment characteristics to identify the location of the community under analysis (e.g. Griffith, 1996; Wilson et al., 1998; Pacific Fishery Management Council<sup>1</sup>, Dyer and Griffith<sup>2</sup>).

Once a location is identified, the second stage is measuring fishing dependency. The dependency is measured as social, psychological (identity), and/or economic. Economic dependency refers to economic vulnerability or ability of fishermen to find alternative employment given the social and physical capital of the area.

This paper uses data collected by the State of Florida for a particular industry and market. The industrial organization analysis traces the fish through the market system by product type and identifies the groups that would be impacted by a regulatory action. The approach recognizes that a particular species may be landed

in one location, sold in another, and consumed in even another. The participants in the market flow are harvesters, wholesalers, and retailers as well as consumers—all part of the industry.

Each fish species may be part of a unique economic group or industry depending on the product market in which it is sold (i.e. fresh vs. frozen, packaged, smoked, dried, restaurant, or institutional consumption). Measuring the fishery dependence of the group or community then includes identifying substitutes not only in production but in consumption; not only in one location but through the product market. This type of analysis has the potential to show clearly where the economic dependency occurs—in a place or in a market.

This paper looks at only two types of measurable loss from regulations: employment and income. The losses are attributable to particular locations. This information on economic relationships together with social and anthropological relationships develops a more complete picture of community. Future research using this approach might look at other related variables, such as loss of capital by vessel owners or gains to those who catch the substitute species as economic relationships become altered because of a regulatory action.

Informed by the earlier studies on fishery-dependent communities, Madeira Beach, Fla., and the grouper industry were the selected site for analysis because of economic importance (over \$6 million annual ex-vessel value) and because the fishery closure in 2001 provided an opportunity to collect data on economic relationships in the industry to measure potential losses.

The commercial harvesting sector in Madeira Beach includes vessels with bottom longline, hook and line, and bandit rig (hook and line) gear (Cato and Prochaska, 1997). These vessels catch several species of grouper (Serranidae) and shark (Lamniformes). The wholesale sector of the industry includes fish houses which broker fish and provide services to the vessels such as transportation, accounting, fish filleting, and sales to other wholesale outlets and retailers. Other firms in Madeira Beach provide maintenance, gear, bait, ice, groceries, and supplies. The

retail sector includes grocery stores and restaurants, either specialized in seafood sales or in general food sales.

The research here is preliminary in the sense that we do not consider cumulative effects on this industry from regulations on swordfish (Xiphiidae) and sharks which affect the same reef fish industry. Earlier impacts on the City of Madeira Beach and its fishing activity are described in the FMP for Highly Migratory Species (USDOC, 1999). This FMP says "Nevertheless, NMFS is aware that the cumulative impacts of shark measures in this FMP may put some fishermen out of business and result in a permanent loss of community infrastructure in Madeira Beach" (USDOC, 1999:70).

This research also does not consider the effects of imports on the market, fluctuations in demand, or certain ethnographic relationships in the market. Antozzi (2001) documents a 246% increase in fresh snapper (Lutjanidae) imports to the U.S. between 1991–2000, predominantly from Mexico, Panama, and Brazil. He also shows a 155% increase in fresh grouper imports for the same period from Mexico, Panama, and Columbia. These imports are probably substitutes in consumption for grouper products currently caught by U.S.-based fishermen. Import substitutability may be of particular importance in this market and deserves attention inasmuch as it reflects altered economic relationships.

### Background Regulations and Data

The grouper fishery is managed under the Reef Fish Fishery Management Plan passed in 1984 by the Gulf of Mexico Fishery Management Council. This fishery has had a permit moratorium since May 1992.<sup>4</sup>

Grouper are managed as one unit for recreational catches and as two units (shallow water and deep water) for commercial harvest. Shallow-water grouper include red, *Epinephelus morio*; gag, *Mycteroperca microlepis*; black, *Mycteroperca bonaci*; yellowfin, *Mycteroperca venenosa*; yellowmouth, *Mycteroperca*

<sup>3</sup>McCay, B. J. 2000. Defining community: a fisheries perspective. Presentation at the annual meeting of the American Anthropological Association, San Francisco, 15–19 Nov. 2000.

<sup>4</sup>The moratorium allows transfer of permits between vessels. Fish dealers are also required to have permits to handle grouper and may buy only from permitted vessels.

Table 1.—Commercial grouper catches and value for the west coast of Florida, 1996–99 by species.<sup>1</sup>

| Species       | 1996      |                      | 1997      |                      | 1998      |                      | 1999       |                      |
|---------------|-----------|----------------------|-----------|----------------------|-----------|----------------------|------------|----------------------|
|               | Pounds    | Ex-vessel value (\$) | Pounds    | Ex-vessel value (\$) | Pounds    | Ex-vessel value (\$) | Pounds     | Ex-vessel value (\$) |
| Black grouper | 443,790   | 1,000,266            | 283,651   | 620,596              | 292,632   | 648,620              | 312,106    | 703,525              |
| Gag           | 1,481,641 | 3,474,761            | 1,657,075 | 3,837,629            | 2,718,533 | 6,309,071            | 2,129,664  | 5,052,567            |
| Misty         | 1,229     | 1,826                |           |                      |           |                      |            |                      |
| Nassau        | 798       | 1,163                |           |                      |           |                      |            |                      |
| Other grouper | 4,561     | 7,059                | 4,281     | 6,715                | 6,832     | 11,999               | 9,773      | 19,298               |
| Red           | 5,274,922 | 9,871,816            | 5,765,110 | 10,497,403           | 4,680,358 | 8,705,411            | 17,016,621 | 13,163,410           |
| Scamp         | 231,133   | 556,094              | 255,768   | 600,664              | 220,756   | 509,195              | 225,346    | 537,239              |
| Snowy         | 112,344   | 209,893              | 184,253   | 352,071              | 130,148   | 252,809              | 168,243    | 333,068              |
| Warsaw        | 21,869    | 33,463               | 36,363    | 54,771               | 30,164    | 48,715               | 68,014     | 117,484              |
| Yellowedge    | 399,652   | 897,104              | 702,300   | 1,555,649            | 564,218   | 1,292,903            | 814,495    | 1,913,605            |
| Yellowfin     | 12,159    | 24,643               | 1,769     | 3,575                | 297       | 647                  | 441        | 861                  |
| Total         | 7,984,098 | 16,078,088           | 8,890,570 | 17,529,073           | 8,643,938 | 17,779,370           | 10,744,703 | 21,841,057           |

<sup>1</sup> Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, Md., Jan. 2001.

*interstitialis*; rock hind, *Epinephelus adscensionis*; red hind, *Epinephelus guttatus*; and scamp, *Mycteroperca phenax*. Deepwater grouper include misty, *Epinephelus mystacinus*; snowy, *Epinephelus niveatus*; yellowedge, *Epinephelus flavolimbatus*; warsaw, *Epinephelus nigritus*; speckled hind, *Epinephelus drummondhayi*; and scamp (after the shallow-water quota is filled). Protected grouper species are goliath, *Epinephelus itajara*; and Nassau, *Epinephelus striatus* (GMFMC<sup>5</sup>). There are minimum length size requirements and recreational bag and size limits which vary by species. There are two marine reserves established on gag grouper spawning aggregation sites that are closed year-round to all fishing. The sites are off west central Florida and cover 219 n.mi.<sup>2</sup> near the 40-fathom contour (GMFMC<sup>6</sup>).

Grouper worth more than \$31 million ex-vessel value (almost 15.5 million pounds) was landed in Florida coastal areas in 1999. In 1999, over 6 million pounds were landed in Pinellas County on Florida's west central coast, valued at almost \$12 million (Florida Fish and Wildlife Commission<sup>7, 8</sup>).

<sup>5</sup>GMFMC. 1999a. Regulatory amendment to the Reef Fish Fishery Management Plan to set 1999 gag/black grouper management measures (rev.) Aug. Gulf Mex. Fish. Manage. Council., Tampa, Fla.

<sup>6</sup>GMFMC. 1999b. Amendment 17 to the Reef Fish Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico. Sept., Gulf Mex. Fish. Manage. Council., Tampa, Fla.

<sup>7</sup>Eastern Gulf of Mexico is defined as the Gulf coast of Florida from Franklin County (Apalachicola) to Collier County (Everglades City).

Historical grouper catches for west Florida by species are given in Table 1 for 1996–99. The west coast includes all of the landings areas from the Florida panhandle south along the coastline. Of the 11 categories of grouper, red grouper are the most valuable with gag grouper the second most valuable in total landings. Over \$21 million in grouper were landed by the commercial fishing fleet along this coast with the rest (about \$10 million) landed on the east coast of Florida. East coast landings are managed by a different management council.

Table 2 lists average ex-vessel nominal prices for several species for 1993–2000. Average nominal grouper dockside prices in 2001 on the west coast of Florida at the ex-vessel level were \$1.90–\$3.10 for red grouper; \$2.40–3.60 for black grouper; \$2.40–3.60 for gag, warsaw, and other types of grouper. Between 1993 and 2000, grouper prices moved up and down without a clear trend. The range of nominal grouper price increases in those years is between –1% and +12% annually. In other years prices increased between 2 and 6%.

Some studies on the recreational sector operating in the Gulf of Mexico identified particular ports and locations where the fishing activity occurred, but this information is not available for the commercial sector. (Ditton et al., 1992; Holland et al., 1992; Sutton et al.<sup>9</sup>). Within Pinellas County, there are two cities where large

<sup>8</sup>Commercial Fisheries Landings in Florida data available online at the Florida Fish and Wildlife website at [http://www.floridamarine.org/features/view\\_article.asp?id=19224](http://www.floridamarine.org/features/view_article.asp?id=19224).

Table 2.—Average nominal ex-vessel prices for grouper landed on the west coast of Florida, 1993–2000.<sup>1</sup>

| Year | Average ex-vessel price <sup>2</sup> of grouper | Real prices <sup>4</sup> (1982=100) |
|------|---|-------------------------------------|
| 1993 | 1.72  | 1.45                                |
| 1994 | 1.82  | 1.51                                |
| 1995 | 1.80  | 1.44                                |
| 1996 | 1.92  | 1.50                                |
| 1997 | 1.98  | 1.55                                |
| 1998 | 2.06  | 1.66                                |
| 1999 | 2.10  | 1.67                                |
| 2000 | 2.35 <sup>3</sup>                               | 1.77                                |

<sup>1</sup> Source: Calculated from data obtained from personal communication from the National Marine Fisheries Service, Fisheries Statistics and Economics Division, Silver Spring, Md., Jan. 2001.

<sup>2</sup> Prices are unadjusted and averaged across these species: gag, black, nassau, red, snowy, warsaw, yellowedge, yellowfin, scamp. Actual price ranges for 2001 were \$1.90–3.10 for red grouper, \$2.40–3.60 for black grouper, \$2.40–3.60 for other species.

<sup>3</sup> Preliminary.

<sup>4</sup> Seasonally adjusted with producer price index. Base year = 1982.

amounts of grouper are off loaded: Madeira Beach and Tarpon Springs, and Madeira Beach landings are about 70% of the county total. Table 3 lists commercial grouper landings in Pinellas County by species for 1996–99.

Analysis is based on several sources of data. Fish dealer reports (trip tickets) are required for this fishery by the State of Florida and include information from reef fish dealer permit holders. This

<sup>9</sup>Sutton, S. G., R. B. Ditton, J. R. Stoll, and J. W. Milon. 1999. A cross-sectional study and longitudinal perspective on the social and economic characteristics of the charter and party boat fishing industry of Alabama, Mississippi, Louisiana and Texas. Rep. by Human Dimensions of Recreational Fisheries Research Laboratory, Texas A&M Univ. for NMFS. MARFIN program grant NA 77FF0551.

**Table 3.—Commercial grouper landings in Pinellas County by species, pounds, ex-vessel value, 1996-99.<sup>1</sup>**

| Species    | 1996      |                      | 1997      |                      | 1998      |                      | 1999      |                      |
|------------|-----------|----------------------|-----------|----------------------|-----------|----------------------|-----------|----------------------|
|            | Pounds    | Ex-vessel value (\$) | Pounds    | Ex-vessel value (\$) | Pounds    | Ex-vessel value (\$) | Pounds    | Ex-vessel value (\$) |
| Black      | 83,446    | 217,544              | 130,287   | 341,222              | 197,216   | 521,636              | 209,621   | 565,348              |
| Gag        | 578,071   | 1,574,087            | 536,880   | 1,485,547            | 917,525   | 2,547,049            | 835,138   | 2,361,770            |
| Misty      | 329       | 725                  | 808       | 1,752                | 408       | 991                  |           |                      |
| Nassau     | 2         | 3                    |           |                      |           |                      |           |                      |
| Other      | 34,529    | 57,905               | 48,794    | 103,687              | 43,625    | 90,785               | 52,431    | 112,307              |
| Red        | 2,665,142 | 5,764,702            | 2,848,077 | 6,120,517            | 2,718,376 | 5,969,554            | 4,154,947 | 9,190,743            |
| Scamp      | 89,032    | 244,482              | 101,302   | 279,897              | 107,560   | 296,220              | 108,943   | 308,418              |
| Snowy      | 33,186    | 72,777               | 72,358    | 160,707              | 46,065    | 105,811              | 72,311    | 170,365              |
| Warsaw     | 13,110    | 23,270               | 10,541    | 18,731               | 10,538    | 20,123               | 13,742    | 27,979               |
| Yellowedge | 137,900   | 360,746              | 313,503   | 819,183              | 286,925   | 776,133              | 338,397   | 938,713              |
| Yellowfin  | 1,232     | 2,942                | 1,073     | 2,415                | 118       | 311                  | 189       | 469                  |
| Total      | 3,635,979 | 8,319,183            | 4,063,623 | 9,333,658            | 4,328,356 | 10,328,616           | 5,785,719 | 13,676,112           |

<sup>1</sup> Source: Florida Fish and Wildlife Commission, reported commercial landings as of 24 July 2000; 1999 is preliminary.

source provided landings and revenues by species and were obtained with dealer permission from the Florida Marine Research Institute (FMRI) for 1999 and 2000. These data were aggregated across dealers located in Madeira Beach and supplemented by firm settlement sheets. Firm settlement sheets are business receipts which record date of transaction, types of fish bought from particular vessels, price, poundage, and type of vessel. Other settlement sheets record monthly sales of bait, ice, groceries, and other supplies from dealers to vessels. These sheets enabled us to estimate the numbers of vessels, by type of gear used, which off loaded at Madeira Beach dealers in an average year. Through interviews with key informants in the industry, we were able to identify and estimate the number of restaurants and wholesalers which were buying from the Madeira Beach dealers.<sup>10</sup> The study relies heavily on the results of the 1994 Waters<sup>11</sup> survey of the same fishery for vessel characteristics which asked about costs, demographic and economic characteristics in the fishery for 1993. A later survey by Waters<sup>12</sup> provided updated catches and revenues

from logbook data as of 11 April 2001. All of the estimates of impacts of the closures used trip ticket data and firm settlement sheets.

Additional data were collected in on-site interviews with fish dealers, vessel captains and crews, restaurant owners, and supplier firms. The interview period was October 2000–March 2001. Income and demographic data were obtained from the Pinellas County Economic Development Office, the U.S. Census Bureau, the Madeira Beach Chamber of Commerce, and the Gulf of Mexico Fishery Management Council. The impact analysis was run through the REMI (Regional Economic Models, Inc)<sup>13</sup> model for Pinellas County and west central Florida maintained by the Tampa Bay Regional Planning Council.

#### Industrial Organization of the Market

Madeira Beach, Fla., is at the top of the list of places where grouper are off-loaded in the Gulf of Mexico. This is the center of the production for this study. From this center, we trace the fish along industry lines to discover economic

relationships that depend on this center. Thus we can partially measure fishing dependency as the loss in employment and income when the center activity is altered.<sup>14</sup>

Madeira Beach, where the fish are landed, is in Pinellas County, on the west central coast of Florida, between two much smaller fishing communities: Cortez, about 2 h south by sea in another county, and Tarpon Springs, about 3–4 h north by sea in Pinellas County. Fewer and smaller boats off-load in Cortez and Tarpon Springs, which are farther than Madeira Beach is from metro area final sales and distribution markets. Pinellas County is the fourth most populous county in the state with a population of 921,482 (U.S. Census Bureau<sup>15</sup>).

Madeira Beach, incorporated in 1947, now has a resident population of 4,409. About 5,000 additional winter residents also live there part of the year. The top four economic sectors in Madeira Beach are retail trade, \$61.5 million in annual receipts; accommodations and food services, \$16.8 million in annual receipts; wholesale trade, \$13 million in annual receipts; and administrative and support, \$12.3 million in annual receipts (U.S. Census Bureau<sup>15</sup>).

<sup>10</sup>We did not track sales of dealers established outside Madeira Beach. There are dealers who may send a truck to buy fish from vessels ported in Madeira Beach. Their sales are not included in this analysis.

<sup>11</sup>Waters, J. R. 1996. An economic survey of commercial reef fish vessels in the U.S. Gulf of Mexico. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Beaufort, N.C., 63 p.

<sup>12</sup>Waters, J. R. 2001. Various tables prepared for the Gulf of Mexico Fishery Management Council on Grouper Landings in the Gulf of Mexico. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Beaufort, N.C.

<sup>13</sup>REMI model has all the inter-industry relationships that are in an input-output model in the output block and also includes data sets from the Tampa Bay and State of Florida regions to estimate key economic relationships such as the relationships between population and labor supply, labor and capital demand, and market shares. Expenditures in a particular sector can be entered and the output shows employment impacts by sector (e.g. mining, construction) as well as impacts on personal income by sector, changes in the labor force, and wage rates over time. Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

<sup>14</sup>This study is partial because the analysis measures losses from first level impacts only. That is, rather than relying on the REMI model to calculate losses beyond the first level, had budget permitted, we could have calculated and identified losses in the wholesale and retail levels as well.

<sup>15</sup>United States Census. 2000. State and County Quick Facts from the U.S. Census Bureau web: <http://quickfacts.census.gov/qfd/states/2000.html>.

The business profile of Madeira Beach includes 52 restaurants, 1 casino ship, 3 marinas, 30–40 charter vessel operations, and 396 condos, hotels, and rental units. Hotels and motels are scattered along the gulf side of the city, and restaurants and homes are along the intracoastal side. Businesses are related to tourism, fishing, and Gulf of Mexico activities. The average household size is 1.8 persons. There is a 70.9% owner occupied ratio, with the median household income at \$35,247, which is slightly lower than the median household income of Pinellas County at \$35,904 and slightly higher than the U.S. median household income of \$34,067. Waters' 1994 survey<sup>10</sup> found the median income of fishermen to be \$30,000.

Summary data from Waters<sup>11, 12</sup> for the vessels in the reef fish fleet, which includes the grouper vessels, are given in Table 4. Estimated total value for vessels fishing the eastern Gulf of Mexico for reef fish in 1993 exceeded \$26 million using average values. The average trip hired 2–3 crew members and stayed at sea 10–14 days. Trip costs varied by gear type and vessel productivity, and ranged between \$298 and \$2,942 per trip. Survey respondents had an overall average age of 47 years with most in the 40–49 year age group. Very few were younger than 30. Almost all of them had a high school education. Respondents averaged about 44% of household income from commercial fishing for reef fishes and 21% from other types of commercial fishing. Respondents averaged 19 years fishing experience (Waters<sup>11</sup>).

Based on firm settlement sheet data collected from market participants, there were an estimated 87 bottom longliners and at least 48 bandit rigged/vertical line vessels homeported in Madeira Beach. Vessel distribution is given in Table 5.

These vessels employ about 305 fishermen, including crew and captains, who are supported by about 40 office and processing workers. Direct industry annual employment on vessels and in fish dealerships is estimated at 441 for 1999–2000 in Madeira Beach. Fish dealership employees work in the office, unload vessels, process fish, and transport fish (firm settlement sheet data). Indirect employment related to grouper catches is found with wholesal-

**Table 4.—Economic characteristics of reef fish vessels fishing for reef fish on the west coast of Florida, 1993 (unadjusted dollars).<sup>1</sup>**

| Gear type              | No. | Estimated total value of vessels (Million \$) | Range of average annual net income <sup>3, 4</sup> (1,000 \$) | Range of routine costs per trip <sup>2, 4</sup> | Range of average no. trips per year <sup>4</sup> | Range of average no. days per trip <sup>4</sup> |
|------------------------|-----|---|---|---|--|---|
| Vertical hook and line | 339 | 13.98   | 23.8–4.5  | 840–298   | 17–18  | 7.9–3.0   |
| Bottom longline        | 132 | 8.75  | 25.4–15.0   | 1955–1785                                       | 14–15  | 12.0–10.2                                       |
| Fish traps             | 71  | 3.67  | 21.0–19.0   | 726–584   | 11–32  | 4.6–4.1   |

<sup>1</sup> Source: Waters (text footnote 10): 9, 42–45, 65 (Tables 3, 4, 12, 13, 14).

<sup>2</sup> Routine costs and average net income depend on volume caught and length of trip which varies both by gear and within gear type. The ranges presented are the ranges of averages of high volume (top 75%) and low volume (bottom 25%) of vessels.

<sup>3</sup> Before taxes.

<sup>4</sup> High volume-low volume.

**Table 5.—Vessels and employment for grouper vessels in Madeira Beach, 1999–2000.<sup>1</sup>**

| Gear type                  | Vessel size |         |       | Crew size |                    | Total vessels |
|----------------------------|-------------|---------|-------|-----------|--------------------|---------------|
|                            | <36ft       | 36–49ft | >49ft | Average   | Total <sup>2</sup> |               |
| Bottom longliner           | 2           | 52      | 33    | 3.5       | 305                | 87            |
| Bandit                     | 14          | 34      | 0     | 2         | 96                 | 48            |
| Dealer employees           |             |         |       |           | 40                 |               |
| Total estimated employment |             |         |       |           | 441                |               |

Total vessels regularly offloading grouper in Madeira Beach = 135  
 Total vessel employment = 323  
 Total employment = 441

<sup>1</sup> Source: Firm records.

<sup>2</sup> Includes captains

**Table 6.—Estimated annual vessel routine costs by type of vessel off loading in Madeira Beach, Florida and size for 1999–2000.<sup>1</sup>**

| Boat category           | No. | Fuel  | Bait   | Ice   | Salt | Maintenance and gear | Total  |
|-------------------------|-----|-------|--------|-------|------|----------------------|--------|
| Bottom longliner <36'   | 2   | N.a.  |        |       |      |                      |        |
| Bottom longliner 36–49' | 38  | 6,037 | 4,870  | 2,582 | 438  | 10,000               | 23,927 |
| Bottom longliner >49'   | 30  | 5,955 | 11,014 | 4,082 | 461  | 14,520               | 36,032 |
| Bandit rig <36'         | 12  | 2,400 | 801    | 1,272 | 10   | 6,000                | 10,483 |
| Bandit rig 36–48'       | 27  | N.a.  | 232    | 982   | 10   | 8,796                | N.a.   |

<sup>1</sup> Source: Firm settlement sheets and captain interviews.

ers, transportation firms, restaurants, and specialty and general groceries. We did not count this indirect employment with wholesalers and restaurants but allowed it to be calculated by the REMI model. In the 52-sector REMI model, there are linkages between this sector (agriculture, forestry, and fishery services) of the economy and government, construction, transportation, public utilities, financial, insurance, and real estate sectors of the regional economy.<sup>16</sup>

Table 6 lists estimated annual vessel expenditures by type of vessel and size for 1999–2000. These estimates come from interviews with captains, crew members, and from vessel expense receipts. The vessels catching grouper

<sup>16</sup>These are respectively NAICS industry codes: 44-45, 72, 42, 56.

have routine costs for items such as fuel, bait, salt, groceries, and ice. For bait, the grouper fishermen typically use herring (*Clupeidae*) (\$0.39/lb), squid (*Loliginidae* and *Ommastrephida*) (\$0.49/lb), or mullet (*Mugilidae*) (\$0.25/lb) and always buy it because the opportunity cost of catching it themselves is too high. Fuel expenditures have a much larger cost ranging from 300 to 1,000 gal per month (\$2,400–6,000/year). Boat owners in Madeira Beach do much of their own maintenance and repair work. They use local repair shops for major overhauls and parts purchases. They estimate average costs of maintenance and gear for bottom longline vessels at \$1,000 per month and for bandit gear vessels at \$733 per month. Larger bottom longliners (>49 ft) have slightly higher maintenance and gear costs (\$14,520/year) compared to

**Table 7.—Monthly percentages of dockside revenues for red grouper or gag or black grouper caught with bottom longlines or buoy lines in the Gulf of Mexico, logbook data as of 11 April 2001.<sup>1</sup>**

| Year | Jan. | Feb. | Mar. | Apr. | May  | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|------|------|------|------|------|------|------|------|------|-------|------|------|------|-------|
| 1993 | 3.5  | 4.2  | 5.9  | 9.9  | 8.6  | 9.6  | 9.1  | 8.7  | 11.0  | 9.9  | 9.9  | 9.8  | 100.0 |
| 1994 | 6.4  | 12.5 | 10.8 | 7.3  | 7.6  | 9.1  | 7.4  | 7.7  | 8.0   | 7.6  | 6.4  | 9.1  | 100.0 |
| 1995 | 8.8  | 9.2  | 7.8  | 6.9  | 5.7  | 4.7  | 7.6  | 9.0  | 9.6   | 7.7  | 13.2 | 10.0 | 100.0 |
| 1996 | 8.4  | 9.6  | 6.1  | 8.0  | 7.0  | 7.6  | 5.9  | 6.9  | 8.6   | 7.2  | 12.0 | 12.7 | 100.0 |
| 1997 | 10.7 | 8.3  | 8.9  | 7.4  | 9.2  | 8.0  | 7.5  | 7.1  | 7.4   | 7.4  | 8.4  | 9.8  | 100.0 |
| 1998 | 9.5  | 8.4  | 9.1  | 9.5  | 9.3  | 8.3  | 7.4  | 6.9  | 4.8   | 6.7  | 9.3  | 10.9 | 100.0 |
| 1999 | 9.5  | 7.7  | 13.6 | 8.8  | 7.4  | 9.2  | 7.9  | 8.8  | 3.2   | 8.7  | 7.9  | 7.3  | 100.0 |
| 2000 | 9.0  | 8.4  | 11.2 | 8.8  | 10.1 | 5.5  | 4.3  | 3.1  | 3.4   | 12.9 | 11.7 | 11.6 | 100.0 |

<sup>1</sup> Source: Waters (see text footnote 11).

smaller longliners (36–49 ft) at \$10,000/year. Bandit-rigged vessel maintenance and gear costs range from \$6,000/year for vessels < 36 ft to \$8,796 for vessels 36–48 ft (key informant interviews; firm settlement sheet data). Based on other estimates, labor costs for longlining vessels are about 32% of total costs and sales expenses are 4% of total costs of the vessels (Porter et al., 2001:67).

Historically, there have been several fish dealers in Madeira Beach. During 1999 there were four fish houses, which bought almost 100% of the grouper and shark. One dealership closed between August 2000 and January 2001 when it was reopened by a new owner. In the interim, many of the vessels off-loaded their catches at the other dealers in Madeira Beach or sold to dealers who sent trucks to the area.

Fish dealers in Madeira Beach have costs attached to buying and reselling the fish including shipping costs which have several components in addition to labor: cardboard boxes at \$1.48 per box without a liner bag and \$1.60 with a liner bag, wooden boxes at \$3.00 per box, and truck and air freight charges. Almost all the truck services and drivers used in Madeira Beach are local, and the specialized shipping boxes are made in Avon Park, Fla.

Dealers provide vessels with a variety of services such as off-loading, moorage, and transportation at a flat rate per pound of fish. This rate is typically around 7% of the ex-vessel price which is consistent with other studies which show the following costs as percentages of total costs for longliners: dry-dock, 2%; moorage, 1%; insurance, 3%; and bookkeeping, 1%. Adding these costs to routine costs in Table 6 puts between \$6.4 and \$7.7 million in annual direct expenditures

into the Madeira Beach economy from the reef fish fleet.

There is vertical integration in this industry and differentiation of services offered by dealers in Madeira Beach. At least one dealer owns vessels, while another is integrated into seafood retail sales in restaurants. Yet another dealer sells to out-of-region markets in Chicago and New York, while another fillets about 90% of the catch off loaded to his dealership and sells to local restaurants. Another dealer specializes in sales to upscale restaurants in the area. One dealer has ownership interests in tackle replacement and repair. One market participant said that some species sell better in various locations such as deepwater grouper in the Canadian market (market participant interviews, 2000).

This integration and specialization is commonly observed in fisheries in various parts of the world. For example, canneries may own vessels or purchase catch on a contractual basis, and provide services such as bookkeeping, docking, and unloading. These contractual economic relationships typically smooth price fluctuations for consumers as well as for fishermen.

The area of the west coast of Florida around St. Petersburg and Tampa is well known for its grouper products. About 70% of all grouper landed in Madeira Beach is consumed within 40 miles, while 30% is “exported” to other parts of Florida, out of state, and a small percentage to Canada. The value added from ex-vessel to wholesale in this industry is about 20% with about another 55–75% value added from wholesale to retail depending on species (Hamilton et al., 1996). The fish dealers in Madeira Beach sell to at least 200 local restaurants and to >24 wholesale distributors who resell

to additional retail outlets. There are 26 other fish dealers permitted for grouper in Pinellas County besides those located in Madeira Beach (interviews; firm settlement sheet data, 2000). There are two major fish processors and a major fish distributor within a 30 min drive of Madeira Beach who buy and process fish for large retail buyers such as grocery stores and restaurant chains. The processing is low value-added such as filleting. The largest restaurant distributor in Florida, located south of Bradenton (Manatee County), distributes fish and seafood throughout Florida.

According to the market participants, prices are affected by supply, local tourist demand fluctuations, and the prices of close substitutes for grouper. The fluctuations in monthly percentage of revenues and landings of red and black grouper caught with longlines and with vertical gear in the Gulf of Mexico are given in Tables 7–10. The highest prices are often in spring and late fall during the tourist season but fluctuate over years and by gear. Without a full demand analysis, it is not clear which drives market prices more, demand or supply in a particular month.

In this market, there are a number of restaurants which specialize in serving grouper sandwiches or other grouper preparations on their menus. Some restaurant chefs claim that locally caught grouper has particular properties desired by their customers. These properties relate to texture and taste which consumers believe make grouper a “better eating” fish than others that might be considered substitutes. Local restaurants prefer shallow-water grouper which they say satisfies their customers. When asked what might be a substitute in consumption, no one could offer an idea. Several chefs and restaurant and grocery opera-

**Table 8.—Monthly percentages of pounds landed for red grouper or gag or black grouper caught with bottom longlines or buoy lines in the Gulf of Mexico, logbook data as of 11 April 2001.<sup>1</sup>**

| Year | Jan. | Feb. | Mar. | Apr. | May  | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|------|------|------|------|------|------|------|------|------|-------|------|------|------|-------|
| 1993 | 3.4  | 4.1  | 5.3  | 8.8  | 8.7  | 11.6 | 10.0 | 8.9  | 10.6  | 9.6  | 9.3  | 9.8  | 100.0 |
| 1994 | 5.9  | 11.5 | 9.6  | 6.7  | 8.8  | 10.7 | 8.0  | 7.7  | 8.1   | 7.5  | 6.2  | 9.2  | 100.0 |
| 1995 | 7.8  | 7.9  | 6.6  | 6.1  | 5.7  | 5.4  | 8.7  | 9.1  | 9.5   | 6.8  | 13.2 | 13.2 | 100.0 |
| 1996 | 8.2  | 9.8  | 5.8  | 7.1  | 7.0  | 8.6  | 6.5  | 6.8  | 8.3   | 6.8  | 12.3 | 12.8 | 100.0 |
| 1997 | 9.7  | 8.3  | 8.1  | 6.5  | 10.4 | 9.6  | 8.4  | 7.0  | 7.3   | 7.4  | 7.5  | 9.8  | 100.0 |
| 1998 | 8.6  | 8.0  | 8.0  | 8.4  | 9.3  | 9.4  | 7.9  | 7.1  | 4.7   | 7.3  | 9.0  | 12.4 | 100.0 |
| 1999 | 8.6  | 8.6  | 12.8 | 8.7  | 7.7  | 10.9 | 8.4  | 8.8  | 3.1   | 7.7  | 6.8  | 7.8  | 100.0 |
| 2000 | 8.9  | 7.8  | 10.3 | 7.9  | 10.2 | 6.7  | 4.9  | 3.5  | 3.7   | 13.0 | 11.9 | 11.1 | 100.0 |

<sup>1</sup> Source: Waters (see text footnote 11).

**Table 9.—Monthly percentages of dockside revenues for red grouper or gag or black grouper caught with vertical lines in the Gulf of Mexico, logbook data as of 11 April 2001.<sup>1</sup>**

| Year | Jan. | Feb. | Mar. | Apr. | May  | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|------|------|------|------|------|------|------|------|------|-------|------|------|------|-------|
| 1993 | 4.8  | 4.8  | 7.6  | 10.2 | 12.7 | 9.0  | 10.0 | 8.2  | 9.0   | 7.0  | 8.7  | 8.1  | 100.0 |
| 1994 | 7.3  | 7.6  | 10.9 | 10.3 | 9.0  | 8.4  | 8.8  | 9.1  | 9.1   | 6.5  | 5.7  | 7.2  | 100.0 |
| 1995 | 7.7  | 6.7  | 8.6  | 7.4  | 10.0 | 8.5  | 8.4  | 7.0  | 6.0   | 7.2  | 13.7 | 8.9  | 100.0 |
| 1996 | 9.1  | 10.2 | 5.4  | 9.2  | 9.2  | 7.8  | 5.6  | 6.7  | 7.4   | 8.6  | 9.9  | 10.9 | 100.0 |
| 1997 | 10.0 | 7.4  | 11.2 | 7.8  | 11.4 | 8.2  | 8.5  | 7.8  | 7.3   | 5.7  | 7.8  | 6.8  | 100.0 |
| 1998 | 10.4 | 7.8  | 9.1  | 7.8  | 9.4  | 6.7  | 6.2  | 5.3  | 6.2   | 12.5 | 11.1 | 7.4  | 100.0 |
| 1999 | 9.7  | 7.6  | 12.1 | 10.1 | 10.0 | 7.2  | 8.3  | 7.9  | 5.9   | 6.5  | 8.2  | 6.3  | 100.0 |
| 2000 | 6.4  | 7.2  | 8.9  | 8.1  | 11.2 | 8.3  | 6.6  | 7.2  | 6.7   | 12.1 | 7.9  | 9.4  | 100.0 |

<sup>1</sup> Source: Waters (see text footnote 11).

**Table 10.—Monthly percentages of pounds landed for red grouper or gag or black grouper caught with vertical lines in the Gulf of Mexico, logbook data as of 11 April 2001.<sup>1</sup>**

| Year | Jan. | Feb. | Mar. | Apr. | May  | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|------|------|------|------|------|------|------|------|------|-------|------|------|------|-------|
| 1993 | 4.7  | 4.6  | 7.0  | 9.2  | 12.7 | 10.4 | 10.9 | 8.6  | 8.9   | 6.9  | 8.1  | 7.8  | 100.0 |
| 1994 | 6.4  | 7.0  | 9.5  | 9.5  | 9.9  | 9.7  | 9.8  | 9.3  | 9.6   | 6.5  | 5.6  | 7.2  | 100.0 |
| 1995 | 6.8  | 5.7  | 7.4  | 6.5  | 10.2 | 9.6  | 9.9  | 7.4  | 6.1   | 6.2  | 13.2 | 11.0 | 100.0 |
| 1996 | 8.8  | 10.3 | 5.3  | 8.4  | 9.2  | 8.8  | 6.1  | 6.8  | 7.5   | 8.0  | 10.2 | 10.8 | 100.0 |
| 1997 | 9.3  | 7.3  | 10.2 | 7.1  | 12.2 | 9.5  | 9.9  | 8.0  | 7.2   | 5.7  | 7.0  | 6.5  | 100.0 |
| 1998 | 9.6  | 7.4  | 8.2  | 7.1  | 9.5  | 7.5  | 6.7  | 5.6  | 6.1   | 13.0 | 10.9 | 8.3  | 100.0 |
| 1999 | 8.8  | 8.2  | 11.1 | 9.9  | 10.4 | 8.4  | 9.2  | 8.3  | 6.0   | 5.9  | 7.3  | 6.6  | 100.0 |
| 2000 | 6.0  | 6.4  | 7.8  | 7.2  | 10.8 | 10.0 | 7.7  | 8.4  | 7.4   | 11.8 | 7.7  | 8.9  | 100.0 |

<sup>1</sup> Source: Waters (see text footnote 11).

tors suggested that red snapper might be a substitute, but that it was now difficult to get under the existing regulations. Grouper has a clear cultural value on the west coast of Florida, but there are no published estimates of the cross elasticity of demand between grouper and other available species or of the determinants of demand.

This description of the market for the grouper landed in Madeira Beach includes a number of economic variables for each level of the industry: harvesting, wholesale, and retail. With the industrial organization approach it is important to describe all levels of the industry and to identify the flow of the product and the economic relationships at each level of the market. For the empirical analysis in the next section, the research used the data from the harvesting level to derive the losses in employment and income for the whole market area.

### Economic Impact of a 1- and 2-Month Closure

The closure of the fishery from 15 February–15 March 2001 was the proposed management alternative adopted by the Gulf of Mexico Fishery Management Council in 1999 to be effective in spring of 2001 (Schirripa et al., 1999; GMFMC, 2001, 2002). The rationale was to provide some protection for spawning gag, red, and black grouper.

To trace the economic impacts of the closure in 2001, we used the industrial organization analysis from the previous section to direct the empirical calculation of lost employment and income. The landings data from the Madeira Beach vessel trip tickets were broken down by gear type and are presented in Table 11 for 1999 and in Table 12 for 2000. Using 2,000 catches during the 15 February–15 March period, the fleet would have lost

9.8% of catch and 11.1% of revenues from a 1-month closure. The 2000 landings are lower in part because one of the dealers died in August 2000, and the dealership did not reopen until January 2001. Not all of this dealer's catch was tracked to Madeira Beach.

To evaluate the direct and indirect impacts of a 1-month, a 2-month, and a complete closure on Madeira Beach and the impacted community, the lost revenues were run through a regional economic model. Direct impacts are those which are felt by the first level of the industry such as fishermen, dealers, and vessel owners. Indirect impacts are those which come about as a consequence of direct impacts. For example, when a fisherman loses a job, the grocery store where he/she buys food would feel an indirect impact from his/her reduction in spending.

The REMI model was run by the Tampa Bay Regional Planning Council



in Tampa, Fla. The model incorporates the economic history of the west central Florida area by county from 1969 to the present. A standard REMI model can have as many as 53 industries, 94 occupations, 25 final demand sectors, and 606 age/gender/racial cohorts linked by economic relationships. After the policy is entered (reduction in fish catch and revenues), the model solves for the resulting impact on various variables such as employment, prices, relative prices, wages, and population. All of the estimates reported here are based on entering into the model only losses directly experienced by the vessel owners, crew, and dealers in Madeira Beach. There are indirect impacts that would occur but which are not included here as losses. These might include job losses to restaurants, bait or tackle shops, or maintenance facilities.

The results from the REMI simulation for the 1-month closure using 1999 and 2000 data are given in Table 13. If the closure occurs for 1 month, 15 February–15 March, and remains in effect, the industry will lose between 232,002 and 278,789 pounds of catch valued at between \$613,119 and \$640,724. This closure is associated with the loss of 33 jobs annually and 319 jobs over a 10-year period. The 1-month closure results in personal income losses of around \$1 million per year in Pinellas County and totals \$10.4 million over a 10-year period (Table 14). Statewide, job losses from a 1-month closure for the 10-year period are 343, and personal income losses are over \$12 million.

The results from the REMI simulation for a 2-month closure for the period 15 February–15 April, using 1999 and 2000 data, respectively, are given in Table 14. If the closure occurs for 2 months and remains in effect, the industry will lose landings between 412,615 and 620,831 pounds valued at between \$1,159,529 and \$1,474,036. The 2-month closure is associated with the loss per year of about 70 jobs and over \$1.5 million in personal income. Over 10 years in Pinellas County, 671 jobs and \$21.6 million in personal income are lost (Table 14). Statewide, losses for the 10-year period from a 2-month closure are 721 jobs and \$26.1 million in personal income.

Table 11.—Commercial grouper catches and revenues by gear type landed in Madeira Beach, 1999.<sup>1</sup>

| Gear  | Shallow-water species <sup>2</sup> |              |                      | Deepwater species <sup>3</sup> |              |                      |
|---|------------------------------------|--------------|----------------------|--------------------------------|--------------|----------------------|
|   | Catch (lb)                         | Revenue (\$) | Ex-vessel price (\$) | Catch (lb)                     | Revenue (\$) | Ex-vessel price (\$) |
| Bandit                                      | 45,415                             | 112,050      | 2.47                 | 1,338                          | 1,764        | 1.32                 |
| Closure <sup>4</sup>                        | 3,355                              | 7,801        | 2.33                 | 24                             | 60           | 2.50                 |
| Longline                                    | 2,377,839                          | 5,399,025    | 2.27                 | 62,565                         | 162,555      | 2.60                 |
| Closure <sup>4</sup>                        | 239,472                            | 521,614      | 2.18                 | 3,559                          | 7,954        | 2.23                 |
| Hook and line                               | 261,970                            | 646,199      | 2.46                 | 2,237                          | 4,796        | 2.14                 |
| Closure <sup>4</sup>                        | 17,142                             | 41,943       | 2.45                 | 8                              | 18           |                      |
| Unknown gear                                | 98,056                             | 239,704      | 2.44                 | 9,257                          | 20,866       | 2.25                 |
| Closure <sup>4</sup>                        | 14,631                             | 32,282       | 2.21                 | 0                              | 0            | 0                    |
| Dive  | 12,251                             | 31,369       | 2.56                 |                                |              |                      |
| Closure <sup>4</sup>                        | 598                                | 1,447        |                      |                                |              |                      |
| Total                                       |                                    |              |                      |                                |              |                      |
| All gear                                    | 2,795,531                          | 6,428,347    | 2.32                 | 75,397                         | 189,981      | 2.52                 |
| Closure <sup>4</sup>                        | 275,198                            | 605,087      |                      | 3,591                          | 8,032        | 2.24                 |
| Closure percent of yearly                   | 9.8%                               | 9.4%         |                      |                                |              |                      |
| All gear, shallow and deep species combined | 2,870,928                          | 6,618,328    | 2.31                 |                                |              |                      |
| Closure <sup>4</sup>                        | 278,789                            | 613,119      | 2.20                 |                                |              |                      |
| Closure percent of yearly                   | 9.7%                               | 9.3%         |                      |                                |              |                      |

<sup>1</sup> Source: Florida Fish and Wildlife Commission and Madeira Beach dealer trip reports.

<sup>2</sup> Shallow-water groupers includes red, gag, black, yellowfin, yellowmouth, rock hind, red hind, scamp.

<sup>3</sup> Deepwater grouper includes misty, snowy, yellowedge, warsaw, speckled hind.

<sup>4</sup> Catches during 15 February–15 March, 1999 period used to approximate actual closures in 2001.

One-month closures from February to March will reduce catches by about 9.7% and annual revenues about 9–11%. A 2-month closure more than doubles these reductions such that a 2-month closure from 15 February through 15 April would result in about a 17–21% reduction in annual landings and a 20–23% reduction in annual revenues.

The implications of these reductions in revenues and employment rely on a number of factors which relate to the vulnerability or resilience of the industry as mentioned by McCay.<sup>3</sup> In this case, the consequences depend on 1) the fleet's ability, given existing regulations, to incur costs and switch to another species, gear, or fishery, 2) the impact on revenues and costs if the fleet displaces effort into time periods before or after the closure and causes prices to fall, 3) the wholesale market's ability to compensate for a 2-month supply interruption to restaurants and groceries without relying on imports, and 4) the ability of labor markets to respond to employment interruptions at all levels of the industry (harvest, wholesale, retail).

This industry, like all fresh food markets, operates at the ex-vessel (harvesting) level with a relatively small profit margin and a reduction in catches may move the harvesting and the wholesale sectors of the industry back and up along its long-

run cost curve to a position of higher costs. Unless the fleet is able to switch to another fishery, these costs may not be able to be reduced in the short run by expanding catches. Because of previous regulations, options for switching in this case seem relatively limited and might require relocation for a stable group of owners and crew. Even assuming costs remain constant, the closure could result in an overall reduction in revenues. If the fleet is able to displace effort into other time periods before or after the closure, the displacement still may not compensate with the same revenues as those lost during the closure. There are other constraints such as weather (hurricanes) and availability of stock which would constrain this mobility into other time periods.

Erosion of a small profit margin with declining revenues combined with a 2-month supply interruption leaves the market open to entry of imports. With a 2-month closure, fish suppliers may lose buyers to imports which would impair their long-term ability to recover. The established industry in Madeira Beach, and the market which serves predominantly the surrounding geographical area, may be completely restructured by these closures. The various sectors are integrated and have historical economic relationships which implies that

**Table 12.—Commercial grouper catches and revenues by gear type landed in Madeira Beach, 2000.<sup>1</sup>**

| Gear  | Shallow-water species <sup>2</sup> |              |                      | Deepwater species <sup>3</sup> |              |                      |
|---|------------------------------------|--------------|----------------------|--------------------------------|--------------|----------------------|
|   | Catch (lb)                         | Revenue (\$) | Ex-vessel price (\$) | Catch (lb)                     | Revenue (\$) | Ex-vessel price (\$) |
| Bandit  | 75,090                             | 171,738      | 2.29                 | 1,132                          | 2,803        | 2.48                 |
| Closure <sup>4</sup>                            | 4,929                              | 15,214       | 3.08                 | 0                              | 0            | 0                    |
| Longline  | 1,598,400                          | 3,845,930    | 2.41                 | 370,257                        | 966,858      | 2.61                 |
| Closure <sup>4</sup>                            | 165,712                            | 463,458      | 2.80                 | 28,357                         | 81,556       | 2.88                 |
| Hook and line                                   | 253,928                            | 634,978      | 2.50                 | 1,619                          | 3,455        | 2.13                 |
| Closure <sup>4</sup>                            | 20,419                             | 58,284       | 2.85                 | 114                            | 313          | 2.75                 |
| Unknown gear                                    | 65,233                             | 130,739      | 2.00                 | 3,363                          | 12,379       | 3.68                 |
| Closure <sup>4</sup>                            | 10,104                             | 16,204       | 1.60                 | 1,874                          | 4,839        | 2.58                 |
| Dive  | 8,659                              | 22,168       | 2.56                 | 120                            | 120          | 1.00                 |
| Closure <sup>4</sup>                            | 493                                | 856          | 1.80                 | 0                              | 0            |                      |
| Total   |                                    |              |                      |                                |              |                      |
| All gear  | 2,001,310                          | 4,805,553    | 2.40                 | 376,491                        | 985,615      | 2.62                 |
| Closure <sup>4</sup>                            | 201,657                            | 554,016      | 2.75                 | 30,345                         | 84,708       | 2.79                 |
| Closure percent of yearly                       | 10.1%                              | 11.5%        |                      |                                |              |                      |
| All gear, all shallow and deep species combined | 2,377,801                          | 5,791,168    | 2.44                 |                                |              |                      |
| Closure <sup>4</sup>                            | 232,002                            | 640,724      | 2.76                 |                                |              |                      |
| Closure percent of yearly                       | 9.8%                               | 11.1%        |                      |                                |              |                      |

<sup>1</sup> Source: Florida Fish and Wildlife Commission and Madeira Beach trip reports.  
<sup>2</sup> Shallow-water grouper includes red, gag, black, yellowfin, yellowmouth, rock hind, red hind, scamp.  
<sup>3</sup> Deepwater grouper includes misty, snowy, yellowedge, warsaw, speckled hind.  
<sup>4</sup> Catches during 15 February–15 March, 2000 period used to approximate actual closures in 2001.

**Table 13.—Summary of economic impacts of one month grouper closure on Madeira Beach.<sup>1</sup>**

| Item  | Pounds  | Revenue (\$) |
|---|---------|--------------|
| Direct Revenue Losses   |         |              |
| Estimates using 1999 landings (all gear)                                |         |              |
| 15 February–15 March  | 278,789 | 613,119      |
| 16 March–15 April   | 342,042 | 860,917      |
| Total   | 620,831 | 1,474,036    |
| Percent of total  | 21.6%   | 22.3%        |
| Estimates using 2000 landings (all gear)                                |         |              |
| 15 February–15 March  | 232,002 | 640,724      |
| 16 March–15 April   | 180,613 | 518,805      |
| Total   | 412,615 | 1,159,529    |
| Percent of total  | 17.4%   | 20%          |
| Direct employment losses from one month closure <sup>2</sup>            |         |              |
| 33 Full-time jobs per year <sup>3</sup>                                 |         |              |
| Indirect effects on Pinellas County from one month closure <sup>2</sup> |         |              |
| Employment loss over ten years: 319 jobs <sup>4</sup>                   |         |              |
| Personal income losses over ten years: \$10.4 million                   |         |              |

<sup>1</sup> Source: Compiled from data in Tables 11, 12, and REMI model output.  
<sup>2</sup> Based on REMI computer model of west central Florida.  
<sup>3</sup> Based on 441 vessel, crew, and fish dealer employees losing 1-month employment.  
<sup>4</sup> Over 340 jobs are lost when effects are considered statewide over 10 years.

**Table 14.—Ten-year impacts on employment and personal income in Pinellas County and the state of Florida from 1-month, 2-month, or 12-month closures of the grouper fishery in Madeira Beach.**

| Closure period                | Impact |        |        |        |        |        |        |        |        |         |
|-------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
|                               | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 |
| One month closure             |        |        |        |        |        |        |        |        |        |         |
| Pinellas County               |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 33.0   | 32.5   | 32.0   | 31.7   | 31.4   | 31.2   | 31.4   | 31.7   | 32.0   | 32.4    |
| Personal income (Millions \$) | 0.7    | 0.8    | 0.9    | 0.9    | 1.0    | 1.1    | 1.1    | 1.2    | 1.3    | 1.4     |
| State of Florida              |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 35.2   | 35.2   | 35.2   | 34.2   | 33.2   | 32.2   | 36.1   | 34.2   | 34.2   | 33.2    |
| Personal income (Millions \$) | 0.9    | 1.1    | 1.1    | 1.1    | 1.2    | 1.2    | 1.3    | 1.3    | 1.6    | 1.6     |
| Two month closure             |        |        |        |        |        |        |        |        |        |         |
| Pinellas County               |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 69.5   | 68.4   | 67.4   | 66.7   | 66.1   | 65.8   | 65.9   | 66.5   | 67.0   | 67.8    |
| Personal income (Millions \$) | 1.4    | 1.6    | 1.8    | 2.0    | 2.1    | 2.2    | 2.4    | 2.5    | 2.7    | 2.9     |
| State of Florida              |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 75.2   | 74.2   | 73.2   | 71.3   | 70.3   | 70.3   | 72.3   | 71.3   | 71.3   | 72.3    |
| Personal income (Millions \$) | 1.8    | 2.1    | 2.3    | 2.4    | 2.6    | 2.6    | 2.8    | 2.9    | 3.2    | 3.4     |
| Twelve month closure          |        |        |        |        |        |        |        |        |        |         |
| Pinellas County               |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 339.4  | 334.0  | 329.2  | 325.2  | 322.4  | 321.5  | 322.3  | 324.7  | 327.1  | 331.4   |
| Personal income (Millions \$) | 6.9    | 8.0    | 8.9    | 9.6    | 10.2   | 10.9   | 11.6   | 12.3   | 13.1   | 14.0    |
| State of Florida              |        |        |        |        |        |        |        |        |        |         |
| Employment                    | 367.2  | 362.3  | 355.5  | 348.6  | 345.7  | 343.8  | 345.7  | 346.7  | 349.6  | 353.5   |
| Personal income (Millions \$) | 8.7    | 10.2   | 11.1   | 11.8   | 12.5   | 13.1   | 13.9   | 14.7   | 15.6   | 16.5    |

changes in one sector will be felt in the other sectors. With restructuring, one or another sector of the industry (harvesting, wholesale) may no longer be profitable under the new condition.

If the industry in Madeira Beach could not recover, we estimated the loss from a 12-month or complete closure of the industry comprised of the vessels, crew, and dealers. These results are given in Table 14. A complete closure in Madeira Beach would result in losses to Pinellas

County of 339 jobs per year and \$6.9 million in personal income. Over 10 years, the losses would be 3,275 jobs and \$105 million in personal income. Statewide, losses for a 12-month closure would be 367 jobs the first year and over 10 years, 3,518 jobs and \$128 million in personal income.

**Conclusion**

This analysis provides new information for evaluation of community

impacts of reef fish regulation in the Gulf of Mexico. The analysis provides an empirical estimate of the degree of disruption of economic relationships that might occur in the harvesting sector of the industry. The industrial organization approach provides information about the location of the disruptions relative to the level of the industry as well as, in this case, the geographical location.

The paper also points to additional research that could provide an even

deeper profile of fishery-related activity in Madeira Beach. That research might include demand analysis, anthropological assessment of industry relationships, and exploration of the role of imports, previous regulations, and different types of gear on this market.

### Acknowledgments

Thanks to Kristy M. Mattice who co-authored an earlier paper on this topic and participated in the interview phase of the project, A. Wynne and J. McGuinness at Tampa Bay Regional Planning Council, Michelle Zacks who assisted on related research, Linda O'Bryant for administrative support, and the anonymous reviewers who added a great deal of value to this paper with their careful reading and responses.

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