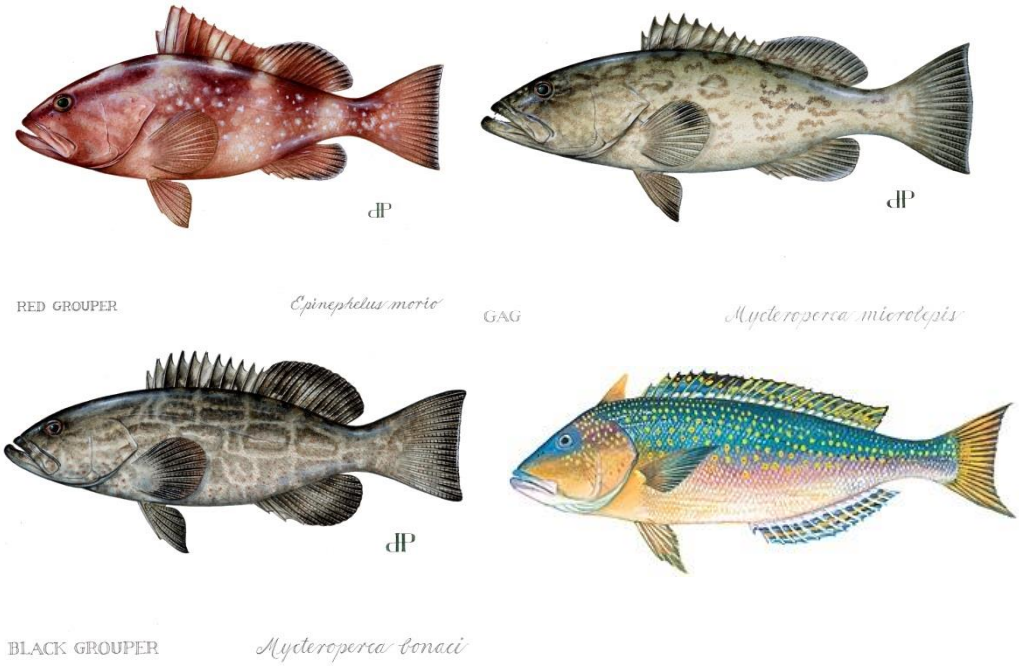
Grouper-Tilefish Individual Fishing Quota Program 5-year Review



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ABBREVIATIONS USED IN THIS DOCUMENT

ACL	annual catch limit
ALS	Accumulated Landings System
AM	accountability measure
BLL	bottom longline
CLB	Coastal Logbook
Council	Gulf of Mexico Fishery Management Council
CPUE	catch per unit effort
CSF	cross species flexibility
CSP	Catch share program
CS Policy	Catch Share Policy
CSVI	community social vulnerability indicators
CU	capacity utilization
DWG	Deepwater grouper
DWH	Deepwater Horizon (oil spill)
EFH	Essential Fish Habitat
EU	excess capacity
FMP	Fishery management plan
FTE	full-time equivalent
FWC	Florida Fish and Wildlife Conservation Commission
GDP	Gross Domestic Product
GG	gag grouper
GGM	gag grouper multiuse
GSAD	Gulf and South Atlantic Dealer
GT	grouper-tilefish
GT-IFQ	Grouper-Tilefish Individual Fishing Quota
Guidance	Guidance for Conducting Reviews of Catch Share Programs
Gulf	Gulf of Mexico
gw	gutted weight
HAPC	Habitat areas of particular concern
HHI	Herfindahl-Hirschman Index
IFQ	Individual fishing quota
ITQ	Individual transferable quota
JEA	Joint Enforcement Agreement
LAPP	limited access privilege program
LASAF	Limited Access System Administration Fund
LKE	Lowest known entity
LL	longline
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MES	minimum efficient scale
mp	million pounds
MSY	maximum sustainable yield
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OC	over capacity
OLE	Office of law enforcement
OSWG	other shallow water grouper
OY	Optimum yield
PCFA	principal components factor analysis
PIN	Personal identification number
pw	product weight
RA	Regional Administrator
Reef Fish FMP	Fishery Management Plan for Reef Fish Resource of the Gulf
RFOP	Reef Fish Observer Program
RG	Red grouper
RGG	Red grouper and gag grouper combined
RGM	Red grouper multiuse
RL	related accounts
RQ	Regional quotient
RS	Red Snapper
RS-IFQ	Red Snapper Individual Fishing Quota
SBA	Small Business Administration
SDF	stochastic distance frontier
Secretary	Secretary of Commerce
SEDAR	Southeast Data, Assessment, and Review
SEFSC	Southeast Fisheries Science Center, NMFS
SEP	Socioeconomic Panel
SERO	Southeast Regional Office, NMFS
SMZ	Special management zone
SOI	segments of interest
SWG	Shallow water grouper
TAC	Total allowable catch
TE	technical efficiency
TF	Tilefish
TL	Total length
USCG	United States Coast Guard
VL	vertical line
VMS	Vessel monitoring system
ww	whole weight

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EXECUTIVE SUMMARY

This review evaluates the progress of the Grouper-Tilefish Individual Fishing Quota (GT-IFQ) program towards achieving the stated goals to rationalize effort and reduce overcapacity of the grouper-tilefish fishing fleet to achieve and maintain optimum yield in these multi-species fisheries. By rationalizing effort, the GT-IFQ program was expected to mitigate some of the problems resulting from derby fishing conditions or at least to prevent the condition from becoming more severe. Further, reducing overcapacity was expected to improve profitability of commercial fishermen who target grouper and tilefish. According to the Magnuson-Stevens Act, a formal and detailed review is required 5 years after the implementation of the program and thereafter no less than once every 7 years. To analyze the program's progress data was obtained from a variety of sources, particularly the GT-IFQ database and annual report, the Southeast Fisheries Science Center's coastal logbook, accumulated landings system, and reef fish observer programs, various economic surveys, and surveys of GT-IFQ participants. Analysis of the program was conducted in accordance of the Guidance for Conducting Review of Catch Share Programs procedural directive. Analyses were broken down into several elements including: Data collection and reporting, Allocations, Transferability and caps, New entrants, Catch and sustainability, Monitoring and enforcement, Administration and cost recovery, and Duration of privileges and subsequent distributions. In addition, this review highlights recommendations provided by the Council's Scientific and Statistical Committees and Advisory Panels. In general, the program has been relatively successful in achieving its stated objectives, although there is still room for further achievement, particularly with respect the overcapacity, discard mortality, and price reporting.

CHAPTER 1. INTRODUCTION AND BACKGROUND

This review is intended to evaluate progress made in meeting the goals of the Grouper-Tilefish Individual Fishing Quota (GT-IFQ) program. The review does not attempt to comprehensively evaluate management of the reef fish fishery or the grouper-tilefish segment of the reef fish fishery. The Gulf of Mexico Fishery Management Council (Council) is required by law to review the GT-IFQ program after 5 years and thereafter every 5 to 7 years. The review provides an overview of the commercial harvest of grouper and tilefish species before and after GT-IFQ program implementation, discusses social, economic, and biological trends as they relate to GT-IFQ program management, and offers conclusions and recommended changes to the program based on this review. Data and information contained in this report were obtained from a variety of sources including, but not limited to peer-reviewed literature, the GT-IFQ online data collection system, the Southeast Fisheries Science Center (SEFSC) reef fish observer program, the SEFSC coastal logbook program, SEFSC accumulated landings system, National Institute of Occupational Safety and Health, various social and economic studies, and surveys of GT-IFQ stakeholders. This report constitutes the findings of the Council and their comprehensive review of the GT-IFQ program.

1.1 Legal Requirements and Guidance for the Review

The National Marine Fisheries Service (NMFS) published the Guidance for Conducting Reviews of Catch Share Programs (Guidance) in 2017 (NMFS 2017).[1] This Guidance is based on the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as well as other agency guidance in the National Oceanic and Atmospheric Administration's (NOAA) Catch Share Policy (CS Policy)[2] and The Design and Use of Limited Access Privilege Programs (LAPPs) (Anderson and Holliday 2007).[3] The goals of the Guidance are to ensure these reviews meet statutory requirements, are generally consistent across the country, and are carried out in a transparent, efficient, and effective manner. The objectives of the Guidance are to specify the process that should be followed, the elements a review should contain, and the program components that should be addressed when completing a review.

The Magnuson-Stevens Act specifies that fishing privileges established under LAPPs are not permanent and may be revoked, limited, or modified at any time. If a program is meeting its stated objectives, then it will likely be continued. However, the Council reserves the right to terminate or modify a program for cause, including if the system is found to have jeopardized the sustainability of the stock or the safety of fishermen. The review provision specified by the Magnuson-Stevens Act requires the Council to evaluate the effectiveness of the program and determine whether it should be modified, extended, or terminated. More specifically, the Magnuson-Stevens Act 303A(c)(1)(G) requires the Council and Secretary of Commerce (Secretary) to:

[1] http://www.nmfs.noaa.gov/op/pds/index.html
[2] http://www.nmfs.noaa.gov/sfa/management/catch_shares/about/documents/noaa_cs_policy.pdf
[3] http://spo.nmfs.noaa.gov/tm/tm86.pdf

> *"include provisions for the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and this Act, and any necessary modification of the program to meet these goals, with a formal and detailed review 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but not less frequently than once every 7 years);"*

The initial review should commence no later than 5 years after the program was implemented. The Magnuson-Stevens Act does not preclude an earlier review, but it is not recommended because it takes time for program participants and related entities (e.g., dealers/first receivers, processors, bait/tackle shops, etc.) to adjust to a new program. In turn, there will be a lag between when those behavioral adjustments occur and when these changes can be discerned, analyzed, and understood. The Councils and NMFS should also follow any timelines for additional program reviews specified by the Fishery Management Plan (FMP) or FMP amendments (hereinafter collectively referred to as "FMP") that created or modified the program. All subsequent reviews should coincide with scheduled Council review of the relevant FMP, but no less frequently than once every 7 years.

The review is considered a Council document. Once a review is completed, the results are to be submitted to the Council for approval and NMFS for concurrence that the review meets the requirements of the Magnuson-Stevens Act and is consistent with the Guidance.

The initial review of a program should compare and analyze the fishery before and after the program's implementation, to the extent data prior to the program's implementation are available. Best available scientific information should be used for the review. If quantitative analyses are not available, qualitative assessments may suffice. The review of a Catch Share Program (CSP) is a retrospective evaluation of an established program. Thus, rather than analyzing the program's expected effects, as is done in the implementing FMP, the task in a review is to describe and analyze the effects that have actually taken place since the "baseline" time period prior to the CSP's implementation, or since the program's implementation. Therefore, Councils need to consider an appropriate baseline for comparison. A baseline period of at least 3 years is preferable, but this may be modified depending on circumstances surrounding the creation and implementation of each program. Even if pre-program data are somewhat limited, the review should describe and analyze any changes that have taken place since the program's implementation, with a general focus on performance trends over that time rather than performance in a specific year.

The review should contain the following eight elements. If a Council determines that one or more of these elements is not applicable to a specific review, the Council should document its rationale for not conducting a more formal analysis of that element. The eight elements are:

1) purpose and need of the review (discuss legal/policy requirements);

2) goals and objectives of the program, the FMP, and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act);

3) history of management, including a description of management prior to the program's implementation, a description of the program at the time of implementation (including enforcement, data collection, and monitoring), and any changes made since the program's implementation or the previous review (including an explanation of why those changes were made);

4) a description of biological, ecological, economic, social, and administrative environments before and since the program's implementation;

5) an analysis of the program's biological, ecological/environmental, economic, social, and administrative effects;

6) an evaluation of those effects with respect to meeting the goals and objectives (i.e., program performance), including a summary of the conclusions arising from the evaluation;

7) a summary of any unexpected effects (positive or negative) which do not fall under the program's goals and objectives; and

8) identification of issues associated with the program's structure or function and the potential need for additional data collection and/or research.

In general, the review should use as holistic an approach as possible given available data and resources. Interdependencies between related fisheries and programs can generate spillover effects that may be unexpected or unintended. When this occurs and it is difficult to separate the effects of the CSP under review from the effects of other programs or management measures in other fisheries, these programs or fisheries should be considered together. Councils should determine if analyzing the CSP under review will likely mischaracterize the program's performance, and the program's effects on human communities, fish stocks, and the ecological communities/environment. In instances where two or more CSPs are found to have significant interdependencies, joint program reviews would likely lead to a more holistic approach and thus a more valid analysis, as well as reduce the administrative costs associated with conducting separate reviews.

1.2 Pre-IFQ Management of Grouper and Tilefish

Quotas

A total grouper commercial quota of 11 million pounds whole weight (mp ww) was implemented in 1990 through Amendment 1 to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico (Reef Fish FMP). This quota was divided into a shallow-water grouper (SWG)

quota (9.2 mp ww) and deep-water grouper (DWG) quota (1.8 mp ww). The shallow-water quota was increased to 9.9 mp ww in 1991 and decreased to 9.8 mp ww in 1992 through two regulatory amendments and the 9.8 mp ww quota stayed in effect through 2003 (Table 1.2.1). In 2004, both the shallow-water and deep-water quotas were decreased and a red grouper quota of 5.31 mp gutted weight (gw) was imbedded in the 8.8 mp gw shallow-water quota. In addition, a 0.44 mp gw quota was established for tilefish (TF). These measures were implemented through Secretarial Amendment 1 to the Reef Fish FMP.

Through Amendment 30B (GMFMC 2008), a rebuilding plan for gag was implemented in 2009 in response to an overfished condition and established a gag quota within the shallow-water quota. The amendment also set the commercial red grouper quota at 5.75 mp gw and established an 'other shallow water grouper' quota of 0.41 mp gw, which was the average landings for these species for the baseline years of 2001-2004. The shallow-water quota was the sum of the red grouper, gag, and other SWG species quotas.

Table 1.2.1. Commercial quotas (mp gw) and season length for GT-IFQ program share categories prior to program implementation. GG was included in the SWG quota until 2009 and RG was included in the SWG quota until 2004. A TF quota was not implemented until 2004.

Year	SWG Quota	GG Quota	SWG Days Open	RG Quota	RG Days Open	DWG Quota	DWG Days Open	TF Quota	TF Days Open
1990	7.80	*	311	*	311	1.35	365	n/a	365
1991	9.44	*	365	*	365	1.35	365	n/a	365
1992	9.35	*	366	*	366	1.35	365	n/a	365
1993	9.35	*	365	*	365	1.35	365	n/a	365
1994	9.35	*	365	*	365	1.35	365	n/a	365
1995	9.35	*	365	*	365	1.35	365	n/a	365
1996	9.35	*	366	*	366	1.35	365	n/a	365
1997	9.35	*	365	*	365	1.35	365	n/a	365
1998	9.35	*	365	*	365	1.35	365	n/a	365
1999	9.35	*	320	*	320	1.35	365	n/a	365
2000	9.35	*	320	*	320	1.35	365	n/a	365
2001	9.35	*	320	*	320	1.35	365	n/a	365
2002	9.35	*	320	*	320	1.35	365	n/a	365
2003	9.35	*	320	*	320	1.35	365	n/a	365
2004	8.80	*	319	5.31	275	1.02	196	0.44	365
2005	8.80	*	282	5.31	320	1.02	174	0.44	325
2006	8.80	*	365	5.31	320	1.02	174	0.44	203
2007	8.80	*	365	5.31	320	1.02	153	0.44	108
2008	8.80	*	366	5.31	320	1.02	131	0.44	130
2009	0.41	1.32	365	5.75	320	1.02	178	0.44	135

Size limits
Through Amendment 1 (GMFMC 1989), a 20-inch minimum size limit was implemented for red grouper, gag, black grouper, yellowfin grouper, and Nassau grouper (Figure 1.2.1). Minimum size limits were not put in place for other species of grouper managed under the FMP. A 16-inch minimum size limit was put in place in 1999 for scamp. In more recent years, revisions in the size limit have been made for gag, black grouper, and red grouper. The reductions in the minimum size limit for gag and red grouper were put in place to reduce the number of discards.

DWG species and TF do not have minimum size limits because of the deeper depths where they are caught. Any fish brought up from those depths are likely to suffer from lethal barotrauma. There is no conservation benefit of releasing fish that will die.

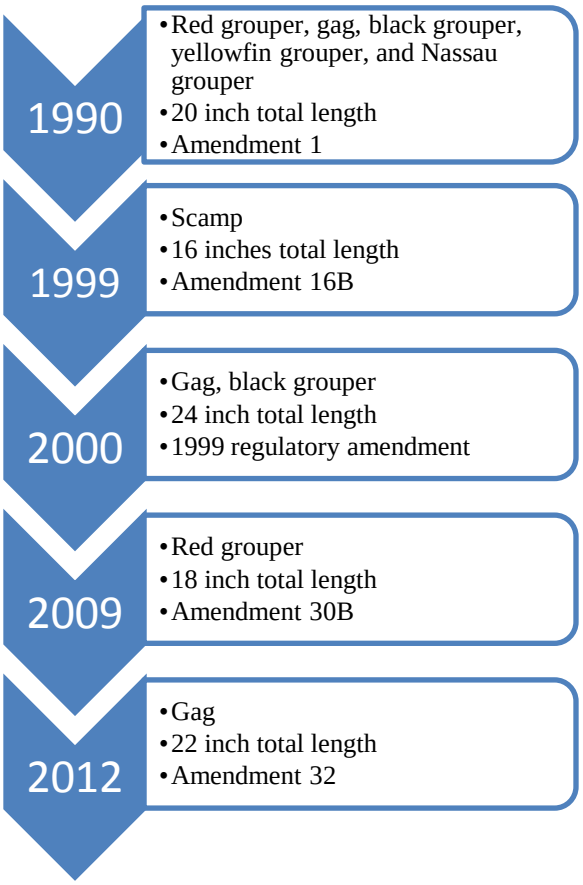

Figure 1.2.1. Minimum size lengths and regulatory vehicles for commercially caught groupers.

Trip limits
Trip limits were applied to shallow-water and deep-water groupers for only 2 years. In 2004, commercial fishing for SWGs and DWGs closed prior to the end of the fishing year. Fishing for DWGs closed on July 15, 2004, and fishing for SWGs closed on November 15, 2004. In

November 2004, representatives of the commercial sector fishing for grouper requested an emergency rule to establish trip limits for the 2005 fishing year. The trip limit was initially set at 10,000 lbs gw. If the fleet was estimated to have landed more than 50% of either the shallow-water or the red grouper quota on or before August 1, then a 7,500-lb gw trip limit would take effect; and if the sector was estimated to have landed more than 75% of either the shallow-water or the red grouper quota on or before October 1, then a 5,500-lb gw trip limit would take effect. These trigger points were reached on July 9, 2005, and August 4, 2005, respectively. Commercial fishing for SWGs was closed on October 10, 2005. Fishing for DWGs was closed on June 23, 2005, as NMFS determined the 1.02 mp gw quota had been caught. A framework action, implemented January 1, 2006, established a 6,000-lb gw aggregate shallow-water and deep-water groupers combined trip limit for the commercial sector's grouper harvest, replacing the 10,000/7,500/5,500 step-down trip limit that had been implemented by the emergency rule. This trip limit, along with other measures, kept SWG fishing open for the 2006 fishing year. In the subsequent years until the GT-IFQ program began in 2010, management measures kept commercial SWG fishing open until the end of the fishing year. For DWG, the trip limits were less effective with fishing for DWGs closing on June 27, 2006, June 2, 2007, and May 10, 2008 (although the fishing season was reopened on November 1, 2008, when it was determined the 2008 quota had not been caught). All trip limits were terminated with the start of the GT-IFQ program.

Season closures

With the exception of 1990 when fishing for grouper closed on November 8, fishing for shallow-water and deep-water groupers remained open for the entire year until 1999. In 1999, a framework action was implemented that established a February 15 – March 15 closure to protect grouper spawning aggregations. This closure continued through 2008, after which the GT-IFQ program began.

SWG and DWG quota closures are discussed under trip limits above. For tilefish, quota closures began in 2005 and continued through 2008. Tilefish quota closures were as follows: November 21, 2005; July 22, 2006; April 18, 2007; and May 10, 2008 (although the fishing season was reopened on November 1, 2008, after it was determined the 2008 quota had not been caught).

Permit Requirements

Commercial reef fish permits were established through Amendment 1 in 1990. Amendment 4 established a moratorium on the issuance of new reef fish permits for a maximum period of 3 years. This moratorium was extended in Amendments 9 (implemented in 1994), 11 (implemented in 1996), and 17 (implemented in 2000). It was extended indefinitely in 2005 through Amendment 24. Rulemaking from Amendment 14, implemented in 1997, provided for a 10-year phase-out for the fish trap fishery; allowed transfer of fish trap endorsements for the first 2 years, and prohibited the use of fish traps west of Cape San Blas, Florida.

Two different endorsements have been needed for certain types of reef fish fishing. In 1994, a fish trap endorsement was implemented and fishermen had to show landings from fish traps between January 1, 1991 and November 19, 1992, to qualify for the endorsement. This endorsement was phased out in 2007 when fish traps were no longer considered an allowable gear type. In response to sea turtle interactions with bottom longline gear, a longline

endorsement for vessels fishing in the eastern Gulf was implemented in 2010. Endorsements were given to permit holders whose vessels had average annual reef fish landings of 40,000 lbs gw or more from 1999 through 2007.

1.3 GT-IFQ Program Description

1.3.1 IFQ Goals and Objectives

According to Section 303A(c)(1)(G) of the Magnuson-Stevens Act, a primary goal of the review is to assess progress in meeting the goals of the program and the Magnuson-Stevens Act. NOAA's CS Policy indicates it is necessary to examine objectives as well, including those of the FMP. Thus, the goals and objectives in this case include those identified in the implementing Amendment, the FMP, the CS Policy, and the Magnuson-Stevens Act, particularly those specific to LAPPs, though the primary focus should be on those identified in the implementing Amendment. The goals and objectives of the Amendment and FMP should be evaluated with respect to whether they are clear, measurable (at least qualitatively[4]), achievable (i.e., are two or more objectives mutually exclusive?), and still appropriate under the current circumstances. Fishery performance changes over time, and for other reasons than the effects of the program or other management measures. Such changes should be taken into account when evaluating the efficacy of the original goals and objectives. If certain goals and objectives are found not to be clear, measurable, achievable, and/or still appropriate, the review should note deficiencies for the Council to address. Thus, one specific purpose of the reviews is to encourage Councils and NMFS to clearly identify specific performance standards that can be used in assessing whether, or to what extent, the goals and objectives have been met.

If the program is performing as expected at the time of implementation, then the various goals and objectives either should have been achieved or substantial progress should have been made towards achieving them. If the analysis concludes otherwise, such conclusions may serve as the basis for future changes to the program.

The multi-species GT-IFQ program was implemented to rationalize effort and reduce overcapacity in the commercial grouper and tilefish fishing fleets in order to achieve and maintain optimum yield (OY) in these multi-species fisheries. By rationalizing effort, the GT-IFQ program was expected to mitigate some of the problems resulting from derby fishing conditions or at least to prevent the condition from becoming more severe. Further, reducing overcapacity was expected to improve profitability of commercial fishermen who target grouper and tilefish. Implemented January 1, 2010, anticipated benefits of the program include: increased market stability; elimination of quota closures; increased flexibility for fishing operations; cost-effective and enforceable management; improved safety at sea; reduction in bycatch; and balancing of social, economic, and biological benefits.

[4] For example, qualitative objectives that provide a direction of the desired change may be used when quantitative objectives that provide explicit details on the magnitude of the change are not possible.

In addition to the specific goals of the GT-IFQ program, section 303A(c)(1) of the Magnuson-Stevens Act established goals specific to LAPPs, which include:

- assist in rebuilding if established for one or more species that are subject to overfishing or are overfished,
- contribute to reducing overcapacity if established in a fishery where overcapacity exists,
- promote fishing safety,
- promote fishery conservation and management , and
- promote social and economic benefits.

Given that the program has been in place for several years, the Council should use this review to evaluate 1) whether the original goals of the program have been met or if further progress is needed toward achieving the goals, and 2) should new goals be added to address changes in the fishery that have come about as a result of the IFQ programs. This review also allows an opportunity for further clarification of goals and objectives. For example, a Council may have indicated that a goal of the program is to reduce overcapacity. Such a goal tells the review team the direction of the desired change in overcapacity, but not the magnitude of the desired change. For example, a goal is to reduce overcapacity, and the Council may determine from the results of this review to define a desired capacity in the program or for the reef fish fishery as a whole. If the Council actually intended to indicate that its goal was to eliminate overcapacity, then the goal needs to be clarified. If it has a particular target level of capacity reduction in mind, or alternatively a particular level of harvesting capacity, then that level should be stated explicitly.

The GT-IFQ program has fundamentally changed the way fishing for IFQ-managed species is conducted. Goals and objectives might need to be modified to because of these changes. For example, would further reductions in overcapacity be consistent with the goal to reduce discards and bycatch if multi-species reef fish fishermen are not able to obtain quota for incidentally caught IFQ-managed species? Due to the multi-species nature of the reef fish fishery, many commercial trips (especially bandit boats) are targeting an array of species. Without available quota, discard mortality may be an increasing concern. Reducing overcapacity has the effect of reducing the number of vessels engaged in the fishery, which may also lead to a decrease in employment. The Council should weigh these concerns in light of the review and determine if changes or further direction is needed in the goals and objectives of the program. This review will also highlight other areas of concern, such as access to shares and allocation, new entrants, changing behavior or relationships, distributional issues, and continuing inefficiencies in the fishery.

1.3.2 IFQ Design and Structure

Development of the GT-IFQ program began in 2008, when a majority of eligible voters supported the formation of the GT-IFQ program through a referendum. Eligible voters were commercial Gulf reef fish permit holders having annual average grouper and tilefish landings of

at least 8,000 lbs during 1999-2004. During 2008, the Council developed Amendment 29[5] to the Reef Fish FMP, outlining the key components of the GT-IFQ program. In January 2009, the Council approved Amendment 29 by a vote of 14 to 3. Amendment 29 was approved by NMFS in July 2009. Implementation of the program began in fall 2009 and the first fishing year of the program began on January 1, 2010. Initial shares were issued based on the amount of grouper-tilefish logbook landings reported under each entity's (unique individual[s] and/or corporations) qualifying permit from 1999 through 2004, with an allowance for dropping one year of landings. There were 766 GT-IFQ shareholder accounts created based on the number of entities that qualified for initial shares in one or more share category. For the first 5 years of the program, shares and allocation could only be sold to and fished by an entity that held a valid commercial Gulf reef fish permit and had an active GT-IFQ online account. Beginning January 1, 2015, all U.S. citizens and permanent resident aliens were eligible to purchase GT-IFQ shares and allocation, although a valid Gulf reef fish permit was still required to harvest, possess, and land any IFQ managed species.

The GT-IFQ program began with five different GT-IFQ share categories for 17 species: DWG, gag grouper (GG), red grouper (RG), other SWG, and (TF) (Table 1.3.2.1). DWG included the following species: snowy grouper, speckled hind, warsaw grouper, yellowedge grouper, and misty grouper. SWG included black grouper, scamp, yellowfin grouper, yellowmouth grouper, rock hind, and red hind. TF included blueline tilefish, golden tilefish, goldface tilefish, anchor tilefish, and blackline tilefish. GG only has gag, while RG only has red grouper. In 2012, the following species were removed from the IFQ program: rock hind, red hind, misty grouper, anchor tilefish, and blackline tilefish. Each GT-IFQ share category has distinct shares and associated allocations. Shares are a percentage of the commercial quota, while allocation refers to the actual poundage that is possessed, landed, or transferred during a given calendar year. At the beginning of each year, allocation is distributed to GT-IFQ shareholder account. The amount allocated to an account is based on the share percentages of the annual quota held by a GT-IFQ shareholder. Allocation can then be used to harvest GT-IFQ species or sold to another valid shareholder account. Adjustments in quota can occur if the status of a stock changes as a result of new assessments or through the reallocation of quota between fishing sectors. An in-season increase in quota is distributed proportionately among shareholder accounts based on the percentage of shares each account holds at the time of the adjustment. All units of allocation and landings are in lbs gw.

Table 1.3.2.1 GT-IFQ species by share category

IFQ Category	Species[1]
Gag (GG)	Gag[2]
Red grouper (RG)	Red grouper[2]
Deep-water grouper (DWG)	Snowy grouper
	Speckled hind[2]
	Warsaw grouper[2]
	Yellowedge grouper

[5] http://sero.nmfs.noaa.gov/sf/pdfs/Amendment%2029%20Final%20Rule.pdf

Other shallow-water grouper (SWG)	Black grouper
	Scamp[2]
	Yellowfin grouper
	Yellowmouth grouper
Tilefishes (TF)	Blueline tilefish (grey)
	Golden tilefish
	Goldface Tilefish

[1] The following species were removed in 2012: rock hind (SWG), red hind (SWG), misty grouper (DWG), anchor tilefish (TF), and blackline tilefish (TF).
[2] Includes a multi-use flexibility measure.

The GT-IFQ program uses an online system, where all transactions are completed through a web-based portal maintained in NMFS' Southeast Regional Office (SERO). The Southeast Catch Share Program portal[6] also houses the Red Snapper IFQ (RS-IFQ) Program (2007 – current), the Bluefin Tuna Individual Bycatch Program (2015 – current), and the Headboat Collaborative program (2014 – 2015). Participants in the GT-IFQ program use an online account for all transactions including share and allocation transfers, landings, and cost recovery fee payment. Each account has its own unique user identifier and password.

There are three main account types in the GT-IFQ online system: shareholder, vessel, and dealer accounts. Shareholder accounts may hold shares and allocation or just hold allocation. These accounts are the main way in which fishermen interact with the web-based system. Shareholder accounts can transfer shares and allocation, submit landing notifications, as well as view associated vessel accounts and activity ledgers (i.e., share ledger, allocation ledger, landing ledger). Vessel accounts belong to shareholder accounts and may hold allocation; they do not hold shares. There may be multiple vessel accounts associated with one shareholder account. A vessel account is linked to a Gulf of Mexico (Gulf) commercial reef fish permit. Any vessel account without an associated reef fish permit may not be used to harvest IFQ species. Sufficient allocation must be in the vessel account prior to completing the landing transaction. Upon completion of a landing transaction, the GT-IFQ online system deducts the allocation from the vessel account. Dealer accounts are associated with federal dealer permit holders. Prior to August 7, 2014, the federal dealer permit was the Gulf reef fish dealer permit; afterwards the federal permit became the Gulf and South Atlantic Dealer (GSAD) permit. Dealers are limited to initiating and completing landing transactions and paying the allocation holder's cost recovery fees. All GT-IFQ dealers are required to have a Gulf IFQ endorsement, which may be printed through their IFQ account. A printed copy of the IFQ dealer endorsement must accompany vehicles used to transport IFQ species on land. Endorsements are valid when a dealer's permit is active and the dealer has submitted all collected cost recovery fees to NMFS.

Each shareholder account is composed of a unique set of entities (single or combination of individuals and/or business) and no two accounts may be composed of the same set of entities. A unique entity may be a single person or business, or a combination of people and/or businesses. For any business that is part of a shareholder account, NMFS collects the owner information for that business (e.g., shareholders) and the percentage owned by each individual.

[6] https://portal.southeast.fisheries.noaa.gov/cs

If a business is owned in part or in total by another business, NMFS collects the ownership information of all parent companies. Owners of a business and the percentage held by such an individual may change over time. Any time a change (e.g., ownership, share percentage owned, address) is made in ownership within a business, the business must inform NMFS. NMFS tracks business owners throughout time using start and end dates for each change submitted to NMFS. SERO maintains a list of shareholder accounts and the shares held per category on their website[7].

The GT-IFQ program has several built-in flexibility measures to accommodate the multi-species nature of the commercial reef fish fishery and to reduce bycatch. There is a multi-use provision for both GG and RG that allows a portion of the RG quota to be harvested under GG and vice versa. A portion of the GG or RG allocation may be reserved each year for multi-use allocation, which may be used to land either gag or red grouper. These portions are placed into two allocation categories: GGM and RGM. The multi-use provision is to ensure that there may be allocation to use if either gag or red grouper are landed as incidental catch. The percentage of multi-use may change each year and may even be zero. Since 2013, the red grouper multi-use (RGM) and gag multi-use (GGM) allocation was based on formulas (see below) utilizing the commercial quota and the annual catch limits for gag and red grouper. If either stock is under a rebuilding plan, the percentage of the other species multi-use allocation will equal zero. Multi-use allocation cannot be used until all the species-specific allocation has been landed or transferred, including allocation in shareholder and all associated vessel(s) accounts. For example, gag may not be landed under GGM or RGM unless there is no GG allocation remaining in the shareholder and associated vessel(s) accounts. Similarly, multi-use allocation may only be transferred after landing or transferring all the corresponding species-specific allocation in the shareholder and associated vessel(s) accounts. The three remaining share categories (SWG, DWG, and TF) are multi-species categories, consisting of species complexes that are commonly caught together. Three grouper species (scamp, warsaw grouper, and speckled hind) are found in both shallow and deep-water habitats. Thus, flexibility measures are included in the GT-IFQ program to allow these species to be landed under either DWG or SWG categories. Scamp are designated as a SWG species, but may be landed using DWG allocation once all SWG allocation in an account has been harvested. Warsaw grouper and speckled hind are designated as DWG species and may be landed using SWG allocation after all DWG allocation in an account has been harvested.

The GT-IFQ program has a built-in 10% overage measure to allow a once-per-year allocation overage per share category for any GT-IFQ account that holds shares in that share category. For shareholder accounts with shares, a vessel associated with that account can land once during the year 10% more than its remaining allocation in the vessel account. NMFS deducts this overage from the shareholder account's allocation in the following fishing year. Because overages need to be deducted in the following year, GT-IFQ accounts without shares cannot land an excess of their remaining allocation in that share category. Further, GT-IFQ accounts with shares are prohibited from selling shares that would reduce the account's shares to less than the amount needed to repay the overage in the following year.

[7] http://sero.nmfs.noaa.gov/operations_management_information_services/constituency_services_branch/freedom_of_information_act/common_foia/IFQShareholders.htm.

The Magnuson-Stevens Act requires fishery managers to ensure that no one GT-IFQ participant acquires an excessive share of the quota. The GT-IFQ program is monitored to prevent one or more participants from obtaining shares in excess of the established share cap for each species or category (Table 1.3.2.2). The share cap for each category was based on the maximum GT-IFQ shares issued to a single entity at the time of initial apportionment. An allocation cap is set annually and equals the sum of the total allocation (pounds) associated with the five share category caps.

Table 1.3.2.2. Share caps in the GT-IFQ program.

Category	Share Cap %
DWG	14.704321
GG	2.349938
RG	4.331882
SWG	7.266147
TF	12.212356

When harvesting GT-IFQ species, vessels are required to have a reef fish permit and submit a declaration of intent to fish ("hail-out") before leaving port. Declarations can be made through a Vessel Monitoring System (VMS) or through a dedicated phone line. While at sea, vessels are monitored using VMS, which is required to record the location every hour. When returning to port, vessels landing GT-IFQ species must provide an advanced notification of landing ("hail-in"; hereafter referred to as landing notification) indicating the time and location of landing, the intended dealer, and the estimated pounds to be landed by species. Landing notifications can be made via VMS, 24-hour call service center, or through the IFQ online system. Prior to October 27, 2014, the landing notification had to be submitted 3 to 12 hours in advance of landing. An administrative rule extended the landing notification reporting window from 12 to 24 hours and required a vessel to land within 1 hour after the arrival time given in the landing notification. Landing locations must be approved in advance to ensure the sites actually exist and law enforcement agents can access the site. Landing locations must be publicly accessible by land and water. Proposed landing locations can be submitted via the Catch Share website and new locations will be approved or denied only at the end of each calendar-year quarter.

Landing may occur at any time, provided that landing notification has been given between 3 to 24 hours prior to landing. However, offloading of IFQ species is restricted to the hours of 6 a.m. and 6 p.m. local time. The administrative rule in 2014 revised regulations to allow offload to continue after 6 p.m. if an authorized officer is present, available to remain on site, and authorizes the continue offloading. A landing transaction report is completed by the GT-IFQ dealer and validated by the fisherman using the vessel account's Personal Identification Number (PIN). The landing transaction includes the date, time, and location of transaction; weight and actual ex-vessel value of fish landed and sold; and the identity of the shareholder account, vessel, and dealer. All landings data are updated as landing transactions are processed, on a real-time basis. The administrative rule in 2014, required dealers to complete a landing transaction on the day of offload and within 96 hours of landings. The rule also prohibited the deduction of ice and water weight when reporting an IFQ landing transaction, unless the actual weight of the ice and

water could be determined using a scale. The intent of these modifications was to improve the timeliness and accuracy of landing transactions.

For each transaction, NMFS collects share, allocation, and ex-vessel prices. Share transfers are a two-step process with the transferor initiating the transaction, but the transfer of shares is not finalized until the transferee accepts the transaction. There may be a delay between initiation and final acceptance of the transfer. For share transfers, the total value for transfer is entered by the transferor. In 2013, NMFS began also collecting the value from the transferee. The total share value is analyzed as a price per equivalent pound. A price per equivalent pound is the share percentage that would be equal to one pound for that point in time. The exact share percentage that is equivalent to the one pound depends on the commercial quota at that time and will change as the quota increases or decreases. Allocation transfers are an immediate one-step process. As soon as the transferor completes the transaction, the allocation is transferred to the other account. For allocation transfers, the price per pound is entered into the system. Ex-vessel prices are entered through the landing transaction process. Ex-vessel prices are a price per pound before any deductions are made for transferred (e.g., "leased") allocation and goods and/or services (e.g., bait, ice, fuel, repairs, machinery replacement, etc.).

The Magnuson-Stevens Act, in section 304(d)(2)(A)(i), requires a fee to recover the actual costs required to directly administer, manage, and enforce the GT-IFQ program. This fee may not exceed 3% of the actual ex-vessel value. The current cost recovery fee is set at 3%. The Regional Administrator (RA) may review and adjust this fee annually. The IFQ allocation holder specified in the landing transaction is responsible for the payment of the cost recovery fees, while the dealer who receives the fish is responsible for collecting the cost recovery fee and submitting the fee to NMFS on a quarterly basis. Complete regulations governing the GT-IFQ program can be found at 50 CFR 622.22[8] and the program can be accessed through the SERO website.[9] Important information regarding the GT-IFQ program is available for download on the website under Additional Information.

1.3.3 Quotas for GT-IFQ share categories

Table 1.3.3.1 provides the annual quota for each GT IFQ share category. Quota increases since implementation of the GT-IFQ program are also included.

Table 1.3.3.1 Annual quotas for GT-IFQ program share categories including quota increases since implementation of the GT-IFQ program (pounds gutted weight).

DWG	Jan 1	Quota Increase	Increase Date	Dec 31	GG	Jan 1	Quota Increase	Increase Date	Dec 31
2010	1,020,000			1,020,000	**2010**	1,410,000			1,410,000
2011	1,020,000			1,020,000	**2011**	100,000	330,000	June 1	430,000
2012	1,020,000	107,000	Jan 30	1,127,000	**2012**	430,000	137,000	Mar 12	567,000
2013	1,118,000			1,118,000	**2013**	708,000			708,000

[8] www.ecfr.gov
[9] https://portal.southeast.fisheries.noaa.gov/cs

2014	1,110,000			1,110,000	**2014**	835,000			835,000

RG	Jan 1	Quota Increase	Increase Date	Dec 31	SWG	Jan 1	Quota Increase	Increase Date	Dec 31
2010	5,750,000			5,750,000	**2010**	410,000			410,000
2011	4,320,000	910,000	Nov 2	5,230,000	**2011**	410,000			410,000
2012	5,370,000			5,370,000	**2012**	410,000	99,000	Jan 30	509,000
2013	5,530,000			5,530,000	**2013**	518,000			518,000
2014	5,630,000			5,630,000	**2014**	523,000			523,000

TF	Jan 1	Quota Increase	Increase Date	Dec 31
2010	440,000			440,000
2011	440,000			440,000
2012	440,000	142,000	Jan 30	582,000
2013	582,000			582,000
2014	582,000			582,000

Note: Beginning in 2012, quotas equal the ACT.

CHAPTER 2. DATA COLLECTION AND REPORTING

According to Section 303A(c)(1)(H) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), each limited access privilege program (LAPP) must include "an effective system for enforcement, monitoring, and management of the program, including the use of observers or electronic monitoring systems." This section should highlight any important data gaps or deficiencies, including gaps in the ability to validate collected data and any cost estimates for filling any gaps or deficiencies as some data improvements may be cost prohibitive given current resources and other factors. This review should document the reporting burden on participants, evaluate if current data collection programs are redundant, and identify any potential means to reduce reporting burden.

The grouper-tilefish individual fishing quota (GT-IFQ) program uses an online electronic system. All participants must log into their accounts through a web-based portal using assigned user names and passwords. Participants complete all actions through the web-based portal. Transactions include allocation transfers, share transfers, landing notifications, and landing transactions. Participants can also submit new landing locations through the online system and view and pay their cost recovery fees through the website. The electronic nature of the program makes it a near real-time reporting system.

Share transfers are initiated by the transferor and must be accepted by the transferee. Share transfers collect the following information: transferor account, transferee account, share category, share percentage being transferred, total price for the share transfer, and transfer reason. Since mid-year 2010, a minimum transfer price of $0.01 has been required for all share transfers. Despite requiring participants to enter a transaction price for share transfers, many share transactions specify a transaction value of $0.01. Prior to submission of the transfer, the online system calculates the equivalent pounds for the transferred shares and the equivalent price per pound. Starting in 2013, the system began collecting a transfer reason for each share transfer. Participants must choose among seven transfer reasons: barter for allocation, barter for shares, gift, no comment, package deal, transfer to a related account, and sale to another shareholder. Also in 2013, the system began collecting price information from the transferee as well as the transferor. While price information is required for a share transfer, participants may mis-report or under-report prices. Reasons for mis-reported or under-reported prices include: entering a price per pound equivalent[10] instead of transaction price, reluctance to enter price information, gifts, transferring to a related accounts, part of a package deal (e.g., sale of shares with a permit, vessel, and/or other equipment), and/or unrecorded bartering of shares within the GT-IFQ or red snapper individual fishing quota (RS-IFQ) programs.

Allocation transfers are initiated by the transferor but do not require any action from the transferee. Allocation transfers can be to a shareholder account or a vessel account. Allocation transfers collect the following information: transferor, transferee (shareholder and/or vessel

[10] A price per pound equivalent is the share percentage that would equal one pound for that particular period. The exact share percentage that is equivalent to one pound depends on the total commercial quota and will change as the quota changes from year to year or within a year for any quota increases.

account), share category, pounds to be transferred, price per pound, and transfer reason. Allocation transfer prices are currently not required by the online system (e.g., a zero value may be entered). Similar to share transfers, from 2013 onward, participants must pick one of the seven transfer reasons. Similar to share transfers, allocation prices may be mis-reported or under-reported and the potential reasons for mis-reporting or under-reporting are similar as those for share prices.

Participants are required to submit an advance notice of landing (landing notification) prior to landing. For the purposes of these regulations, the term "landing" means to arrive at a dock, berth, beach, seawall, or ramp. The landing notification can be made through a vessel monitoring system (VMS) unit, the website, or a 24-hour call service center. Landing notifications contain the following information: vessel and associated shareholder account, landing location, dealer, date/time of arrival, share category and the estimated pounds to be landed. The submission of a landing notification sends an email to law enforcement and port agents, as well as the dealer listed in the notification (if the dealer supplied an email address and requested notification). The landing notification requirement is intended to provide law enforcement officers the opportunity to be present at the point of landing so they can monitor and enforce individual fishing quota (IFQ) requirements dockside.

Landing transactions are initiated by the dealer but need to be confirmed by the shareholder through the use of a vessel Personal Identification Number (PIN). The dealer enters the pounds (gutted) and actual ex-vessel value of landed fish of each species, the facility where the fish are processed, the vessel landing the fish, the landing notification confirmation number (when available), and the state trip ticket number (optional). The system automatically records the dealer, the date/time of the landing location, and calculates the total value for the transaction and the associated cost recovery fee. The dealer submits the landing transaction, but before it is finalized, the shareholder must enter the vessel PIN to confirm the landing transaction. This step is also used to verify that there is sufficient allocation in the vessel account for this landing. Occasionally, landing transaction corrections are needed. These must be submitted on paper, and be signed by both the dealer and shareholder. In 2011, National Marine Fisheries Service (NMFS) defined actual ex-vessel value as the price paid per pound of fish before any deductions are made for transferred (leased) allocation and goods and services (e.g., bait, ice, fuel, repairs, machinery replacement, etc.). Landing transactions must be entered on the day of the offload, and within 96 hours of the arrival time given on the pre-landing notification. Ice and water weight may not be deducted from the landing transaction, unless the actual weight of ice and water are determined using a scale.

2.1 Data Gaps

The GT-IFQ system is an electronic online system that can require specific information before submission to the system. This limits the degree of data gaps that can occur in this system. One area where the GT-IFQ program has a small deficiency is in gathering accurate price information from all participants. The GT-IFQ system collects price information for share transfers (total value of shares transferred, which in combination with the percentage of shares transferred is used to estimate price per equivalent pound), allocation transfers (price per pound), and ex-vessel

prices (price per pound). According to economic theory, allocation prices should reflect the expected annual profit from harvesting one pound of quota, while share prices should reflect the net present value of the expected profit from harvesting one pound of quota in the long-run. Therefore, changes in these prices over time reflect changes in expected profitability. Because profits are an indicator of economic performance,[11] they also reflect changes in the economic performance of the program. This information is particularly important when it is difficult to estimate the actual profits of entities that participate in the program.

Although ex-vessel prices are required to complete a landings transaction, and share prices must be at least $0.01, allocation prices are not required to complete allocation transfers. Particularly in the program's first few years, prices were under-reported for a relatively high percentage of share and allocation transfers (e.g., total value of shares transferred reported as $0.01). Share transfers that had reported low value could be due to, but not limited to, any of the following: entering a price per pound equivalent[12] instead of transaction price, reluctance to enter price information, gifts, transferring to a related accounts, part of a package deal (e.g., sale of shares with a permit, vessel, and/or other equipment), and/or unrecorded bartering of shares within the GT-IFQ or RS-IFQ programs. Share prices were analyzed to determine which prices are "valid" (i.e., they represent the actual market value of the shares transferred). The process to determine if the reported value was "valid" was based off of similar procedures used in the RS-IFQ program. Descriptive statistics were generated for share prices by year and share category. The distributions of share prices were generally skewed to the right. Maximum valid share prices were selected to exclude unusually high and infrequent share prices, while minimum valid share prices were selected based on low-value statistical outliers. Excluding these outliers is thought to result in a more accurate estimate of the average price.

The percentage of valid share prices was low in all share categories for the first year of the program, with only 40% of all reported share prices determined to be valid, and as low as only 33% in the deep-water grouper (DWG) share category (Table 2.1.1). The percentages increased marginally in the next few years, but substantial changes occurred in 2013 when NMFS made a concerted effort to educate participants about the importance of share price information when analyzing the program. By 2014, nearly 67% of the share transfers had valid prices. In 2013, shareholders were asked to provide a reason for transferring their shares. Specifically, they were asked to pick one of seven potential reasons for transferring shares: "Barter trade for allocation," "Barter trade for shares," "Gift," "Transfer to a related account," "Sale to another shareholder," "Package deal," and "No comment." Each year, "Sale to another shareholder" was the most commonly selected reason for a transfer (Table 2.1.2). The majority of shares were also transferred for this reason. The two other reasons selected most often were "Transfer to a related account" and "No comment." The transfer reasons were used to refine the process of identifying price outliers, and shed light on why the reported values were outliers. For example,

[11] See https://www.st.nmfs.noaa.gov/economics/fisheries/commercial/catch-share-program/background-materials/indicators-definition/tier-2

[12] A price per pound equivalent is the share percentage that would equal one pound for that particular period. The exact share percentage that is equivalent to one pound depends on the total commercial quota and will change as the quota changes from year to year or within a year for any quota increases.

when "Package deal" was selected, final price per equivalent pounds tended to be either extremely low (less than or equal to $1/lb) or extremely high ($80/lb to $660,000/lb). Price per pound for the "Gift" reason were typically low, near $1/lb, but also ranged up to over $20,000/lb. The "Transfer to a related account" reason typically had the lowest value to be entered $0.01/lb, but also ranged as high as $310,000/lb.

Table 2.1.1. Percentage of valid share price information.

DWG	N	%	GG	N	%	RG	N	%
2010	53	33%	2010	107	42%	2010	111	42%
2011	44	46%	2011	47	34%	2011	76	45%
2012	34	44%	2012	68	53%	2012	124	61%
2013	30	57%	2013	52	59%	2013	106	73%
2014	38	61%	2014	78	74%	2014	107	74%
SWG	**N**	**%**	**TF**	**N**	**%**	**ALL**	**N**	**%**
2010	76	39%	2010	38	42%	2010	385	40%
2011	42	40%	2011	24	41%	2011	233	41%
2012	41	42%	2012	14	32%	2012	281	51%
2013	49	60%	2013	13	45%	2013	250	63%
2014	33	52%	2014	17	50%	2014	273	67%

Table 2.1.2. Share transfer reasons

	2013		2014	
Reason	**N**	**%**	**N**	**%**
Barter trade for allocation	-	-	7	0.97
Barter trade for shares	8	0.22	10	4.62
Gift	11	0.12	11	2.49
No comment	67	12.74	68	10.68
Package deal	22	3.62	22	3.40
Transfer to a related account	66	12.88	44	11.06
Sale to another shareholder	223	14.76	247	39.73

Allocation transfer prices are collected on a per pound basis. Transfers that had low or no price information may be due to, but not limited to, any of the following: reluctance to enter price information, gift, transferring to a related account, part of package deal, or bartering for shares and/or allocation in the GT-IFQ program. Allocation prices were analyzed to determine which prices were deemed valid or representative of the program. The process to determine this was based off of similar procedures used in the RS-IFQ program.

Allocation prices were analyzed on a yearly basis and generally had a bimodal distribution that depicted a subset of transactions with low price information. The minimum allocation price was set to the lowest point between the bimodal distributions. The maximum allocation prices were selected to exclude unusually high and infrequent allocation prices, including all prices in excess

of the maximum ex-vessel price reported.[13] Excluding these outliers is thought to result in an accurate estimate of the average price.

The percentage of valid allocation prices was extremely low in the first year of the program, with only 14% of all allocation transfers having a valid price (Table 2.1.3). The percentage of allocation prices increased slightly in 2011, but did not substantially increase until 2013 and 2014. By 2014, 48% of all allocation prices were valid. As with share prices, this uptick in valid reported prices coincided with NMFS' outreach efforts to educate the participants on the benefits of providing valid allocation prices. In 2013, participants were asked to supply a reason for each allocation transfer. In both 2013 and 2014, the most commonly reported reasons were "No comment," followed by "Sale to another shareholder," and "Transfer to a related account" (Table 2.1.4).

Table 2.1.3. Percentage of valid allocation price information.

	N	%	GG	N	%	RG	N	%
2010	68	14%	2010	150	16%	2010	153	14%
2011	116	18%	2011	303	24%	2011	482	31%
2012	213	28%	2012	631	36%	2012	746	39%
2013	215	35%	2013	705	41%	2013	827	47%
2014	325	38%	2014	1,015	45%	2014	1,337	58%
SWG	**N**	**%**	**TF**	**N**	**%**	**ALL**	**N**	**%**
2010	75	12%	2010	35	13%	2010	481	14%
2011	117	21%	2011	62	19%	2011	1,080	25%
2012	279	31%	2012	93	24%	2012	1,962	34%
2013	354	39%	2013	88	30%	2013	2,188	41%
2014	443	44%	2014	153	36%	2014	3,273	48%

Table 2.1.4. Allocation transfer reasons

	2013		2014	
Reason	**N**	**lb**	**N**	**lb**
Barter trade for allocation	167	175,545	98	175,545
Barter trade for shares	14	56,675	19	56,675
Gift	139	81,314	126	81,314
No comment	2,276	5,362,270	3,145	5,362,720
Package deal	60	467,153	77	467,153
Transfer to a related account	1,075	2,651,134	1,043	2,651,134
Sale to another shareholder	1,549	3,763,044	2,317	3,763,044

[13] Fishermen would be expected to lose money and be worse off if they pay more for the allocation than the price they receive for their landed fish, which is not consistent with economically rational behavior, all other things being equal.

Unlike for share transfers, there were no high prices associated with the transfer reason "Package deal"; in fact, most of the prices were $0/lb. When "No comment" was provided as the transfer reason, the price ranged from $0/lb to $10/lb (the maximum the system allows), the same range as seen for all transfer reasons. Therefore, transfer reasons were not as helpful in explaining variability in allocation prices as they were with explaining variability in share prices.

Mitchell (2016) identified two data gaps with respect to the collection of ownership data in the GT-IFQ and RS-IFQ programs. Accurate estimates of market concentration are critical with respect to determining whether markets are competitive. This is true for allocation and share markets as well as product (seafood) markets. Based on his conclusion that market concentration is most accurately represented at the affiliated entity level, as opposed to the individual IFQ account or Lowest Known Entity (LKE) level, Mitchell recommended that the collection of detailed ownership data (i.e., the percentage ownership by each individual in every business that participates in the reef fish fishery) be expanded from entities with commercial Gulf of Mexico (Gulf) reef fish permit holders, IFQ shares, and annual allocation to dealers as well. The lack of such data may lead to concentration in the shares, allocation, and product markets being underestimated and thus the degree of competition in these markets being overestimated. In turn, current assessments of whether existing share and allocation caps are performing as intended may be inaccurate. Adding to this potential source of inaccuracy is the fact that detailed ownership data is not collected for "joint" owners (e.g., two or more members of a family own a permit or account but have not formally created a partnership or corporation) of reef fish permits and IFQ accounts. Instead, NMFS' current protocol is to assume the individuals own equal percentages of the business and thus the accounts held by the business. Although likely true in some cases, the validity of this assumption cannot currently be discerned. To the extent the assumption is inaccurate, assessments of market concentration and competition and the performance of share and allocation caps will also be inaccurate.

Though not stated explicitly in either study, the findings in Mitchell (2016) and Keithly (2017) suggest that analyses of market concentration, competition, and demand are currently hampered by the lack of retail level data regarding fish harvested in the IFQ programs. Specifically, confidence in the accuracy of these types of analyses would be greatly enhanced if retail price data and data regarding the final point of sale (e.g., restaurants, grocery stores, export markets, etc.) were available as they would help better define the boundaries of relevant markets, determine the products that consumers consider to be "good" substitutes for the seafood harvested through the IFQ programs, and thereby better discern the effects of the IFQ programs on consumers and others in the product distribution chain as well as program participants. Another data gap area identified is with reporting of IFQ violations. While the NMFS receives information regarding violations and seizures from federal agents, not all state agencies supply this information to NMFS. This commonly occurs when state regulations match federal regulations, and violations are enforced on the state level rather than federal.

2.2 Reporting Burden

The estimate of the reporting burden for the RS-IFQ and the GT-IFQ programs is updated every three years. Nearly all information for the program is collected electronically through the web-based system and satellite-linked vessel monitoring systems. Additionally, there is a 24-hour call line for landing notifications, and paper form submissions for landing corrections, account applications, and landing transactions under catastrophic conditions. The time to fill out the various forms is between 1 minute and 6 minutes. The IFQ account application, which is filled out for any shareholder account that is not associated with a permit, occurs every two years and takes about 15 minutes.

Landings data are also collected through the Southeast Fisheries Science Center's (SEFSC) Coastal Logbook (CLB) program and state trip tickets (dealer reports). Any fisherman whose vessel has a federal Gulf commercial reef fish permit must submit a trip report form (coastal logbook) within 7 days after each trip on which Gulf reef fish were caught. The coastal logbooks collect information on all caught species, regardless of whether it is landed or federally managed. Each logbook record contains information about the vessel, the operator, trip dates (start and unload), days at sea, crew, offload location, dealer, state trip ticket number, gear and effort information, and catch. Information regarding trip expenses (e.g., cost of ice, bait, groceries, and labor), price and quantity of fuel used, trip revenue (ex-vessel value), and whether the trip was taken by a hired captain or owner-operator is also collected for a sample of trips each year. Any dealer who purchases fish managed by the Reef Fish Fishery Management Plan (Reef Fish FMP) is required to report electronically through their state's trip ticket program on a weekly basis. The state trip tickets report information about the trip (trip start date, vessel logbook number, gear, area fish caught) and the landings (landing date, landing location, dealer, species landed (amount, size, and condition), and ex-vessel value. State trip tickets and vessel logbooks collect more information than is collected through the IFQ landing transactions, but also collect some of the same information collected through the IFQ program, specifically with respect to the landing of IFQ species (e.g., pounds landed, ex-vessel price and value, vessel ID, dealer, landing date, etc.). As a result, these data collection programs result in duplicative reporting for the fishermen (coastal logbook and IFQ) and dealers (trip ticket and IFQ). However, some overlap in the data collection programs may be desirable as it allows analysts to compare data provided from multiple sources and determine which data are the most accurate and therefore would lead to the most accurate estimates.

Timeliness is key in the IFQ program, as deductions in allocation for landings occur in near real-time. Delaying the input of that information may lead to inaccurate account balances prior to fishing trips, which in turn could lead to increased violations for insufficient allocation. Additionally, some overlap in the data collection programs may be desirable as it allows analysts to compare data provided from multiple sources and determine which data are the most accurate and therefore would lead to the most accurate estimates.

2.3 Conclusions

This analysis shows that there is a distinct data gap when collecting share and allocation price information. While the program has made great strides in collecting a higher percentage of valid data, there is still room for improvement. The addition of the transfer reasons for both share and allocation transfers has helped explain why prices may vary so widely in the program.

A possible avenue to improve price information in share and allocation transfers is to allow the system to further limit the prices placed on each transaction, perhaps in coordination with the reason selected. Alternatively, a mechanism that allows the price to be entered but warns the user it is outside of a typical range may be a better option. This would allow higher prices to be entered, as often happens when a transfer is part of a larger package deal involving the sale of additional assets (e.g., vessel, gear, etc.), but would remind the user of the benefits of the transfer price information. Any such mechanism to limit or warn the user would require constant monitoring to ensure the values are consistent with market conditions.

The Southeast Regional Office (SERO) and the SEFSC are aware of the duplicative reporting between the IFQ, the coastal logbooks, and the trip ticket programs. All three programs are run on different operating systems for different purposes, which makes the elimination of duplicative reporting difficult. The IFQ system needs real-time reporting of IFQ species to deduct allocation from the accounts in a timely manner, but it does not collect any other additional information. In 2012, IFQ staff sought public opinion on including some additional information in the IFQ landing transaction, such as primary gear, coastal logbook number, and trip ticket number. The idea was to compare the three data sets more comprehensively, but overwhelming opinion from constituents is that this would be unnecessarily duplicative and time-consuming. Therefore, the IFQ program added an optional trip ticket number to the landing transaction form, as well as a method to enter the trip ticket number at a later time, and did not pursue mandatory reporting of trip ticket numbers on IFQ landing transactions. The SEFSC is still looking into methods to better reconcile the differences in data among these three data sources. Once that has been analyzed, both SERO and SEFSC will re-visit possible means to reducing duplicative reporting. Before the information can be combined into one database, there must be an understanding of why information is not reported exactly the same between data sources. Differences in values reported may be due to but not limited to different understandings about reporting catch sold back to the crew, how seizures are processed, and accounting for fish that spoiled and therefore were not sold to a dealer. Until these reasons are better understood and reporting more standardized it may not be beneficial to reduce the duplicative reporting, as comparing these records highlights areas for improvement.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Biological

In addition to the quota closures, trip limits, minimum size limits, and permit requirements (Chapter 1) that were used to manage the commercial harvest of grouper and tilefish before implementation of the grouper-tilefish individual fishing quota (GT-IFQ) program, other regulations were in place that affected commercial harvest. These include time and area closures and gear restrictions, which have largely remained unchanged since the program began.

Time and Area Closures/Gear Restrictions
The Coral FMP, implemented in 1982, prohibited the use of some gears in the East and West Flower Garden Banks as well as the Florida Middle Grounds (Figure 4, areas j1, j2, and b). These areas were designated as Habitat Areas of Particular Concern (HAPCs) to protect soft coral areas from the use of any fishing gear interfacing with bottom, such as trawling gear, bottom longlines, buoy gear, and all traps/pots. Other HAPCs were developed through Generic Amendment 3 for addressing Essential Fish Habitat (EFH) in 2005 (Figure 4, areas 1-10, r, s, and t). Depending on the HAPC, activities such as bottom anchoring and the use of trawling gear, bottom longlines, buoy gear, and all traps/pots on coral reefs were prohibited to protect coral reefs in these areas.

Stressed areas for reef fish were developed in the initial FMP, implemented in 1984 (Figure 4, area g). These stressed areas created a permanent closure of the near shore waters to the use of fish traps, power heads, and roller trawls (i.e., “rock hopper trawls”) across the Gulf of Mexico (Gulf).

A longline and buoy gear boundary was established through Amendment 1 and implemented in 1991 (Figure 4, area c). The directed harvest of reef fish with longlines and buoy gear was prohibited inshore of a line approximating the 50-fathom depth contour west of Cape San Blas, Florida and the 20-fathom depth contour east of Cape San Blas. Additionally, the retention of reef fish captured incidentally in other longline operations (e.g., sharks) was limited to the recreational bag limit. In 2010, this measure was revised to reduce bycatch of endangered sea turtles, particularly loggerhead sea turtles for longline gear through Amendment 31 (Figure 4). This measure prohibits the use of bottom longline gear shoreward of a line approximating the 35-fathom contour from June through August east of Cape San Blas (20 fathoms for the rest of the year).

Amendment 5 (GMFMC 1994), created the Alabama Special Management Zone (SMZ). In the SMZs, a vessel with a commercial reef fish permit is limited to hook-and-line gear with no more than three hooks.

There are several sites in the Gulf that have fishing restrictions to preserve some aspect of grouper reproduction. A 1999 regulatory amendment established two marine reserves

(Steamboat Lumps and Madison-Swanson) that were sited on gag spawning aggregation areas where all fishing except for surface trolling during May through October is prohibited (219 square nautical miles; Figure 4, areas kMS and kSL). The action initially had a 4-year sunset clause, but Amendment 19, implemented in 2002 extended the marine reserves indefinitely. Another no-take area designed to protect spawning areas of gag and other groupers is The Edges marine reserve (Figure 4, area kTE). This closure, implemented through Amendment 32 in 2012, closes this area from January 1 to April 30. All commercial and recreational fishing or possession of fish managed by the Gulf of Mexico Fishery Management Council (Council) is prohibited. The intent of the closure is to protect gag and other groupers during their respective spawning seasons.

The Tortugas North and South Marine Reserves no-take marine reserves were cooperatively implemented by the state of Florida, National Ocean Service (NOS), the Council and the National Marine Fisheries Service (NMFS), and the National Park Service in 2001 (Figure 3.1.1., areas d1 and d2). These reserves were designed to protect stocks such as spawning populations of mutton snapper, as well as allow research to assess the value of no-use reserves.

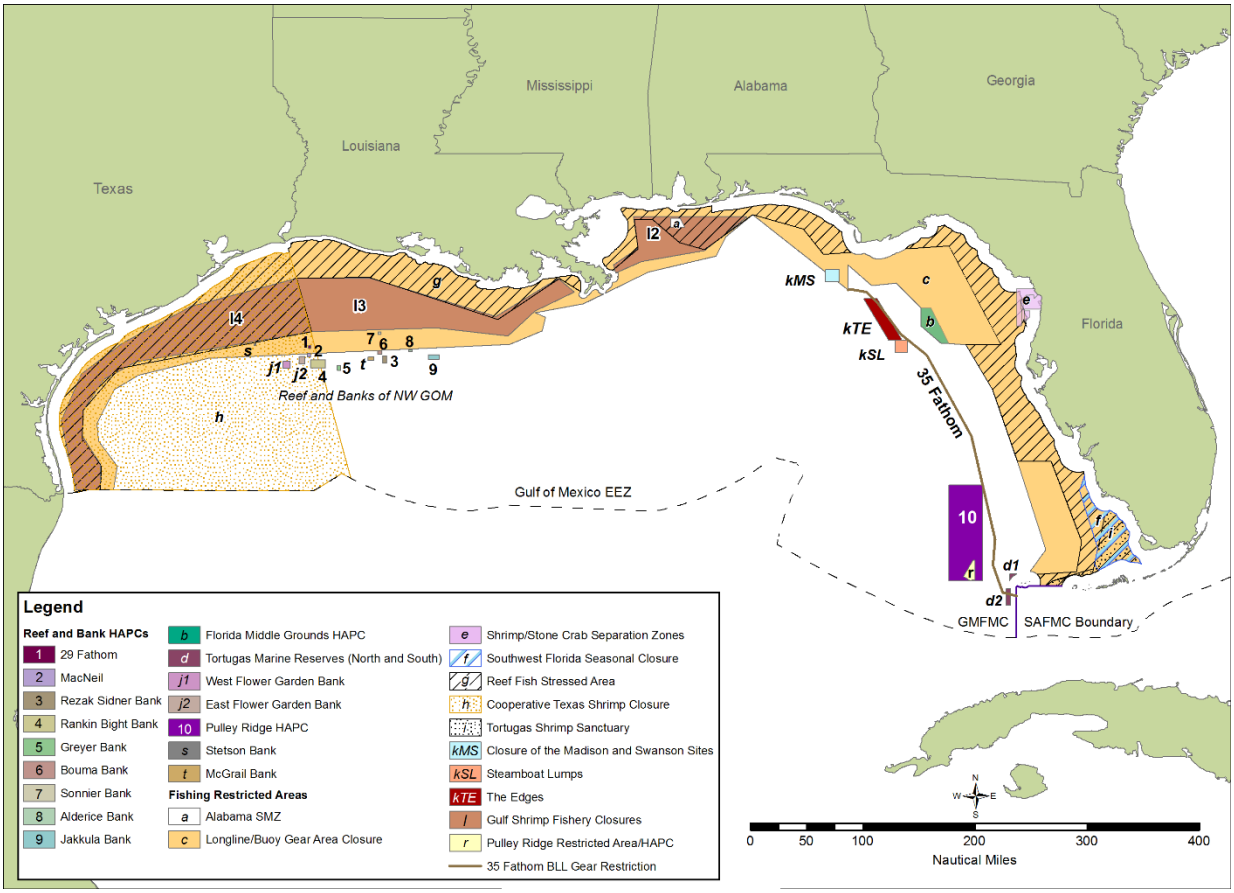

Figure 3.1.1. Map of fishery management closed or gear restricted areas in the Gulf.

History of Gear Requirements/Restrictions

Gear requirements/restrictions have been put in place to protect habitat, reduce bycatch/discards and bycatch/discard mortality, and improve enforcement. Fish traps were phased out of the reef fish fishery in 2007 to protect hard bottom habitat. Amendment 1, implemented in 1990, restricted fishermen to a maximum of 100 fish traps per permit holder. This action was followed by Amendment 5, implemented in 1994, that implemented a 3-year moratorium on the use of fish traps by creating a fish trap endorsement. Only fishermen who could demonstrate fish trap landings received the endorsement. Amendment 14, implemented in 1997, provided for a 10-year phase-out for the fish trap fishery and Amendment 15, implemented in 1998, prohibited the harvest of reef fish from traps other than permitted reef fish traps, stone crab traps, or spiny lobster traps. Although the 10-year phase out of traps continued, Amendment 16A, implemented in 2000, prohibited fish traps beginning on February 7, 2001, south of 25.05 degrees north latitude. Fish traps were ultimately phased out north of 25.05 degrees north latitude on February 7, 2007.

Additional gear requirements have been implemented to reduce bycatch and discard mortality for both sea turtles and fish. Amendment 18A, implemented in 2006, required that vessels with reef fish permits had to have the appropriate gear and printed release protocols on board for the safe release of incidentally caught endangered sea turtle species and smalltooth sawfish. Additional sea turtle protections through gear restrictions were put in place through Amendment 31. This action, implemented in 2010, was designed to reduce the number of sea turtle interactions with longline gear. The action not only restricted where longline vessels could fish (see time and area closures/gear restrictions above), but also restricted the total number of hooks that may be possessed onboard each reef fish bottom longline vessel to 1,000. Of those 1,000 hooks, only 750 can be rigged for fishing.

Gear requirements were put in place through Amendment 27, implemented in 2008, to reduce discard mortality by the commercial and recreational sectors. The action required non-stainless steel circle hooks be used when using natural baits and that venting tools and dehooking devices be on board and used when fishing for reef fish. Although the amendment was implemented in January 2008, the effective date for the use of circle hooks, venting tools, and dehookers was delayed until June 1, 2008, so that fishermen could acquire the hooks and tools. The venting tool requirement was rescinded in 2013 through a framework action, because of concerns the tool hampered the ability of fishermen to use other devices that can reduce discard mortality such as fish descenders. There was also concern as to whether the devices were being used correctly.

Because of the use of fishing restrictions in particular areas, commercially permitted reef fish vessels were required to have vessel monitoring systems (VMS) onboard beginning in 2007. These systems assist the enforcement of fishing regulations, particularly area-based regulations. This action was taken through Amendment 18A (GMFMC 2005) and working systems were required to be onboard by May 6, 2007.

3.2 Economic

Details on the economic environment for the commercial sector of the Gulf reef fish fishery, including the GT-IFQ and red snapper individual fishing quota (RS-IFQ) programs, are provided in the Red Grouper Allowable Harvest Framework Action (GMFMC 2016a), Modifications to Gag Minimum Size Limits, Recreational Season and Black Grouper Minimum Size Limits Framework Action (GMFMC 2016b), Reef Fish Amendment 28 (GMFMC 2015a), Modifications to Greater Amberjack Allowable Harvest and Management Measures Framework Action (GMFMC 2015b), and the Framework Action to Set the Annual Catch Limit and Bag Limit for Vermilion Snapper, Set Annual Catch Limit for Yellowtail Snapper, and Modify the Venting Tool Requirement (GMFMC 2013). The following sections contain additional information on the economic environment of the commercial sector.[14]

3.2.1 Permits

The GT-IFQ and RS-IFQ programs are components of the Gulf reef fish fishery. Any fishing vessel that harvests and sells any reef fish species managed under the reef fish FMP from the Gulf exclusive economic zone (EEZ) must have a valid Gulf commercial reef fish permit, including species managed under the GT-IFQ and RS-IFQ programs. This Gulf commercial reef fish permit is considered a limited access permit, meaning that no new permits can be created. The Gulf commercial reef fish permits expire one year from renewal and will terminate if not renewed within one of the expiration date. The number of permits that were valid and renewable in a given year has continually decreased since the permit first became limited access in 19xx. This decline has continued since the GT-IFQ program was implemented, but at a slower rate. Specifically, from 2008 to 2015, the number of permits valid in each year were 1,099, 998, 969, 952, 917, 898, 882, and 868, respectively. The greater number of terminated permits in 2009, was most likely influenced by the RS-IFQ program initiated in 2007. Permits valid in 2007, would expire in 2008, and terminate in 2009. To a lesser extent there was an increase in terminated permits in 2012, which was most likely influenced by the GT-IFQ program. As of January 20, 2017, there were 848 valid or renewable reef fish permits, 779 of which were valid. To harvest IFQ species, a vessel permit must also be linked to an IFQ account and possess sufficient allocation for this species. IFQ accounts can be opened and valid permits can be linked to IFQ accounts at any time during the year. Eligible vessels can receive annual allocation from other IFQ participants.

3.2.2 Shareholder Accounts

As of December 14, 2016, there were 750 accounts with shares in one or more share categories. On average (mean), each of these accounts holds just over 0.13% of the shares in each category. However, the distribution of shares within each category is highly skewed. In other words, some

[14] The time series for estimates in this section are not always the same due to differences in the availability of certain data, models, etc. Also, depending on the particular estimate, some are specific to the GT-IFQ program, some apply to the GT-IFQ and RS-IFQ programs, while others are for the Gulf reef fishery as a whole.

accounts have a relatively high percentage of the shares in a category while others have no or a very low percentage of the shares. The largest or maximum percent of shares held by a single account in each category ranges from 2.297% for GG to 4.168% for RG, 4.443% for OSWG, 4.774% for RS, 11.874% for TF, and 13.031% for DWG. Thus, in percentage terms, these estimates indicate there are some relatively large shareholder accounts in the DWG and TF categories in particular. This finding is consistent with findings in Mitchell (2016) which indicate the concentration of shares is greatest in the TF and DWG categories and least in the GG category. The skewed distributions also cause the median shares held by each account to be much less than the mean share; specifically, they are less than 0.001% in the DWG, TF and RS categories, while slightly higher for RG, GG, and other SWG at 0.002, 0.008, and 0.008%, respectively (see Table 3.2.2.1). Therefore, the median estimates are likely more representative of the "average" shares held by each account.

Table 3.2.2.1. Quota share statistics (in percent) for all 750 IFQ accounts with shares, December 14, 2016.

Statistic	DWG Shares	RG Shares	GG Shares	OSWG Shares	TF Shares	RS Shares
Maximum	13.031	4.168	2.297	4.433	11.864	4.774
Median	0.000	0.002	0.008	0.008	0.000	0.000
Mean	0.133	0.133	0.133	0.133	0.133	0.133

Note: Shares are not aggregated across categories because a 1% share does not represent the same poundage or value across categories. For example, a 5% share that is spread across all categories is not truly equal to a 5% share in a single category such as red snapper.

Quota shares have value in multiple ways. First, shares have value because they are an asset. The asset value of each account's shares is determined by the market price of the shares and the amount of shares it contains. Statistics regarding the maximum, median, and mean value of each account's shares are in Table 3.2.2.2, which again are reflective of the skewed distribution of shares across accounts in each category. The total value of all shares in the Gulf IFQ programs is nearly $345 million (2015$), with the bulk of that value coming from ownership of RS and RG shares, accounting for about 59% and 29% of the total value, respectively, or 88% of the total value combined. Thus, GG, TF, DWG, and other OSWG only account for about 12% of the total value of all shares. The findings are similar when looking at the maximum and mean asset values of shares, with RS and RG having the highest maximum and mean estimates. The account with the largest asset value of shares is worth about $10.7 million, with RS shares representing the bulk of that value, while the mean asset value of shares per account is about $459,000. Again, the medians are significantly lower for each category, and for all categories combined (only around $55,000), indicating that many accounts have few if any shares in some categories.

Table 3.2.2.2. Quota share value statistics for all 750 IFQ accounts with shares, December 14, 2016. All dollar estimates are in 2015 dollars.

Statistic	DWG	RG	GG	OSWG	TF	RS	All
Maximum	$1,699,976	$4,170,547	$473,801	$156,872	$633,857	$9,636,420	$10,686,172
Total	$13,046,635	$100,057,634	$20,631,355	$3,538,563	$5,343,205	$201,855,901	$344,473,294
Median	$0	$2,179	$1,697	$277	$0	$3	$55,042
Mean	$17,396	$133,410	$27,508	$4,718	$7,124	$269,141	$459,298

Note: Share value estimates are based on 2015 share prices per pound (IFQ database accessed 12/14/16) and pounds under 2017 beginning of the year quotas. Thus, the commercial red snapper quota is the quota that existed prior to the court decision to vacate the rule that reallocated red snapper ACL from the commercial sector to the recreational sector in Amendment 28.

In addition to their asset value, shares have value because they result in annual allocation which can either be transferred (referred to by the industry as 'leased' when transferred for value) or used for harvesting purposes (i.e., landings). Statistics regarding the potential transfer value associated with the annual allocation for each account with shares are provided in Table 3.2.2.3, while statistics regarding the potential ex-vessel value (revenue) associated using their annual allocation for harvesting purposes is provided in Table 3.2.2.4. The transfer value of annual allocation should approximate the expected net revenue or economic profit of the annual allocation in the short-term (i.e., in a given year). Thus, if the commercial quotas for all of the IFQ species were harvested, economic profits from those landings would be expected to be about $30.6 million, with the bulk of those profits (88%) arising from the harvest of RS and RG. Although one account could be expected to earn close to $1 million in short-term profits, if the account holders retain their initial annual allocations, the mean value per account is only around $41,000 and the median is much less still at about $4,700.[15] Thus, the distribution of expected short-term profits is also likely to be highly skewed. These same general findings also apply to the distribution of potential ex-vessel value across accounts (i.e., RS and RG account for the bulk of the potential ex-vessel value, some account holders generate much higher ex-vessel revenues than others, the mean is much lower than the maximum ex-vessel value generated by a single account holder, and the median ex-vessel value per account holder is much less than the mean).

Table 3.2.2.3. Potential lease value of annual allocation in 2017 for all 750 IFQ accounts with shares, December 14, 2016. All dollar estimates are in 2015 dollars.

Statistic	DWG	RG	GG	OSWG	TF	RS	All
Maximum	$156,120	$347,005	$40,975	$13,965	$53,167	$885,679	$976,915
Total	$1,198,160	$8,325,169	$1,784,232	$315,006	$448,177	$18,552,491	$30,623,234
Median	$0	$181	$147	$25	$0	$0	$4,697
Mean	$1,598	$11,100	$2,379	$420	$598	$24,737	$40,831

Note: Annual allocation lease value estimates are based on 2015 allocation prices (IFQ database accessed 12/14/16) and pounds under 2017 beginning of the year quotas. Thus, the commercial red snapper quota is the quota that existed prior to the court decision to vacate the rule that reallocated red snapper ACL from the commercial sector to the recreational sector in Amendment 28.

[15] "Accounts" do not actually harvest landings and thus do not earn profits per se; rather, vessels and the businesses that own them do. Further, annual allocation is often transferred, so the actual distribution of short-term profits would likely differ from the potential distribution based on the distribution of annual allocation at the beginning of the year. The purpose of these estimates is to characterize the distribution of annual allocation and its value across accounts in the short-term.

Table 3.2.2.4. Potential ex-vessel value of annual allocation in 2017 for all 750 IFQ accounts with shares, December 14, 2016. All dollar estimates are in 2015 dollars.

Statistic	DWG	RG	GG	OSWG	TF	RS	All
Maximum	$615,141	$1,277,757	$110,417	$106,366	$199,548	$1,318,487	$1,736,148
Total	$4,720,957	$30,655,294	$4,808,035	$2,399,293	$1,682,120	$27,618,594	$71,884,293
Median	$0	$667	$396	$188	$0	$0	$13,665
Mean	$6,295	$40,874	$6,411	$3,199	$2,243	$36,825	$95,846

Note: Ex-vessel value estimates are based on 2015 average ex-vessel prices (IFQ database accessed 12/14/16) and pounds under 2017 beginning of the year quotas. Thus, the commercial red snapper quota is the quota that existed prior to the court decision to vacate the rule that reallocated red snapper ACL from the commercial sector to the recreational sector in Amendment 28. Ex-vessel value is estimated using all ex-vessel price data, including outliers, consistent with how it is estimated in the annual reports.

3.2.3 IFQ and Gulf Reef Fish Vessels

The information in Tables 3.2.3.1 and 3.2.3.2 describes the activity of all 731 vessels that were active in the Gulf IFQ programs from 2011 to 2015, including their activities in Gulf and South Atlantic non-IFQ fisheries.[16] The maximum annual gross revenue earned by a single vessel during this time was about $4.65 million (2015 dollars), though the mean gross revenue was only about $167,000 and the median was only around $64,000. Although a majority of these vessels' gross revenue came from harvesting IFQ species, a significant portion came from harvesting non-IFQ species in the Gulf, with a minor amount coming from harvests in the South Atlantic.

Table 3.2.3.1. Revenue per vessel statistics for the 731 vessels active in Gulf IFQ Programs from 2011-2015. All dollar estimates are in 2015 dollars.

Statistic	IFQ Revenue	Gulf Non-IFQ Revenue	South Atlantic Revenue	Total Gross Revenue
Maximum	$2,526,408	$2,137,797	$294,094	$4,646,978
Median	$30,469	$17,819	$0	$64,083
Mean	$95,285	$69,692	$1,610	$166,587

[16] Sources: IFQ data (IFQ database accessed 12/14/16) for IFQ species and Southeast Coastal Logbook data (SEFSC/SSRG Socioeconomic Panel, 12/2/16) for non-IFQ species.

Table 3.2.3.2. Total revenue and revenue per vessel statistics for the 731 vessels active in Gulf IFQ Programs from 2011-2015 by year. All dollar estimates are in 2015 dollars.

Year	Number of Vessels	Statistic	IFQ Revenue	Gulf Non-IFQ Revenue	South Atlantic Revenue	Total Gross Revenue
2011	507	Maximum	$822,177	$788,585	$144,073	$1,564,485
		Total	$34,798,866	$28,488,696	$831,853	$64,119,415
		Median	$22,082	$17,666	$0	$53,394
		Mean	$68,637	$56,191	$1,641	$126,468
2012	499	Maximum	$836,060	$1,052,499	$137,591	$1,726,206
		Total	$41,396,071	$30,344,100	$838,966	$72,579,136
		Median	$30,776	$17,382	$0	$67,762
		Mean	$82,958	$60,810	$1,681	$145,449
2013	479	Maximum	$1,901,900	$1,592,744	$84,563	$3,266,955
		Total	$47,952,067	$34,134,606	$607,961	$82,694,635
		Median	$31,276	$18,834	$0	$60,840
		Mean	$100,109	$71,262	$1,269	$172,640
2014	505	Maximum	$2,224,675	$2,137,797	$294,094	$4,362,472
		Total	$54,828,613	$38,846,974	$1,045,642	$94,721,230
		Median	$35,119	$19,534	$0	$73,230
		Mean	$108,572	$76,925	$2,071	$187,567
2015	502	Maximum	$2,526,408	$2,120,570	$105,148	$4,646,978
		Total	$58,473,702	$41,857,721	$688,858	$101,020,281
		Median	$35,490	$16,870	$0	$65,489
		Mean	$116,481	$83,382	$1,372	$201,236

Vessel participation in the GT-IFQ and RS-IFQ programs is very fluid and not all of these vessels were active in an IFQ fishery or any other fishery covered by the Southeast Coastal logbooks in every year during this time. The number of vessels that were active in the IFQ programs in each year from 2011 through 2015 was: 471, 473, 447, 473, and 484, respectively. Some important trends can be seen in Table 3.2.3.2. Specifically, revenue from harvesting IFQ species increased significantly, by about $23.7 million or 68%, from 2011 to 2015. This increase was largely caused by higher commercial quotas for several species in the IFQ programs. Though not as large, revenues from harvest of non-IFQ species in the Gulf for these vessels increased as well, but about $13.4 million or about 32%. As a result, total gross revenue for these vessels increased by about $37 million, or about 58%, during this time. The trend in the mean values of IFQ revenue, non-IFQ Gulf revenue, and total gross revenue per vessel are very similar in percentage terms. However, the changes in the median values per vessel are not nearly as pronounced. For example, median IFQ revenue per vessel only increased by 38% and median total gross revenue only increased by about 23% during this time. These finds suggest that the increases in landings and revenues due to higher commercial quotas were not evenly distributed

across vessels, with some experiencing much greater increases than others in percentage as well as in absolute terms.

The information in Tables 3.2.3.3 and 3.2.3.4 represents the activities of all 1,020 vessels that were active in the Gulf reef fish fishery from 2011 to 2015. As in the IFQ fisheries, vessel participation in the Gulf reef fish fishery is very fluid and not all of these vessels were active in the Gulf reef fish fishery or any other fishery covered by the Coastal logbooks in every year during this time. The number of vessels active in the Gulf reef fish fishery in each year from 2011 through 2015 was: 578, 584, 567, 617, and 581, respectively. Also, the trends in revenues for all active Gulf reef fish vessels are similar to those discussed above for vessels in the GT-IFQ and RS-IFQ programs, though the mean and median values are slightly less and South Atlantic revenues are somewhat more important for this group of vessels.

Table 3.2.3.3. Total revenue and revenue per vessel statistics for the 1,020 vessels active in the Gulf reef fish fishery from 2011-2015. All dollar estimates are in 2015 dollars.

Statistic	IFQ Revenue	Gulf Non-IFQ Revenue	South Atlantic Revenue	Total Gross Revenue
Maximum	$2,526,408	$2,137,797	$415,405	$4,646,978
Median	$8,166	$12,368	$0	$41,807
Mean	$69,046	$56,249	$5,279	$130,574

Table 3.2.3.4. Revenue per vessel statistics for the 1,020 vessels active in the Gulf reef fish fishery from 2011-2014 by year. All dollar estimates are in 2015 dollars.

Year	Number of Vessels	Statistic	IFQ Revenue	Gulf Non-IFQ Revenue	South Atlantic Revenue	Total Gross Revenue
2011	692	Maximum	$822,177	$788,585	$272,683	$1,564,485
		Total	$34,798,866	$32,109,572	$3,659,436	$70,567,875
		Median	$6,204	$12,882	$0	$37,096
		Mean	$50,287	$46,401	$5,288	$101,977
2012	693	Maximum	$836,060	$1,052,499	$415,405	$1,726,206
		Total	$41,396,071	$33,893,922	$3,487,630	$78,777,622
		Median	$7,684	$11,801	$0	$40,846
		Mean	$59,735	$48,909	$5,033	$113,676
2013	672	Maximum	$1,901,900	$1,592,744	$271,469	$3,266,955
		Total	$47,952,067	$37,897,489	$3,173,842	$89,023,398
		Median	$8,650	$12,417	$0	$43,161
		Mean	$71,357	$56,395	$4,723	$132,475
2014	703	Maximum	$2,224,675	$2,137,797	$294,094	$4,362,472
		Total	$54,828,613	$43,775,377	$3,870,686	$102,474,675
		Median	$8,012	$13,440	$0	$46,366
		Mean	$77,992	$62,269	$5,506	$145,768
2015	679	Maximum	$2,526,408	$2,120,570	$287,612	$4,646,978
		Total	$58,473,702	$45,762,733	$3,964,425	$108,200,860
		Median	$12,867	$11,864	$0	$44,992
		Mean	$86,117	$67,397	$5,839	$159,353

3.2.4 Economic Performance Indicators for the GT-IFQ Program

Systematically measuring the economic performance of U.S. catch share programs has been difficult because the programs are so diverse in terms of target species, location, size, duration, management objectives, program design features, etc. However, a group of NMFS fisheries economists developed a set of standard economic performance indicators that measure the economic performance of catch share programs regardless of their design.

The approach adopted in the implementation and use of these indicators is to compare the "baseline" estimate for each indicator to its performance following implementation. The baseline is generally the three-year average of the metric prior to implementing the catch shares program. Metrics included in this group of indicators covered six areas: management context (e.g., whether quota increased); management performance (e.g., whether quota was exceeded and whether season length increased); economic benefits (e.g., whether landings revenue increased, whether quota utilization increased, and whether average prices increased); economic efficiency (e.g., whether revenue per vessel increased); capacity (e.g., whether the number of fishing vessels decreased); and distributional effects (e.g., whether the number of shareholder accounts increased or decreased). The metrics used to estimate these estimators have been refined and enhanced in specific programs, including in the GT-IFQ and RS-IFQ programs. Many of these metrics are discussed in greater detail in previous or subsequent sections of this review. This section discusses some of the more basic metrics that are not covered in detail elsewhere in this review and apply to the performance of the GT-IFQ program as a whole (i.e., these metrics are not analyzed by share category or species).

Based on the information in Table 3.2.4.1, the percentage of the total quota allocated to species in the GT-IFQ program initially dropped precipitously in 2010 from 70% to 49%. However, this decline was caused by the Deepwater Horizon (DWH) oil spill rather than implementation of the IFQ program, as evidenced by the fact that the utilization rate has been at 80% or greater and averaged 86% since 2010. Thus, in general, participants in the program have been using a relatively high percentage of the quota they were allocated. As expected, the number of entities holding shares in the program has generally declined since the program was implemented, decreasing by about 15% between 2010 and 2014, though a slight increase occurred in 2015. Similarly, the number of vessels participating in the fishery has generally declined from the baseline period, decreasing by about 32% from the baseline through 2013, though slight increases occurred in 2014 and 2015. Effort as measured by the number of trips and days at sea similarly decline from the baseline through 2013, but again noticeably increased in 2014 and remained at elevated levels in 2015. These estimates suggest that the fleet has become more technically efficient (TE) and capacity has been reduced since the IFQ program was implemented (see Larry's discussion on TE and capacity for a more refined analysis of changes in TE and capacity).

Consistent with estimates in section 3.2.3, total revenue per vessel nearly doubled from the baseline period through 2014. While not increasing quite as much, total revenue per trip and total revenue per day at sea also increased by more than 80%. Average price per pound did not increase by nearly as much, but still increased by almost 19% from the baseline period through

2015. These changes suggest that the IFQ program has conveyed significant economic benefits to entities participating in the GT-IFQ program, though the magnitude of those benefits may have leveled off in recent years. A more refined analysis of the economic benefits generated by the program is discussed in following section regarding net revenues and profitability in the Gulf reef fish fishery.

Table 3.2.4.1 Economic Performance Indicators for the GT-IFQ Program, Baseline (2007-09) through 2015. All dollar estimates are in 2015 dollars.

Year	Aggregate Quota (lbs)	Aggregate Landings (lbs)	Quota Utilization (%)	Entities Holding Shares	Active Vessels	Trips	Days At Sea	Total revenue per vessel ($)	Total revenue per trip ($)	Total revenue per day at sea ($)	Average Price ($)
Baseline	9,820,000	6,863,065	70	N/A	630	6,540	33,546	$70,505	$6,792	$1,324	$3.42
2010	9,030,000	4,440,500	49	743	452	4,381	22,694	$74,771	$7,714	$1,489	$3.51
2011	7,530,000	6,454,219	86	699	440	4,616	23,993	$102,009	$9,724	$1,871	$3.48
2012	8,155,000	7,457,594	91	665	449	4,819	24,997	$111,970	$10,433	$2,011	$3.57
2013	8,456,000	6,835,196	81	644	430	4,588	24,215	$124,268	$11,647	$2,207	$3.84
2014	8,680,000	8,016,943	92	628	435	5,035	26,145	$140,954	$12,178	$2,345	$3.93
2015	8,867,000	7,071,122	80	645	446	5,004	25,755	$140,060	$12,483	$2,425	$4.06

3.2.5 Economic Returns in the G-T IFQ Program

Estimates of economic return measures have not been available historically for the Gulf IFQ programs or the reef fish fishery as a whole. A recently released report (Overstreet et al. 2017) provided the first such estimates for the Gulf reef fish fishery. These estimates are specific to economic performance in 2014. Estimates in the report are based on a combination of Southeast Coastal logbook data, a supplemental economic add-on survey to the logbooks, and an annual economic survey at the vessel level. The economic surveys collect data on gross revenue, variable costs, fixed costs, as well as some auxiliary economic variables (e.g., market value of the vessel). The report provides estimates of critical economic variables for the commercial sector of the Gulf reef fish fishery as a whole, but also provides estimates by "subsets" within this sector. These subsets are referred to as Segments of Interest (SOI). Subsets are generally defined at the individual species (e.g., red snapper), species group (e.g., Jacks), and/or gear-level (e.g., longline). In addition, estimates are provided at the trip level and the annual vessel level for each SOI. For current purposes, the most important results are those specific to the G-T IFQ program. Estimates for various components of the program (e.g., red grouper and DWG) are also provided, but they are qualitatively similar to the results for the program as a whole.

Table 3.2.5.1 provides estimates of the important economic variables for G-T trips (i.e., trips that harvested at least one pound of G-T species). Consistent with estimates in sections 3.2.2 and 3.2.3, the mean and median estimates differ, sometimes significantly, illustrating distribution of the data for these economic variables is highly skewed. This finding suggests that the median estimates are more representative of the true "average" values.

From an economic returns perspective, the two most critical results are the estimates of trip net cash flow and trip net revenue. Trip net cash flow is trip revenue minus the costs for fuel, bait, ice, groceries, miscellaneous, hired crew, and purchases of annual allocation from other allocation holders. Thus, this estimate represents the amount of cash generated by a typical G-T trip over and above the cash cost of taking the trip (i.e., variable costs of the trip). Trip net revenue is trip revenue minus the costs for fuel, bait, ice, groceries, miscellaneous, hired crew, and the opportunity cost of owner's time as captain. By including opportunity cost of the owner's time and excluding purchases of annual allocation, trip net revenue is a measure of the economic performance of the commercial fishing trip. Trip cash flow and trip net revenue were both positive in 2014, generally indicating that "profits" were being earned on G-T trips, though some trips earned much greater profits than others.

Table 3.2.5.1 Economic Characteristics of G-T IFQ Trips in 2014.

	Mean	Median
G-T Trips		
Owner-Operated	69%	NA
Days at Sea	5.11	4
Crew Size	2.79	3
Fuel Used (gallons)	239	150
Landings (gutted lbs)	2,872	1,867
Trip Revenue	$11,088	$6,395
Trip Costs[17]		
Fuel	$827	$571
Bait	$348	$163
Ice	$177	$81
Groceries	$290	$152
Miscellaneous	$273	$89
Hired Crew	$3,184	$1,412
Annual Allocation	$1,494	$202
Owner-Captain Time[18]	$759	$147
Trip Net Cash Flow	$4,495	$1,824
Trip Net Revenue	$5,230	$2,193

Figure 3.2.5.1 illustrates the economic "margins" that were generated on G-T trips, i.e., trip net cash flow and trip net revenue as a percentage of trip revenue. According to this figure, 29%, 17% and 13% of the revenues generated on G-T trips were used to pay for crew costs, fuel/supplies costs, and purchases of annual allocation, while the remaining 41% was net cash flow back to the owner(s). The margin associated with trip net revenue was slightly higher at 47%.

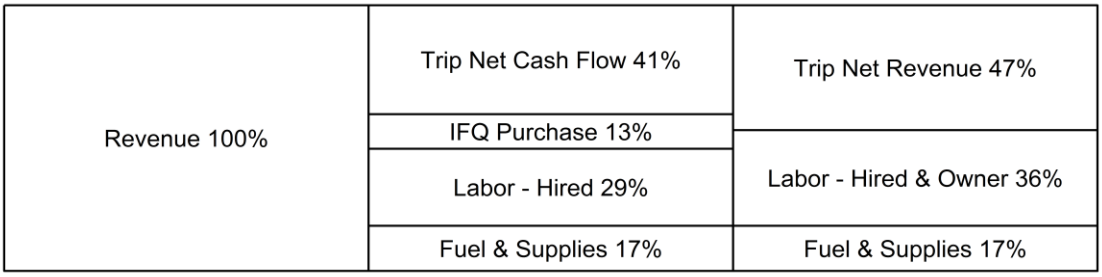

Figure 3.2.5.1 Trip Net Cash Flow and Trip Net Revenue as Percentage of Trip Revenue

[17] The average price of fuel per gallon was $3.44 and the average cost of labor was $266 per crew/day in 2015 dollars.

[18] Owner-Captain Time is the estimated opportunity cost of an owner's labor as captain over the year.

Table 3.2.5.2 provides estimates of the important economic variables at the annual level for all vessels that had G-T landings in 2014. As before, the mean and median estimates differ, and the median values are likely more representative of the true "averages" for vessels that participate in the G-T IFQ program. Similar to the trip level, the three most important estimates of "economic returns" are net cash flow, net revenue from operations,[19] and economic return on asset value. Of these measures, net revenue from operations most closely represents "economic profits" to the owner(s). Net cash flow is total annual revenue minus the costs for fuel, other supplies, hired crew, vessel repair and maintenance, insurance, overhead, loan payments, and purchases of annual allocation. Net revenue from operations is total annual revenue minus the costs for fuel, other supplies, hired crew, vessel repair and maintenance, insurance, overhead, and the opportunity cost of an owner's time as captain as well as the vessel's depreciation. Economic return on asset value is calculated by dividing the net revenue from operations by the vessel value. Net cash flow and net revenue from operations were both positive in 2014, generally indicating that "profits" were being earned by vessels in the G-T IFQ program, though some vessels earned much greater profits than others. In addition, the economic return on asset value was approximately 45% in 2014.

Table 3.2.5.2. Economic Characteristics of G-T IFQ Vessels in 2014. All dollar estimates are in 2015 dollars.

	Mean	**Median**
G-T Vessels		
Owner-Operated	58%	NA
For-Hire Active	6%	NA
Days - Commercial Fishing	73	48
Days - For-Hire Fishing	7	0
Days - Non-fishing	2	0
Vessel Value	$126,979	$75,825
Has Insurance	28%	NA
Total Revenue[20]	$175,728	$103,174
Commercial Fishing	$164,327	$77,552
For-Hire Fishing	$11,400	$0
Costs		
Fuel	$13,990	$8,963
Other Supplies	$16,645	$6,066
Hired Crew	$47,735	$11,862
Vessel Repair & Maintenance	$12,983	$6,420
Insurance	$1,800	$0
Overhead	$8,712	$3,539
Loan Payment	$1,427	$0
IFQ Purchase	$19,991	$4,044
Owner-Captain Time	$9,853	$3,252
Depreciation	$6,349	$3,791
Net Cash Flow	$52,446	$8,652
Net Revenue from Operations*	$57,660	$9,111

[19] Net revenue from operations accrue to the vessel owner and the shareholder, who may not be the same entity.
[20] The total annual revenue estimates for vessels in Overstreet, Perruso, and Liese (2017) do not match the estimates in section 3.2.3 because they used revenue data from the logbook data for IFQ species, rather than data from the IFQ program, but also account for revenues from for-hire fishing activities.

Figure 3.2.5.2 illustrates the economic "margins" that were generated by vessels in the G-T IFQ program, i.e., net cash flow and net revenue from operations as a percentage of total annual revenue. According to this figure, 27%, 17%, 13%, 11%, and 1% of the revenues generated by G-T vessels were used to pay for crew costs, fuel/supplies costs, fixed costs, purchases of annual allocation, and loans while the remaining 31% was net cash flow back to the owner(s). The margin associated with net revenue from operations was slightly higher at 33%.

<table>
<tr><td rowspan="6">Revenue 100%</td><td>Net Cash Flow 31%</td><td rowspan="2">Net Revenue - Operations 33%</td></tr>
<tr><td>IFQ Purchase 11%</td></tr>
<tr><td>Loan Payment 1%</td><td>Depreciation 4%</td></tr>
<tr><td>Fixed Costs 13%</td><td>Fixed Costs 13%</td></tr>
<tr><td>Labor - Hired 27%</td><td rowspan="2">Labor - Hired & Owner 33%</td></tr>
<tr><td>Fuel & Supplies 17%</td><td>Fuel & Supplies 17%</td></tr>
</table>

Figure 3.2.5.2. Net Cash Flow and Net Revenue from Operations as Percentage of Revenue.

Overstreet, Perruso, and Liese (2017) only provide estimates of economic returns in 2014, and thus it cannot be used to assess how economic returns and related measures have changed since the implementation of the G-T IFQ program. However, Liese (pers. communication, Nov. 22, 2017) has conducted an analysis that compares economic returns and related measures in 2006 and 2014, and thus examines how they have changed since the implementation of the G-T and RS-IFQ programs. Because of the years chosen, the changes in economic performance indicated by these results can only, at best, be attributed to the combination of the two IFQ programs as opposed to one or the other. Also, his results apply to all trips that landed Gulf reef fish species as opposed to landings of species managed under one or both of the IFQ programs. Further, as these results are preliminary, only a generally qualitative overview can be provided for this review.

First, effort in the commercial sector of the fishery has decreased significantly according to multiple measures. Specifically, the number of vessels, trips, and days at sea decreased by 31%, 38%, and 28%, respectively, between 2006 and 2014. At the same time, landings of Gulf reef fish were relatively unchanged, decreasing by about 4% during that time. Thus, output per unit of input (one measure of productivity) has increased significantly since the IFQ programs were implemented. Further, even though landings have remained about the same, the average ex-vessel price of Gulf reef fish landings increased by 20% during this time, resulting in a 16% increase in total annual revenues from these landings.

Because productivity increased, costs decreased. Specifically, crew costs decreased by 6%, other variable costs (supplies, fuel, etc.) decreased by 33%, and fixed costs decreased by 19%. The decrease in crew costs was driven by a decrease in crew days of 26%, as crew compensation per day actually increased by 24% (i.e., the amount of labor used decreased somewhat significantly, but "wages" increased somewhat significantly as well). Similarly, even though fuel prices increased by 25%, a 49% decrease in fuel usage was the primary driver of the decline in other

variable costs. In addition, the opportunity costs associated with the owner's labor time and capital invested in the vessel decreased by 16% and 31%, respectively.

Because costs decreased, significantly lower percentages of the total revenues had to be used to cover these costs, in turn resulting in much higher economic returns and margins. Net cash flow to the owner(s) increased by more than 300% while net revenue from operations increased by more than 400%. Trip net revenue as a percentage of total trip revenue increased by 94% while, at the vessel level, net revenue from operations as a percentage of total revenues increased by 180%. While such increases may appear to be exorbitant, it must be kept in mind that, in 2006, net cash flows were only slightly above the break-even point and net revenues from operations were negative.

3.2.6 IFQ Dealers

The information in Tables 3.2.6.1 and 3.2.6.2 account for the activities of all 178 dealers that were active in the IFQ programs from 2011 to 2015. Like vessels, dealer participation in the IFQ programs is fluid and not all of these dealers were active in one or both IFQ programs in each year during this time. Information on the number of dealers active in each of the two programs in a specific year is provided in the annual reports (NMFS 2016a, 2016b). The number of dealers active in either of the programs has increased by about 13% from 2011 to 2015.

The largest dealer to participate in these programs was responsible for purchasing about $10.4 million in seafood, while mean purchases per dealer are only about $655,000 per dealer and median purchases per dealer are only about $193,000. Although most dealers that participate in the IFQ programs rely heavily on purchases of Gulf IFQ species, purchases of non-IFQ species in the Gulf and the South Atlantic are also important (i.e., the landings portfolios of Gulf IFQ dealers are generally more diversified than Gulf IFQ vessels). Further, dependency on Gulf IFQ purchases as opposed to purchases of non-IFQ species varies considerably by dealer.
In addition, although the trends in IFQ purchases by dealers mimics the trends in IFQ vessel revenues, the trends in purchases of non-IFQ species in the Gulf and South Atlantic are not similar to the trends for vessels because some of the landings of non-IFQ species in the Gulf are landed by non-IFQ dealers, and IFQ dealers in the Gulf purchase a fair amount of landings from the South Atlantic. So, although total seafood purchases by IFQ dealers have increased noticeably (about $28 million), the percentage increase for IFQ dealers is about 43%, which is less than for IFQ vessels. Further, the increase in the number of IFQ dealers has caused the increase in the mean value of seafood purchases to increase even less in percentage terms (25%), while the median seafood purchases per dealer actually decreased by more than 7%.

Table 3.2.6.1. Annual purchases per dealer statistics for the 178 dealers active in Gulf IFQ Programs from 2011-2015. All dollar estimates are in 2015 dollars.

Statistic	IFQ Purchases	Gulf Non-IFQ Purchases	South Atlantic Purchases	Total Purchases
Maximum	$9,743,574	$4,902,577	$3,071,392	$10,408,504
Median	$49,935	$3,427	$0	$193,510
Mean	$384,239	$225,057	$46,187	$655,483

Table 3.2.6.2. Total purchases and purchases per dealer statistics for the 178 dealers active in Gulf IFQ Programs from 2011-2015 by year. All dollar estimates are in 2015 dollars.

Year	Number of Dealers	Statistic	IFQ Purchases	Gulf Non-IFQ Purchases	South Atlantic Purchases	Total Purchases
2011	115	Maximum	$4,228,602	$3,317,153	$3,071,392	$6,565,981
		Total	$34,807,792	$25,109,395	$5,461,712	$65,378,899
		Median	$45,061	$583	$0	$187,759
		Mean	$302,676	$218,343	$47,493	$568,512
2012	117	Maximum	$4,105,866	$3,004,376	$2,885,881	$5,660,812
		Total	$41,377,491	$24,632,602	$5,651,179	$71,661,272
		Median	$55,487	$5,252	$0	$206,859
		Mean	$353,654	$210,535	$48,301	$612,490
2013	120	Maximum	$5,761,917	$4,104,867	$2,799,391	$6,730,089
		Total	$47,958,814	$28,592,715	$5,933,101	$82,484,630
		Median	$58,385	$5,123	$0	$218,750
		Mean	$399,657	$238,273	$49,443	$687,372
2014	135	Maximum	$8,878,495	$3,934,230	$3,055,876	$10,034,218
		Total	$54,842,125	$31,117,460	$6,277,512	$92,237,097
		Median	$51,036	$3,903	$0	$175,508
		Mean	$406,238	$230,500	$46,500	$683,238
2015	131	Maximum	$9,743,574	$4,902,577	$1,857,899	$10,408,504
		Total	$58,473,702	$29,632,825	$5,219,857	$93,326,384
		Median	$39,600	$4,503	$0	$173,449
		Mean	$446,364	$226,205	$39,846	$712,415

3.2.7 Imports

Imports of seafood products compete in the domestic seafood market and have in fact dominated many segments of the seafood market. Imports aid in determining the price for domestic seafood products and tend to set the price in the market segments in which they dominate. Seafood imports have downstream effects on the local fish market. At the harvest level for reef fish in general and red grouper in particular, imports affect the returns to fishermen through the ex-vessel prices they receive for their landings. As substitutes to domestic production of reef fish, including red grouper, imports tend to cushion the adverse economic effects on consumers resulting from a reduction in domestic landings. The following describes the imports of fish products which directly compete with domestic harvest of reef fish, including red grouper.

Imports of fresh snapper increased steadily from 22.8 mp product weight (pw) in 2010 to 26 mp pw in 2015. Total revenue from fresh snapper imports increased from $64.6 million (2015 dollars) in 2011 to a high of $78.7 million in 2015. Imports of fresh snappers primarily originated in Mexico, Central America, or South America, and entered the U.S. through the port

of Miami. Imports of fresh snapper were highest on average (2010 through 2015) during the months of March through August. Imports of frozen snapper were substantially less than imports of fresh snapper from 2010 through 2015. Frozen snapper imports ranged from 11 mp pw worth $25.8 million (2015 dollars) in 2010 to 12.3 mp pw worth $33.2 million in 2015. Imports of frozen snapper primarily originated in South America (especially Brazil), Indonesia, and Mexico. The majority of frozen snapper imports entered the U.S. through the ports of Miami and New York. Imports of frozen snappers tended to be lowest during March through June when fresh snapper imports were strong.

Imports of fresh grouper ranged from 9.4 mp pw in 2010 to 10.7 mp pw in 2015. Total revenue from fresh grouper imports ranged from $29.5 million in 2010 (2015 dollars) to $44.4 million in 2015. The bulk of fresh grouper imports originated in Mexico and entered the U.S. through Miami and Tampa. From 2010 through 2015, fresh grouper imports were lowest on average during the month of March and higher the rest of the year, with a peak in July. Imports of frozen grouper were minimal and stable from 2010 through 2015, ranging from 1.3 mp pw to 2 mp pw. The average annual value of frozen grouper imports during this time period was $3.3 million (2015 dollars). Frozen grouper imports generally originated in Mexico and to a lesser extent, Asia and entered the U.S. through Miami and Tampa. There was an inverse relationship in monthly landings between frozen and fresh groupers, with average imports being the highest in March for frozen grouper and lower during other months.

3.2.8 Economic Impacts of the Gulf of Mexico IFQ Fisheries

The commercial harvest and subsequent sales and consumption of fish generates business activity as fishermen expend funds to harvest the fish and consumers spend money on goods and services, such as red grouper purchased at a local fish market and served during restaurant visits. These expenditures spur additional business activity in the region(s) where the harvest and purchases are made, such as jobs in local fish markets, grocers, restaurants, and fishing supply establishments. In the absence of the availability of a given species for purchase, consumers would spend their money on substitute goods and services. As a result, the analysis presented below represents a distributional analysis only; that is, it only shows how economic effects may be distributed through regional markets and should not be interpreted to represent the impacts if these species are not available for harvest or purchase.

Estimates of the U.S. average annual business activity associated with the commercial harvest of IFQ species in the Gulf were derived using the model[21] developed for and applied in NMFS (2015b) and are provided in Tables 3.2.8.1 and 3.2.8.2 for 2010 and 2015, respectively. This business activity is characterized as full-time equivalent jobs, income impacts (wages, salaries, and self-employed income), and output (sales) impacts (gross business sales). Income impacts should not be added to output (sales) impacts because this would result in double counting.

The results provided should be interpreted with caution and demonstrate the limitations of these types of assessments. These results are based on average relationships developed through the

[21] A detailed description of the input/output model is provided in NMFS (2011b).

analysis of many fishing operations that harvest many different species. Separate models for individual species are not available. In 2010, landings of Gulf IFQ species resulted in approximately $34.799 million in gross revenue (2015 dollars). In turn, this revenue generated employment, income, value-added and output impacts of 4,707 jobs, $126.71 million, $179.06 million, and $345.09 billion, respectively. In 2015, landings of Gulf IFQ species resulted in approximately $58.474 million in gross revenue (2015 dollars). In turn, this revenue generated employment, income, value-added and output impacts of 7,926 jobs, $212.95 million, $300.87 million, and $579.87 billion, respectively. Thus, from 2010 to 2015, revenues from the landings of IFQ species increased by about $23.7 million, or by 68%. At the national level, this increase in revenues subsequently lead to an additional 3,219 jobs, $86.24 million in income, $121.81 million in value-added, and $234.78 million in output.

Table 3.2.8.1. Economic impacts of the Gulf IFQ Fisheries in 2010 (2015 dollars). All dollar estimates are in thousands of 2015 dollars; employment is measured in full-time equivalent jobs.

Industry sector	Direct	Indirect	Induced	Total
Harvesters				
Employment impacts	821	128	169	1,117
Income Impacts	18,788	3,488	8,435	30,712
Total value-added impacts	20,027	12,558	14,433	47,018
Output Impacts	34,799	28,312	28,018	91,129
Primary dealers/processors				
Employment impacts	171	68	119	358
Income Impacts	6,130	5,650	5,343	17,123
Total value-added impacts	6,535	7,209	10,060	23,803
Output Impacts	19,731	14,862	19,665	54,257
Secondary wholesalers/distributors				
Employment impacts	79	17	77	174
Income Impacts	3,652	1,086	3,841	8,579
Total value-added impacts	3,893	1,822	6,561	12,276
Output Impacts	9,782	3,567	12,759	26,108
Grocers				
Employment impacts	340	39	76	454
Income Impacts	7,512	2,496	3,771	13,779
Total value-added impacts	8,008	4,022	6,384	18,414
Output Impacts	12,839	6,533	12,533	31,905
Restaurants				
Employment impacts	2,117	141	346	2,604
Income Impacts	30,136	9,140	17,262	56,537
Total value-added impacts	32,123	16,337	29,084	77,545
Output Impacts	58,738	25,566	57,392	141,695
Harvesters and seafood industry				
Employment impacts	3,528	393	786	4,707
Income Impacts	66,219	21,860	38,652	126,731
Total value-added impacts	70,586	41,948	66,521	179,056
Output Impacts	135,889	78,838	130,366	345,094

Table 3.2.8.2. Economic impacts of the Gulf IFQ Fisheries in 2015 (2015 dollars). All dollar estimates are in thousands of 2015 dollars dollars; employment is measured in full-time equivalent jobs.

Industry sector	Direct	Indirect	Induced	Total
Harvesters				
Employment impacts	1,382	215	284	1,881
Income Impacts	31,570	5,861	14,174	51,606
Total value-added impacts	33,652	21,102	24,252	79,006
Output Impacts	58,474	47,573	47,080	153,127
Primary dealers/processors				
Employment impacts	288	115	200	602
Income Impacts	10,301	9,493	8,979	28,773
Total value-added impacts	10,980	12,113	16,904	39,997
Output Impacts	33,155	24,973	33,043	91,170
Secondary wholesalers/distributors				
Employment impacts	134	29	129	292
Income Impacts	6,137	1,825	6,454	14,416
Total value-added impacts	6,541	3,061	11,024	20,627
Output Impacts	16,437	5,993	21,440	43,870
Grocers				
Employment impacts	572	65	127	764
Income Impacts	12,623	4,194	6,336	23,154
Total value-added impacts	13,456	6,759	10,727	30,941
Output Impacts	21,575	10,977	21,059	53,611
Restaurants				
Employment impacts	3,565	238	583	4,386
Income Impacts	50,638	15,358	29,006	95,002
Total value-added impacts	53,978	27,452	48,871	130,301
Output Impacts	98,699	42,959	96,437	238,095
Harvesters and seafood industry				
Employment impacts	5,941	662	1,323	7,926
Income Impacts	111,269	36,732	64,948	212,950
Total value-added impacts	118,608	70,487	111,778	300,873
Output Impacts	228,339	132,475	219,059	579,873

3.3 Social

In a national report on community participation in catch share programs (Colburn et al. 2017), a series of performance indicators were developed to provide an overview of catch share programs and the communities participating in those regional programs. The report focuses specifically on the trends of catch share programs within U.S. fishing communities (in the broadest sense rather than as defined under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)) and presents a set of community-level catch share performance metrics aimed at understanding changes in social vulnerability and fisheries' participation. The following metrics for the GT-IFQ program were included in that report and are presented here as part of the social environment with data updated to 2014 and adapted accordingly.
The metrics developed include two categories of objective community-level indicators that monitor community dependence on catch share species. The first set of indicators is intended to measure commercial fishing engagement by a community for all grouper tilefish species. The index is created through a principal components factor analysis (PCFA) of variables that are thought to contribute to (or detract from) community engagement in commercial fishing activities. The results of the PCFA were used to construct individual index scores for each community, using the regression method and normalized to have a mean of zero. Communities were chosen if they had an index score (standard deviation) of 1.0 or higher at least one year during the time series. The Baseline period of 2007-2009 was an average of those three years for the variables included (see Table 3.3.1). Other indicators include the Regional Quotient (RQ) and the Local Quotient for the GT-IFQ Program. The second set of indicators includes community-specific measures of social vulnerability and gentrification pressure vulnerability, based on those developed in Jepson and Colburn (2013). Together, these four metrics (see Table 3.3.1) form the community catch share performance indicators as developed by Colburn et al. (2017).

Table 3.3.1. Definitions of catch share performance indicators for communities involved with the GT-IFQ program.

Performance Indicator	Definition	Timeframe
Grouper-Tilefish Engagement Index*	Index consisting of Grouper-Tilefish pounds and value, number of permitted reef fish vessels, number of Grouper-Tilefish dealers within a community	Baseline to 2014
Grouper-Tilefish Regional Quotient (pounds and value)	Community landings of Grouper-Tilefish divided by total landings of Grouper-Tilefish in region	Baseline to 2014
Catch Share Program Local Quotient (pounds and value)	Community landings Grouper-Tilefish divided by total landings (all species) in community	Baseline to 2014
Community Social Vulnerability Indicators (CSVIs)	**Social Vulnerability Indicators**: Poverty Index, Population Composition Index, Personal	2014

	Disruption Index, Housing Characteristics Index, Labor Force Structure Index **Gentrification Pressure Vulnerability Indicators**: Housing Disruption Index, Retiree Migration Index, Urban Sprawl Index	American Community Survey 5-year Estimate

Grouper-Tilefish Commercial engagement

The program-specific commercial Fishing Engagement Index scores for the Gulf GT-IFQ Program are presented in Table 3.3.2. The index is an indicator of the importance of IFQ grouper -tilefish fishing in a community relative to other communities. It is a measure of the presence of IFQ grouper-tilefish fishing activity including pounds and value of grouper-tilefish, number of reef fish permits and number of reef fish dealers within the community. There are 54 communities in Table 3.3.2 that were highly engaged (1.0 standard deviation or more above the mean) in the Gulf GT-IFQ Program fishery for at least one year from the Baseline through 2014.

Table 3.3.2. Fishing Engagement Index scores of communities highly engaged in the Gulf GT-IFQ Program for one or more years from the Baseline (2007-2009) through 2014.

Community	Baseline	2010	2011	2012	2013	2014
Madeira Beach, FL	17.038	20.328	19.511	18.171	18.958	17.895
Panama City, FL	11.105	6.677	8.029	8.966	9.444	11.098
Saint Petersburg, FL	9.937	8.373	8.258	8.518	9.179	8.054
Key West, FL	9.049	7.950	8.405	10.327	10.272	8.894
Apalachicola, FL	7.664	4.809	5.442	5.645	4.107	5.087
Destin, FL	6.308	6.966	6.992	5.740	5.288	6.292
Tarpon Springs, FL	6.110	6.656	6.250	7.916	7.811	7.809
Cortez, FL	4.967	6.200	7.214	6.710	4.337	5.434
Tampa, FL	3.486	1.345	2.296	0.619	0.295	0.718
Islamorada, FL	2.930	2.234	1.851	1.734	1.465	1.288
Panacea, FL	2.922	2.452	1.860	1.139	1.418	1.420
Naples, FL	2.836	1.953	1.689	1.900	1.184	1.052
Fort Myers, FL	2.682	2.384	2.631	2.516	2.889	1.160
Spring Hill, FL	2.418	0.419	-0.164	-0.161	-0.157	-0.048
Pensacola, FL	2.409	3.176	2.725	3.244	2.433	2.855
Redington Shores, FL	2.310	3.440	4.476	5.593	6.248	6.337
Marathon, FL	2.272	3.862	4.186	3.166	4.228	1.369
Golden Meadow/Leeville, LA	2.248	2.376	3.017	1.926	1.485	0.597
Ruskin, FL	2.159	2.403	2.879	2.285	2.193	1.329
Clearwater, FL	2.018	2.629	2.118	3.192	2.781	1.791
Crystal River, FL	1.991	2.362	2.302	2.208	1.878	1.566

Key Largo, FL	1.901	4.843	2.288	2.282	1.586	0.749
Galveston, TX	1.849	1.633	2.308	1.637	3.106	5.463
Tallahassee, FL	1.844	1.326	1.140	0.911	0.609	0.378
Summerland Key, FL	1.832	2.006	3.314	1.766	1.982	0.625
Bon Secour, AL	1.779	1.394	0.907	1.152	-0.157	0.337
Largo, FL	1.712	-0.167	-0.164	-0.161	0.267	1.064
Steinhatchee, FL	1.566	2.200	1.262	2.136	1.188	2.194
Saint Marks, FL	1.369	0.454	1.015	0.498	0.408	0.662
Fort Walton Beach, FL	1.360	1.419	1.380	0.392	0.825	0.183
Port Isabel, TX	1.358	1.229	-0.164	-0.161	-0.157	-0.107
Hudson, FL	1.358	1.182	0.633	1.121	0.844	1.296
Sarasota, FL	1.347	0.415	0.296	-0.161	-0.157	0.070
Saint James City, FL	1.269	0.930	0.946	1.110	0.808	0.379
Grand Bay, AL	1.225	-0.167	-0.164	-0.161	-0.157	-0.107
Indian Shores, FL	1.224	-0.167	-0.164	-0.161	-0.157	0.364
Bayou La Batre, AL	1.122	1.176	1.262	1.028	0.915	0.804
Eastpoint, FL	1.118	0.626	0.640	0.624	0.513	0.199
Hernando Beach, FL	1.046	-0.167	0.297	0.252	0.265	0.480
Theodore, AL	1.006	0.578	0.598	0.373	1.205	-0.056
Grand Isle, LA	0.869	1.147	0.375	-0.161	0.467	0.356
Houston, TX	0.864	0.684	1.043	0.837	0.703	0.836
Freeport, TX	0.758	0.866	0.929	1.040	0.777	0.783
Port Bolivar, TX	0.602	1.057	0.928	0.938	0.732	0.175
Fort Myers Beach, FL	0.600	0.651	1.107	1.617	0.796	2.837
Dunedin, FL	0.591	0.588	1.304	1.135	1.395	0.865
Homosassa, FL	0.585	0.998	1.058	0.850	0.795	0.431
Anna Maria, FL	0.449	-0.167	0.298	1.059	0.849	0.250
Pascagoula, MS	0.353	1.477	0.910	0.911	0.876	0.693
Land O Lakes, FL	0.334	1.598	1.175	0.752	0.231	0.304
Tavernier, FL	0.310	1.381	0.449	1.737	1.582	0.007
Matlacha, FL	0.029	0.562	0.797	1.309	0.523	0.504
Big Pine Key, FL	-0.035	-0.167	0.296	-0.161	1.408	1.153
Slidell, LA	-0.182	-0.167	-0.164	1.382	0.393	0.173

Note: Highlighted cells indicate high engagement.

Most highly engaged communities are in Florida, with Galveston, TX the only community outside the state that was highly engaged throughout the time series. Golden Meadow/Leeville, LA had been highly engaged until 2014. Other communities, like Bayou La Batre, AL, have been highly engaged four out of the six time periods. Key Largo and Summerland Key, FL were both highly engaged five out the six years, only recently not highly engaged. The communities of Dunedin, Tavernier, Tallahassee, Hudson, and Fort Walton Beach, FL and Bon Secour, AL have

been highly engaged either early on or in the latter years of the program for at least three out of the six time periods.

Of the 54 communities found in Table 3.3.2, the top ten communities that were highly engaged for all years from the Baseline through 2014 are depicted in Figure 3.3.1. The engagement scores for those highly engaged communities display some fluctuation, but tend to be fairly stable for most communities. The community of Madeira Beach, FL has remained at the top throughout the time series presented in Figure 3.3.1 with an upward spike in 2010 that may be related to the fishery closures as a result of the DWH MC252 oil spill. Because the closures were primarily to the northwest of Madeira Beach, fishermen homeported there may not have been affected as much by the closures (as depicted by engagement scores in Figure 3.3.1), whereas many communities in Florida's Panhandle experienced a downward spike in 2010.

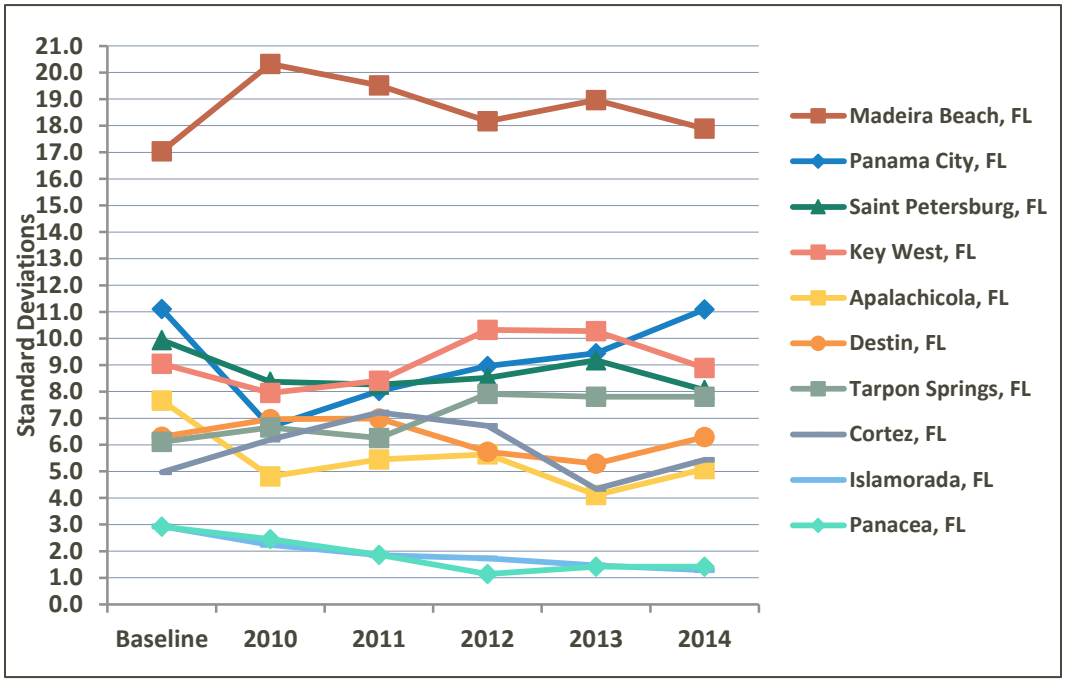

Figure 3.3.1. Fishing Engagement Index scores of the top ten communities highly engaged in the Gulf GT-IFQ Program for all years from the Baseline (2007-2009) through 2014.

For those communities midway between the upper community and those at the bottom, engagement has fluctuated. But several show a drop in engagement in 2010 that could be related to the longline endorsement in Amendment 31 (GMFMC 2010). Those at the bottom of the scale have fairly stable engagement scores over time, showing a downward trend.

Communities that demonstrated a stable or increase in the grouper-tilefish Fishing Engagement Index score from the Baseline period through 2014 are depicted in Figure 3.3.2. Redington Shores and Marathon, FL have seen the greatest increase in levels of grouper-tilefish engagement over time, with both seeing a rise of several standard deviations. Most communities with increasing engagement seemed to remain fairly stable in their engagement scores, with the top community of Madeira Beach, FL showing just a slight decrease after the upward spike in 2010.

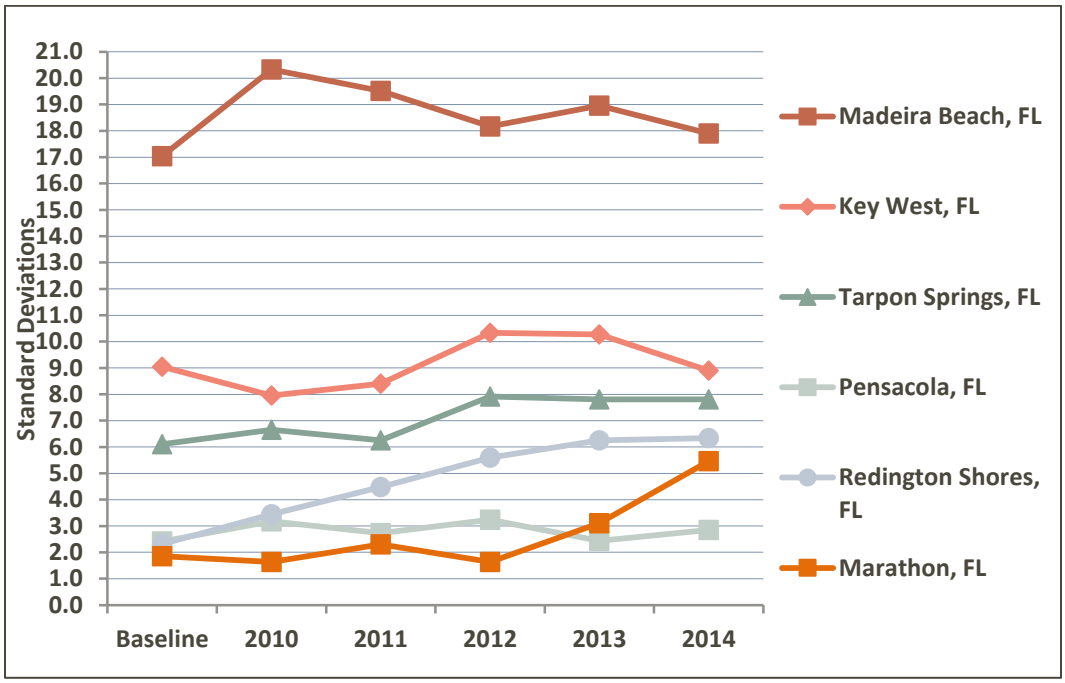

Figure 3.3.2. Fishing Engagement Index scores of communities highly engaged in the Gulf GT-IFQ Program for all years with increasing engagement from the Baseline (2007-2009) through 2014.

Communities that demonstrated a decreasing grouper-tilefish Fishing Engagement Index score from the Baseline through 2014 are depicted in Figure 3.3.3. The decreasing engagement scores do not indicate a significant decline in involvement, but do demonstrate considerable fluctuation from the Baseline through implementation to the most recent years. The communities of Panama City and Apalachicola, FL both saw a significant drop in 2010 that could likely be related to the fishing closures due to the DWH MC252 oil spill, although Panama City has recovered to near baseline status. With the longline endorsement in Amendment 31(GMFMC 2010), several communities were also likely to have seen some decrease in their engagement during or after 2010. Other fluctuations depicted are difficult to explain as they may have occurred for numerous reasons, e.g., vessel migration, weather, and other closures. The communities of Destin, Cortez and Apalachicola saw drops in 2013 but have seen a rise in engagement scores in 2014. Communities at the lower end of the scale again seem to have declining engagement scores over time.

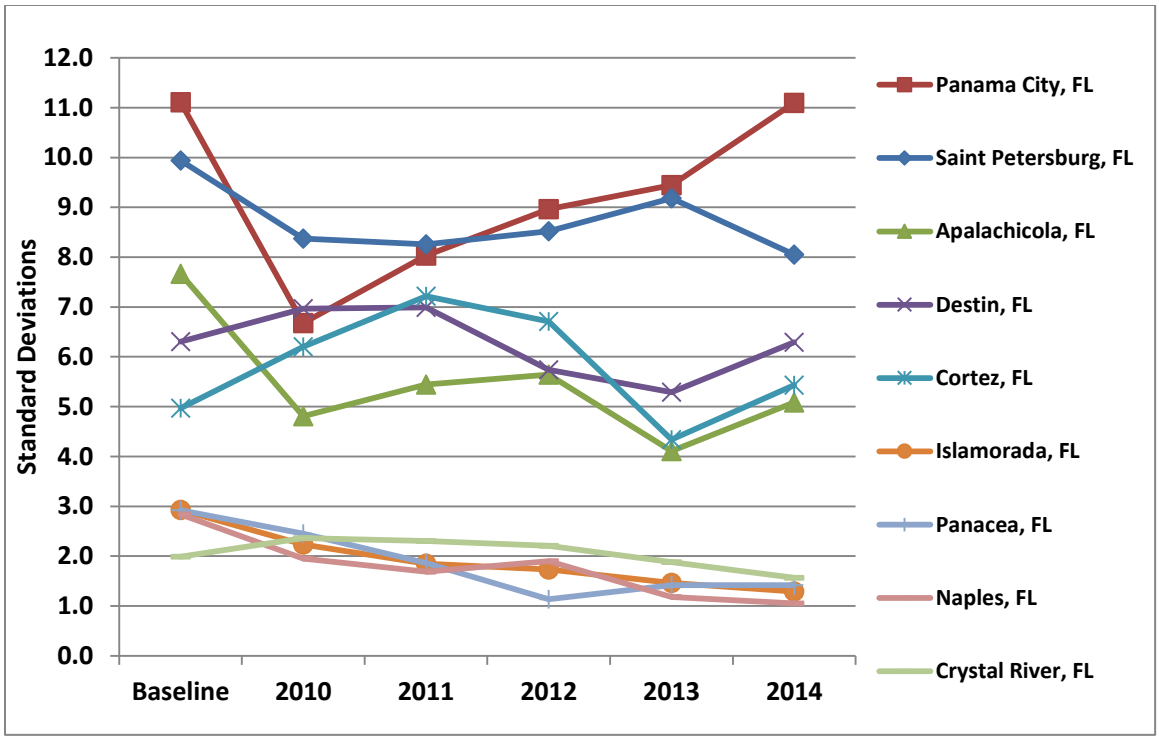

Figure 3.3.3. Fishing Engagement Index scores of communities highly engaged in the Gulf GT-IFQ Program for all years with decreasing engagement from the Baseline (2007-2009) through 2014.

The top 10 communities that were highly engaged for fewer than all years within the Gulf GT-IFQ Program are depicted in Figure 3.3.4. Although a crowded group of communities make it difficult to follow any particular trend, for many it demonstrates decreasing engagement. Tampa, Spring Hill, Largo, and Tallahassee, FL and Bon Secour, AL have all seen significant declines in engagement since implementation of the program but seem to see increases in 2014. These decreases may have resulted from the longline endorsement in Amendment 31(GMFMC 2010).

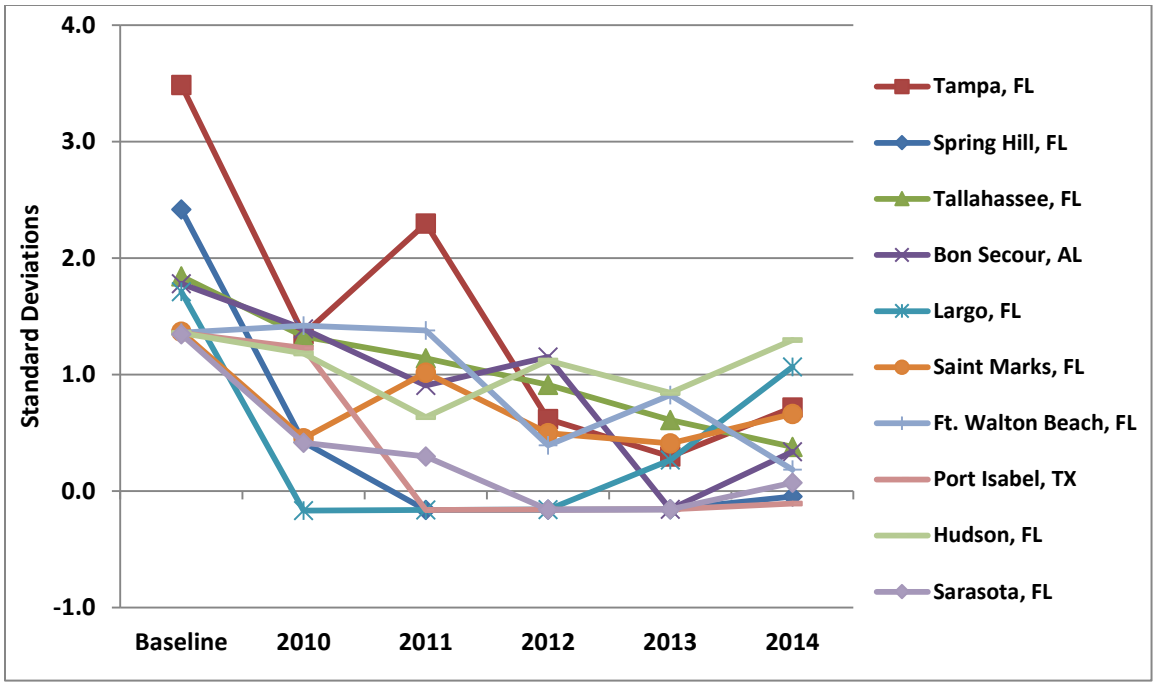

Figure 3.3.4. Fishing Engagement Index scores of top 10 communities highly engaged in the Gulf of Mexico GT-IFQ Program for fewer than all years from the Baseline (2007-2009) through 2014

Regional Quotient

Another measure of a community's involvement in the IFQ grouper-tilefish fishery is its RQ. RQ is the proportion of IFQ grouper-tilefish landed within a community out of the total amount of IFQ grouper-tilefish landed within the Southeast region. It is an indicator of the percent contribution in pounds or value of IFQ grouper-tilefish landed within that community relative to the regional fishery. The RQ is calculated as a species group that comprises all grouper-tilefish species included in the IFQ program, excluding all other grouper-tilefish species in the reef fish fishery. The RQ is reported individually only for those communities that were **highly engaged for all years** from the Baseline through 2014. All other communities that landed IFQ grouper-tilefish are grouped as "Other Communities." Figure 3.3.5 and Figure 3.3.6 show the RQ both in pounds and value, respectively from the Baseline to 2014.

The dominant IFQ grouper-tilefish communities for pounds landed included the Florida communities of Madeira Beach, Panama City, Apalachicola, Cortez, St. Petersburg, and Tarpon Springs (Fig. 3.3.5). Most communities saw some fluctuation in their Regional Quotient with several seeing a decrease in 2010, likely related to the fishery closures as a result of the DWH MC252 oil spill or Amendment 31 (GMFMC 2010). Other communities, like Madeira Beach and Cortez, saw slight increases in their RQ during that time period with decreases following. Overall trends in RQ for pounds seem to be fairly stable for most communities.

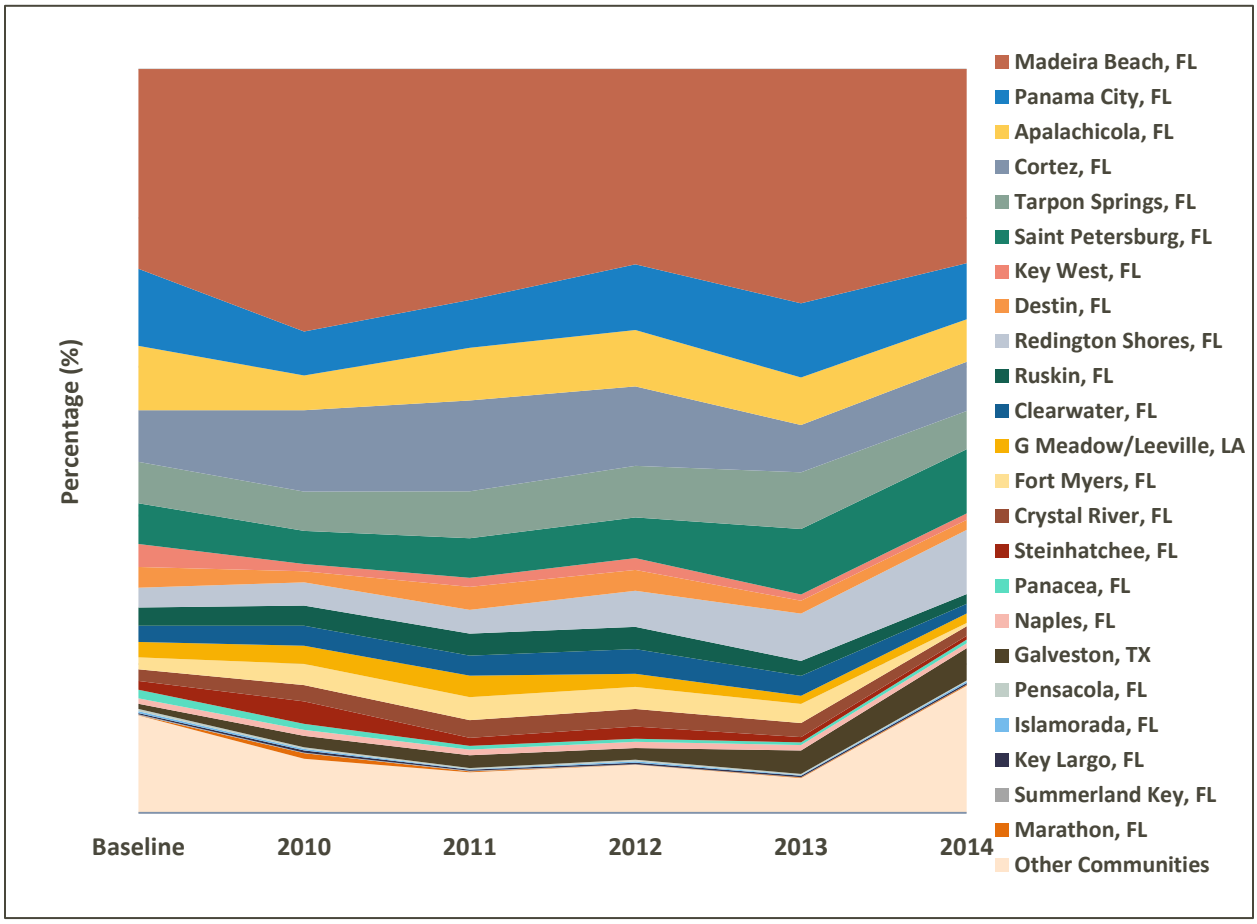

Figure 3.3.5. Regional Quotient (POUNDS) for communities highly engaged in the Gulf of Mexico GT-IFQ Program for all years from the Baseline (2007-2009) through 2014

The dominant IFQ grouper-tilefish communities for value landed are roughly the same as for pounds landed (Fig. 3.3.6). Most communities saw similar fluctuation in their RQ for value to that for pounds. One change was that the communities of St. Petersburg and Tarpon Springs, FL switched rankings in terms of value when compared to pounds in the RQ. However, they are very close on both measures. Again, the overall trend in RQ value seems to be fairly stable for most communities, although the category of "Other Communities" does show a decline in RQ until it begins to increase in 2014.

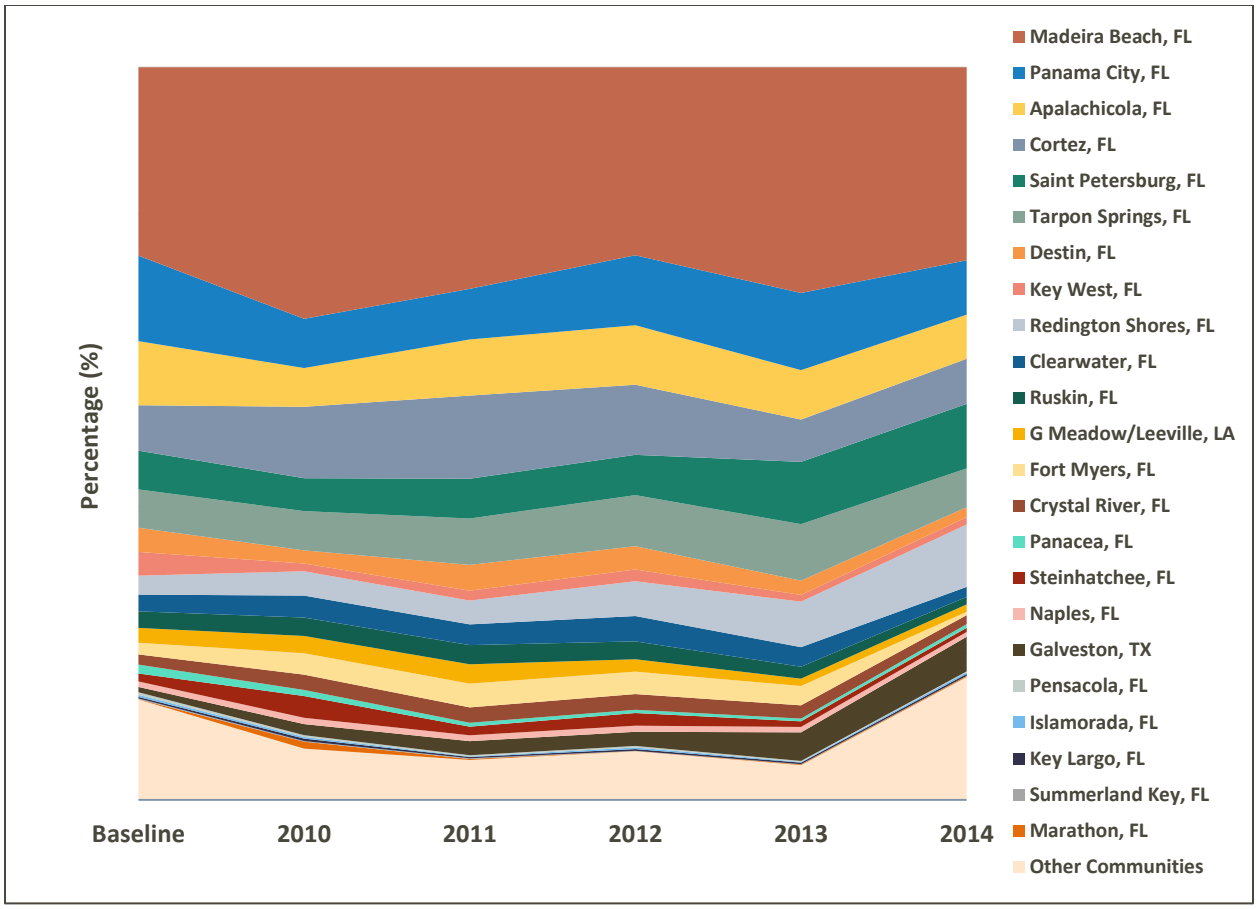

Figure 3.3.6. Regional Quotient (VALUE) for communities highly engaged in the Gulf of Mexico GT-IFQ Program for all years from the Baseline (2007-2009) through 2014

Local Quotient

The community Local Quotient is the percentage of IFQ grouper-tilefish landed within a community out of the total amount of all species landed within that community. It is an indicator of the contribution in pounds or value of IFQ grouper-tilefish to the overall landings in a community. Figure 3.3.7 and Figure 3.3.8 show the Local Quotient both in pounds and value from the Baseline to 2014.

The Local Quotient for pounds landed for several communities fluctuated from the Baseline through 2014 (Fig.3.3.7). The communities of Redington Shores, Ruskin, Steinhatchee, and St. Petersburg, FL all saw considerable fluctuation over time in their grouper-tilefish Local Quotient for pounds landed. St. Petersburg, FL saw a substantial increase in its Local Quotient, while Steinhatchee, FL saw a considerable decrease. The Local Quotient for IFQ grouper-tilefish pounds landed remained fairly stable for most communities although not high in terms of its overall contribution to pounds landed. In contrast, the Local Quotient for Madeira Beach, Redington Shores, Ruskin, and Tarpon Springs, FL often contributed well over 30 percent of total pounds landed in these communities.

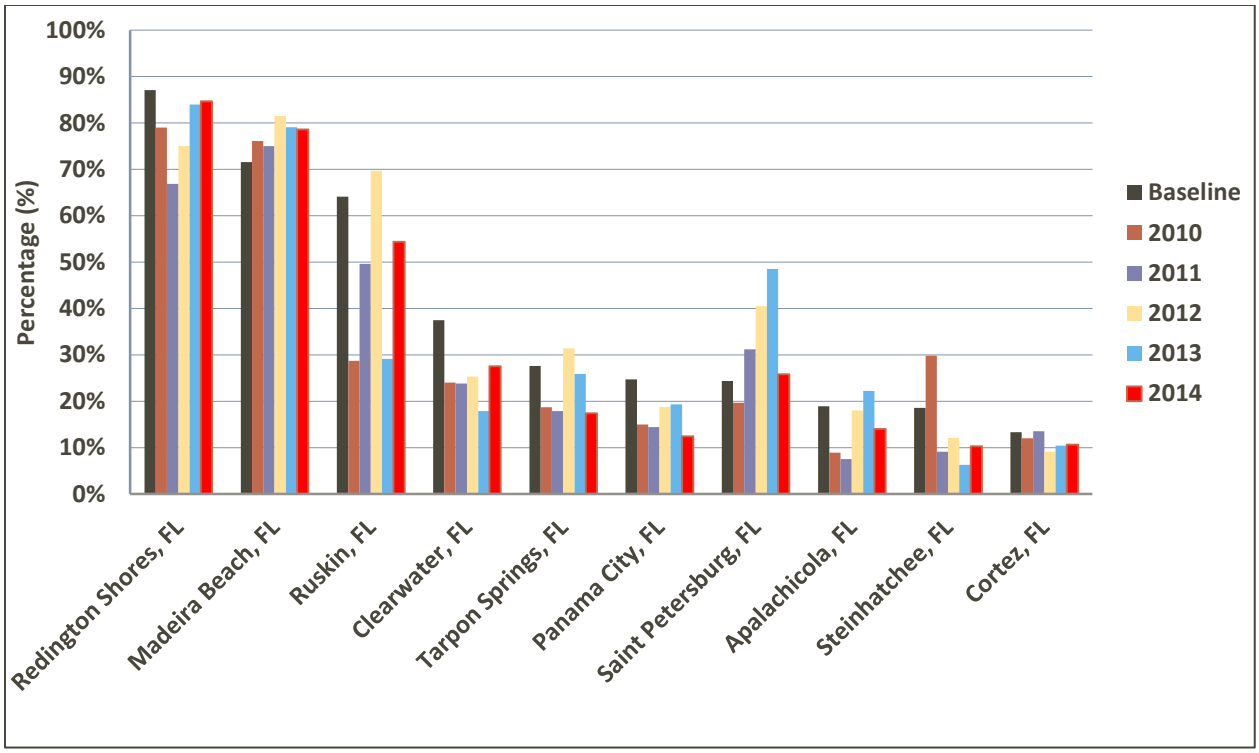

Figure 3.3.7. Local Quotient (POUNDS) for top ten communities highly engaged in the Gulf of Mexico GT-IFQ Program for all years from the Baseline (2007-2009) through 2014

The trend for Grouper-Tilefish Local Quotient for value landed is almost identical to the Local Quotient for pounds, except that the value makes up a higher percentage of total species value than pounds landed within most communities (Fig. 3.3.8). Cortez, FL showed the most marked difference in its IFQ grouper-tilefish Local Quotient for value over that for pounds landed, with its value contributing over 40 percent of its total landings value while the Local Quotient for pounds landed is just over 10 percent. For most years, the Local Quotient for Madeira, FL is close to 90 percent for value landed and 80 percent for pounds landed.

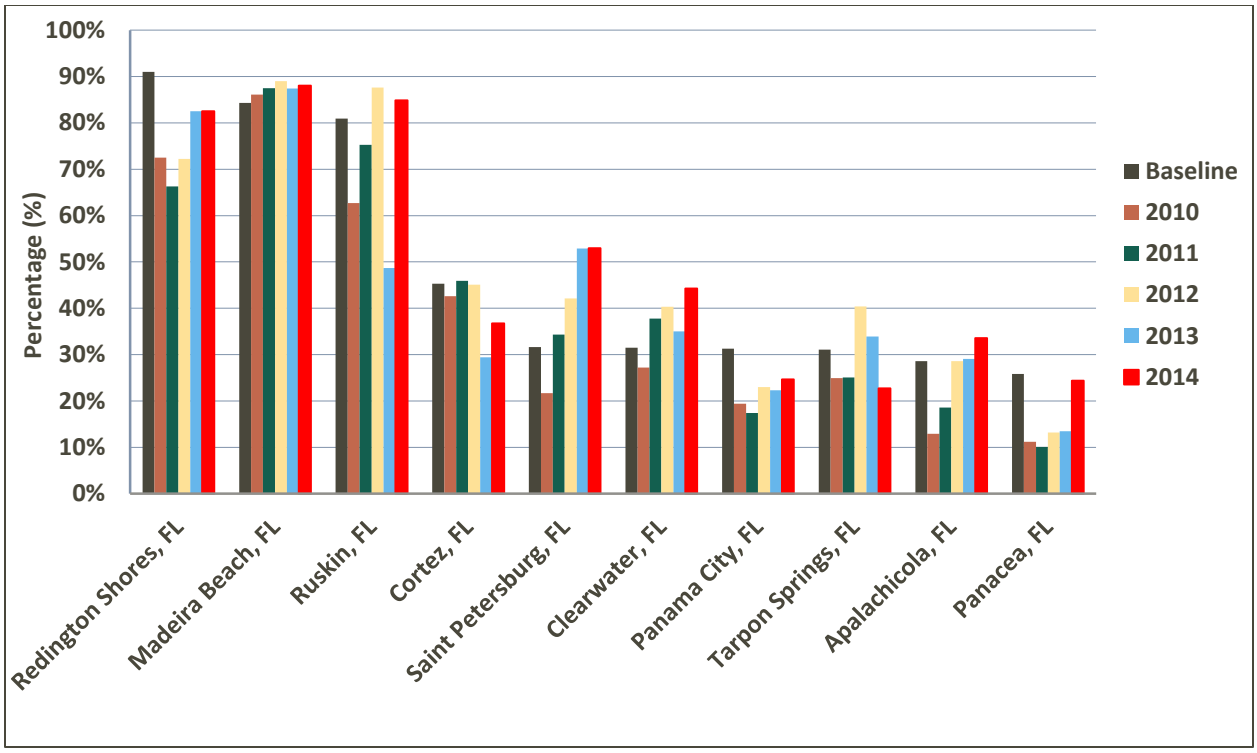

Figure 3.3.8. Local Quotient (VALUE) for top ten communities highly engaged in the Gulf of Mexico GT-IFQ Program for all years from the Baseline (2007-2009) through 2014

Community Social Vulnerability Indicators (CSVIs)

The two categories of CSVIs discussed below include social vulnerability and gentrification pressure vulnerability. The Social Vulnerability Indicators represent social factors that can shape either an individual's or community's ability to adapt to change (poverty, personal disruption, labor force structure, and population composition vulnerability). The Gentrification Pressure Vulnerability Indicators characterize factors that over time may indicate a threat to the viability of a vibrant commercial working waterfront including property and businesses (urban sprawl, housing disruption and retiree migration).

The Social Vulnerability Indicators for communities that were **highly engaged** in the Gulf GT-IFQ Program for at least one year from the Baseline to 2014 are included in Table 3.3.3. Communities **highly engaged for all years** are highlighted. These communities have a wide range in populations. Apalachicola and Panama City, FL have high vulnerabilities in relation to other Florida communities. The communities in Mississippi and Texas have higher vulnerabilities than the communities in other states. Almost every **highly engaged** community has high vulnerabilities related to housing characteristics except Islamorada, Key West and Naples.

Table 3.3.3. Community Social Vulnerability Indicators for communities highly engaged in the Gulf of Mexico GT-IFQ Program for one or more years from the Baseline (2007-2009) through 2014

Community	Population Size (2013)	Personal Disruption	Population Composition	Poverty	Labor Force Structure	Housing Characteristics
Apalachicola, FL	1,916	Med High	Moderate	High	Moderate	High
Clearwater, FL	108,551	Moderate	Low	Moderate	Moderate	Med High
Cortez, FL	4,051	Low	Low	Low	High	High
Crystal River, FL	3,095	Moderate	Low	Moderate	High	Med High
Destin, FL	12,623	Low	Low	Low	Low	Moderate
Fort Myers, FL	64,488	High	Med High	High	Med High	Med High
Galveston, TX	48,178	Med High	Moderate	Med High	Low	Med High
Islamorada, FL	6,230	Low	Low	Low	Med High	Low
Key West, FL	24,934	Low	Low	Low	Low	Low
Madeira Beach, FL	4,283	Low	Low	Low	Moderate	Moderate
Marathon, FL	8,405	Med High	Moderate	Med High	Low	Med High
Naples, FL	19,990	Low	Low	Low	High	Low
Panacea, FL	775	High	Low	High	Med High	N/A
Panama City, FL	36,205	Med High	Moderate	Med High	Moderate	Med High
Pensacola, FL	52,268	Moderate	Low	Moderate	Low	Med High
Redington Shores, FL	1,804	Low	Low	Low	High	Moderate
Ruskin, FL	17,311	Med High	Med High	Moderate	Low	High
St. Petersburg, FL	246,642	Low	Low	Low	High	High
Steinhatchee, FL	935	Low	Low	Low	High	High
Tarpon Springs, FL	23,564	Moderate	Low	Moderate	Med High	Med High
Golden Meadow/Leeville, LA	1,790	Med High	Low	Moderate	Med High	High
Key Largo, FL	10,959	Low	Low	Low	Low	Med High
Summerland Key, FL	N/A	N/A	N/A	N/A	N/A	N/A
Anna Maria, FL	1,556	Low	Low	Low	High	Low
Bayou La Batre, AL	2,646	High	Med High	High	Moderate	High
Big Pine Key, FL	5032	N/A	N/A	N/A	N/A	N/A
Bon Secour, AL	743	N/A	N/A	N/A	N/A	N/A
Dunedin, FL	35,421	Low	Low	Low	Med High	Med High
Eastpoint, FL	2,229	Med High	Low	High	Low	High
Fort Myers Beach, FL	6,457	Low	Low	Low	High	Moderate
Fort Walton Beach, FL	19,962	Moderate	Low	Moderate	Low	Moderate
Freeport, TX	12,105	High	High	High	Low	High
Grand Bay, AL	3,637	Low	Low	Low	Moderate	Med High
Grand Isle, LA	854	Low	Low	Moderate	Moderate	Med High
Hernando Beach, FL	1,962	Low	Low	Low	Med High	Moderate
Homosassa, FL	2,403	Moderate	Low	Med High	High	Med High
Houston, TX	2,134,707	Med High	High	Med High	Low	Med High
Hudson, FL	11,738	Moderate	Low	Moderate	High	High
Indian Shores, FL	1,423	Low	Low	Low	High	Moderate
Land O Lakes, FL	32,831	Low	Low	Low	Low	Low

Largo, FL	77,898	Moderate	Low	Moderate	Moderate	High
Matlacha, FL	884	Low	Low	N/A	High	High
Pascagoula, MS	22,372	Med High	Moderate	Med High	Moderate	Med High
Port Bolivar, TX	1907	N/A	N/A	N/A	N/A	N/A
Port Isabel, TX	5,019	High	High	High	Med High	High
St. James City, FL	3,451	Med High	Moderate	Med High	Moderate	Med High
St. Marks, FL	246	Moderate	Low	Moderate	High	Med High
Sarasota, FL	52,588	Low	Low	Low	Moderate	High
Slidell, LA	27,257	Med High	Low	Moderate	Moderate	Moderate
Spring Hill, FL	99,779	Moderate	Low	Moderate	Low	Med High
Tallahassee, FL	181,376	N/A	N/A	N/A	N/A	N/A
Tampa, FL	343,768	Med High	Med High	Med High	Low	Moderate
Tavernier, FL	2,290	Low	Low	Moderate	Low	Med High
Theodore, AL	5,895	Med High	Moderate	Moderate	Low	High

Note: Highlighted cells indicate communities that were highly engaged for all years from the Baseline through 2014.

The Gentrification Pressure Vulnerability Indicators characterize factors that over time may indicate a threat to the viability of a vibrant commercial working waterfront (urban sprawl, housing disruption and retiree migration). Gentrification Pressure Vulnerability Indicators for communities that were **highly engaged** in the Gulf GT-IFQ Program for at least one year from the Baseline (2007-2009) to 2014 are included in Table 3.3.4. Communities **highly engaged for all years** are highlighted. The most **highly engaged** communities scored moderately vulnerable or low for most indicators. This is in contrast to Madeira Beach, Naples, Redington Shores, Cortez, and Tarpon Springs, which showed moderate to high gentrification vulnerability for at least two and sometimes three indices. The Urban Sprawl Index did demonstrate a trend, with most communities registering low vulnerabilities and none above moderate.

Table 3.3.4. Gentrification Pressure Vulnerability Indicators for communities highly engaged in the Gulf of Mexico GT-IFQ Program for one or more years from the Baseline (2007-2009) through 2014

Community	Housing Disruption	Retiree Migration	Urban Sprawl
Apalachicola, FL	Low	Moderate	Low
Clearwater, FL	Moderate	Moderate	Low
Cortez, FL	Moderate	High	Low
Crystal River, FL	Low	High	Low
Destin, FL	Moderate	Low	Low
Fort Myers, FL	Moderate	Moderate	Low
Galveston, TX	Moderate	Low	Low
Islamorada, FL	High	Med High	Low
Key West, FL	Moderate	Low	Low
Madeira Beach, FL	High	Moderate	Moderate
Marathon, FL	Moderate	Low	Low
Naples, FL	Med High	High	Moderate
Panacea, FL	N/A	Low	Low

Panama City, FL	Moderate	Low	Low
Pensacola, FL	Low	Moderate	Low
Redington Shores, FL	Med High	Med High	Moderate
Ruskin, FL	Moderate	Low	Low
St. Petersburg, FL	Med High	High	Low
Steinhatchee, FL	N/A	High	N/A
Tarpon Springs, FL	Moderate	Med High	Low
Key Largo, FL	Moderate	Low	Low
Golden Meadow/Leeville, LA	Low	Low	Low
Summerland Key, FL	N/A	N/A	N/A
Anna Maria, FL	Moderate	High	Moderate
Bayou La Batre, AL	High	Low	Low
Big Pine Key, FL	N/A	N/A	N/A
Bon Secour, AL	N/A	N/A	N/A
Dunedin, FL	Low	Med High	Low
Eastpoint, FL	Low	Low	Low
Fort Myers Beach, FL	Med High	High	Low
Fort Walton Beach, FL	Med High	Low	Low
Freeport, TX	Moderate	Low	Low
Grand Bay, AL	Low	Low	Low
Grand Isle, LA	High	Moderate	Low
Hernando Beach, FL	Moderate	High	Low
Homosassa, FL	Low	High	Low
Houston, TX	Low	Low	Low
Hudson, FL	Low	High	Low
Indian Shores, FL	Low	High	Low
Land O Lakes, FL	Low	Low	Low
Largo, FL	Low	Med High	Low
Matlacha, FL	Med High	High	Low
Pascagoula, MS	Low	Low	Low
Port Bolivar, TX	N/A	N/A	N/A
Port Isabel, TX	Moderate	Moderate	Low
St. James City, FL	Moderate	Moderate	Low
St. Marks, FL	Low	High	Low
Sarasota, FL	High	Moderate	Low
Slidell, LA	Moderate	Moderate	Low
Spring Hill, FL	Moderate	Low	Low
Tallahassee, FL	N/A	N/A	N/A
Tampa, FL	Med High	Low	Low
Tavernier, FL	Low	Low	Low
Theodore, AL	Low	Low	Low

Note: Highlighted cells indicate communities that were highly engaged for all years from the Baseline through 2014.

CHAPTER 4. ELIGIBILITY AND PARTICIPATION

Section 303A(c)(1)(D) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) indicates that eligibility requirements must be established for participation in limited access privilege programs (LAPP). Eligibility requirements determine who is allowed to hold shares or allocation (e.g., owner on board provisions, etc.). This section will determine if any existing restrictions on eligibility are inhibiting or precluding the achievement of the program's goals and objectives, or if any additional restrictions are necessary to achieve particular objectives.

For the first 5 years of the grouper-tilefish individual fishing quota (GT-IFQ) program (the years under review), only those entities that possessed a valid commercial Gulf of Mexico (Gulf) reef fish permit and were a U.S. citizen or resident alien were eligible to participate in the program under the shareholder role. A shareholder account is an individual fishing quota (IFQ) account that may hold shares and/or allocation, and includes accounts that only hold allocation. Initial recipients of shares were not required to maintain their commercial reef fish permit during the first 5 years of the program in order to retain their shares during that time. A shareholder account that no longer had a valid commercial Gulf reef fish permit could maintain or decrease their shares or allocation, but could not obtain additional shares or allocation, nor harvest GT species. A shareholder account, vessel account, and valid commercial reef fish permit are needed to harvest GT species. The Southeast Regional Office (SERO) Permits office and the IFQ online system utilize the same database. Therefore shareholders accounts were established with the same criteria as the Permits office uses to record permit ownership. This allowed the IFQ on-line system to be linked in real-time to permits and permit validity.

Each shareholder account is composed of a unique set of entities (single or combination of individuals and/or business) and no two accounts may be composed of the same set of entities. A unique entity may be a single person or business, or a combination of people and/or businesses. For any business that is part of a shareholder account, National Marine Fisheries Service (NMFS) collects the owner information for that business (e.g., shareholders) and the percentage owned by each individual. If a business is owned in part or in total by another business, NMFS collects the ownership information of all parent companies. Owners of a business and the percentage held by such an individual may change over time. Any time a change (e.g., ownership, percentage owned, address) is made in ownership within a business, the business must inform NMFS. NMFS tracks business ownership throughout time using start and end dates for each change submitted to NMFS.

An entity may be associated with more than one IFQ shareholder account. IFQ shareholder accounts with at least one entity in common are called related accounts (RL). While no two IFQ accounts have the same set of entities, one entity may be associated with multiple IFQ accounts. For example John Smith may hold an account, and John Smith and Jane Smith may hold another account. These accounts are considered related as John Smith is involved in both accounts. Similarly, if John Smith is an owner of John Smith, Inc., that account is also related to the John Smith account and the John Smith and Jane Smith account. Likewise, an account may be held by John Smith, Inc. and another account is held by Smith LLC. Both John Smith, Inc. and Smith

LLC may have one or all owners in common, and therefore are related accounts. Due to the change in business ownership, relations between accounts may change over time. For example, John Smith may have held shares in ABC, Inc. in 2010, but not in 2014. That would mean that the ABC, Inc. account was related to the John Smith account in 2010, but not in 2014. For the purpose of this discussion, RL accounts are determined by the owners of each account at the end of the fishing year.

4.1 Participation Changes

The program began with 766 shareholder accounts with shares in at least one share category. The total number of shareholder accounts with shares decreased each year (Table 4.1.1). The number of accounts with shares varied by share category. Shallow water grouper (SWG) always had the greatest number of accounts with shares, while tilefish (TF) always had the least number of accounts with shares. All share categories showed a decreasing trend in the number of accounts with shares over time. The observed decreasing trend in the number of shareholder accounts with shares does not mean that there were no new participants each year or accounts that newly acquired shares. Within any share category there were between 6 and 25 accounts that acquired shares for the first time (new shareholder account) in that category (Table 4.1.2). New shareholder accounts occur in the program for a variety of reasons: participant entering the program, transferring to a related account due to a permit name change[22], or managing related accounts from one account[23]. Accounts with shares can be classified by the volume of shares held: small (less than 0.05%), medium (0.05%-1.49999%), and large (greater than or equal to 1.5%). In all share categories, the majority of accounts with shares were classified as small shareholders, while the fewest number of accounts held a large volume of shares. This is consistent with results seen in the Gulf Red Snapper IFQ (RS-IFQ) program 5-year review. Participants in the GT-IFQ program often hold shares in more than one category (Table 4.1.3). The majority of the participants held shares in at least three categories. The percentage of accounts holding shares in one or two share categories has increased slightly in the two most recent years (2013-2014) to 6% and 8%, respectively.

[22] IFQ accounts are established based on the name(s) of the Gulf commercial reef fish permit holder. If the name(s) of the permit holder change (e.g., adding/removing a spouse), a new IFQ account must be established to link to the permit.

[23] Some IFQ participants are associated with more than one IFQ account (e.g., John Smith vs. John and Jane Smith, incorporating each vessel under a different company name), and therefore may shift all their shareholding to one account for ease of management.

Table 4.1.1. Number and volume of shareholder accounts with shares by share category.

DWG	Small	Med.	Large	Total
Initial	299 (2%)	169 (58%)	12 (40%)	480
2010	300 (2%)	148 (54%)	13 (44%)	461
2011	275 (2%)	143 (53%)	13 (45%)	431
2012	253 (2%)	134 (49%)	14 (49%)	401
2013	238 (2%)	131 (49%)	13 (49%)	382
2014	224 (2%)	129 (45%)	15 (53%)	368

GG	Small	Med.	Large	Total
Initial	415 (6%)	330 (88%)	3 (6%)	748
2010	424 (5%)	290 (85%)	5 (10%)	719
2011	391 (4%)	263 (81%)	7 (15%)	661
2012	355 (4%)	249 (80%)	8 (16%)	612
2013	342 (4%)	244 (78%)	9 (18%)	595
2014	333 (4%)	233 (78%)	9 (18%)	575

RG	Small	Med.	Large	Total
Initial	435 (5%)	248 (77%)	9 (18%)	692
2010	421 (4%)	237 (80%)	7 (16%)	665
2011	377 (3%)	227 (81%)	6 (16%)	610
2012	349 (3%)	212 (77%)	8 (20%)	569
2013	339 (3%)	200 (72%)	11 (25%)	550
2014	327 (3%)	192 (71%)	11 (26%)	530

SWG	Small	Med.	Large	Total
Initial	467 (6%)	275 (68%)	10 (26%)	752
2010	460 (5%)	250 (65%)	11 (30%)	721
2011	421 (5%)	242 (65%)	11 (30%)	674
2012	384 (4%)	234 (65%)	11 (31%)	629
2013	364 (4%)	227 (65%)	13 (31%)	604
2014	351 (4%)	218 (64%)	13 (32%)	582

TF	Small	Med.	Large	Total
Initial	171 (2%)	100 (36%)	16 (62%)	287
2010	185 (2%)	85 (30%)	17 (68%)	287
2011	164 (1%)	79 (28%)	17 (71%)	260
2012	155 (1%)	76 (27%)	15 (72%)	246
2013	144 (1%)	72 (25%)	16 (74%)	232
2014	143 (1%)	69 (26%)	15 (73%)	227

Total Shareholders	
Initial	766
2010	743
2011	699
2012	665
2013	644
2014	628

Note: Small accounts hold < 0.05%; medium accounts hold 0.05% - 1.49999%; large accounts hold ≥ 1.5% shares.

Note: The number of accounts with shares is classified by volume of shares held. The number in parentheses indicates the percentage of all accounts with shares within that year and share category.

Table 4.1.2. Number of accounts acquiring shares for the first time by share category.

Year	2010	2011	2012	2013	2014
DWG	17 (9.26%)	25 (3.06%)	18 (2.21%)	13 (0.46%)	12 (2.28%)
GG	16 (4.07%)	25 (2.81%)	18 (4.62%)	21 (1.97%)	11 (1.53%)
RG	18 (2.95%)	23 (3.46%)	19 (5.81%)	20 (5.29%)	11 (2.79%)
SWG	13 (5.09%)	25 (3.35%)	17 (2.06%)	17 (1.47%)	13 (1.15%)
TF	18 (16.22%)	13 (2.03%)	14 (0.94%)	6 (1.88%)	10 (1.48%)

Table 4.1.3. Number of accounts that hold shares in one or more share categories.

Share categories	2010	2011	2012	2013	2014
1	18 (2%)	22 (3%)	34 (5%)	33 (5%)	37 (6%)
2	34 (5%)	39 (6%)	42 (6%)	48 (7%)	51 (8%)
3	258 (35%)	239 (34%)	225 (34%)	214 (33%)	206 (33%)
4	172 (23%)	176 (25%)	156 (23%)	153 (24%)	145 (23%)
5	261 (35%)	223 (32%)	208 (31%)	196 (30%)	189 (30%)
Total Accounts	743	699	665	644	628

Prior to 2015, a valid commercial Gulf reef fish permit was initially required to open a GT-IFQ account, but the account could continue to hold shares and allocation without maintaining a reef fish permit. Accounts without a reef fish permit could neither acquire more shares or allocation nor harvest GT-IFQ species, but could transfer those shares or allocation to another shareholder account. Even within the first year of the GT-IFQ program, there were accounts with shares that no longer held permits (Table 4.1.4). The number of accounts with shares and without a permit has increased each year. In 2014, 26% of all accounts with shares did not also hold a permit. At the end of the first year of the program, only a small amount of shares (less than or equal to 1%) were held by accounts that did not also hold a permit. The amount of shares held in accounts without permits has increased in all share categories. In 2014, between 5-8% of shares were held by accounts without permits. The increase in percentage of shares held by accounts without a permit may be due to a variety of reasons. There are many accounts within the IFQ system that are related to another account through a common entity. This increase in accounts without permits holding shares may be influenced by business practices among these related accounts. Participants with multiple accounts (e.g., each vessel is incorporated) may transfer all the shares to one account and later transfer the permit to another vessel. This allows for a separation of the shares from the vessels fishing. Discussions with industry representatives indicated that this separation of assets may be a growing business practice.

Table 4.1.4. Number of accounts that hold shares by permit status.

DWG	Permit N (share %)	No Permit N (share %)
2010	449 (99%)	12 (1%)
2011	392 (96%)	39 (4%)
2012	359 (97%)	42 (3%)
2013	323 (95%)	59 (5%)
2014	296 (93%)	72 (7%)

GG	Permit N (share %)	No Permit N (share %)
2010	690 (99%)	29 (<1%)
2011	578 (98%)	83 (2%)
2012	513 (97%)	99 (3%)
2013	475 (94%)	120 (6%)
2014	433 (94%)	142 (6%)

RG	Permit N (share %)	No Permit N (share %)
2010	641 (99%)	24 (<1%)
2011	537 (98%)	73 (2%)
2012	479 (98%)	90 (2%)
2013	440 (96%)	110 (4%)
2014	402 (95%)	128 (5%)

SWG	Permit N (share %)	No Permit N (share %)
2010	692 (99%)	29 (<1%)
2011	591 (97%)	83 (3%)
2012	527 (96%)	102 (4%)
2013	479 (94%)	125 (6%)
2014	433 (92%)	149 (8%)

TF	Permit N (share %)	No Permit N (share %)
2010	282 (99%)	5 (<1%)
2011	238 (98%)	22 (2%)
2012	224 (98%)	22 (2%)
2013	200 (96%)	32 (4%)
2014	187 (95%)	40 (5%)

Total	Permit	No Permit
2010	714	29
2011	612	87
2012	556	109
2013	507	137
2014	465	163

A GT-IFQ account holder obtains allocation either from shares (distributed at the beginning of the year and any in-season quota increases) or through the transfer from another account holder. Accounts that hold allocation are termed allocation holders. Allocation holders may also hold shares. The number of allocation holders is typically greater than the number of shareholders. By the end of the first year of the program, there were 816 allocation holders. The number of allocation holders decreased over time to 795 allocation holders in 2014 (Table 4.1.5). The percentage of accounts that held allocation and shares has decreased over time. In 2010, 94% of the allocation holders also held shares, but by 2014, this had decreased to 80%. Similar decreases in the number of allocation holders and those that also held shares occurred within each share category. The continued decrease in allocation holders with shares may result from a variety of factors, for example, a shareholder may manage shares in related accounts,[2] be unable

to buy shares (e.g., availability or price), change their harvesting behavior, and/or may be influenced by the RS-IFQ program. The RS-IFQ and GT-IFQ programs have a large amount of overlap; 75-83% of the vessels that landed at least one pound of GT-IFQ species also landed at least one pound of RS-IFQ species each year (Table 4.1.6). The multi-species harvest overlap observed in the reef fish complex likely contributes to the increased number of allocation holders in some share categories, as fishermen seek to reduce their bycatch and discards through allocation transfers. Quota increases may also allow allocation to be indirectly distributed among more participants through transfers. As the quota increases, those with shares receive a larger amount of allocation than previously. If the allocation received by the fisherman is more than needed to land within that share category, they might transfer the allocation to another account that does not have shares, rather than land the allocation themselves.

Table 4.1.5. Allocation holders by share status.

DWG	N	With shares	With Transfer
2010	512	472 (92%)	40 (8%)
2011	521	445 (85%)	76 (15%)
2012	498	416 (84%)	81 (16%)
2013	465	384 (83%)	81 (17%)
2014	457	365 (80%)	92 (20%)

RG	N	With shares	With Transfer
2010	744	690 (93%)	54 (7%)
2011	739	675 (91%)	64 (9%)
2012	715	605 (85%)	110 (15%)
2013	683	563 (82%)	120 (18%)
2014	689	544 (79%)	145 (21%)

TF	N	With shares	With Transfer
2010	299	271 (91%)	28 (9%)
2011	309	263 (85%)	46 (15%)
2012	292	243 (83%)	49 (17%)
2013	282	230 (82%)	52 (18%)
2014	279	217 (78%)	62 (22%)

GG	N	With shares	With Transfer
2010	789	740 (94%)	49 (6%)
2011	767	694 (90%)	73 (10%)
2012	743	645 (87%)	98 (13%)
2013	716	595 (83%)	121 (17%)
2014	726	580 (80%)	146 (20%)

SWG	N	With shares	With Transfer
2010	762	725 (95%)	37 (5%)
2011	760	687 (90%)	73 (10%)
2012	737	644 (87%)	93 (13%)
2013	720	602 (84%)	118 (16%)
2014	722	578 (80%)	144 (20%)

ALL	N	With shares	With Transfer
2010	816	765 (94%)	51 (6%)
2011	833	756 (91%)	77 (9%)
2012	812	701 (86%)	111 (14%)
2013	786	659 (84%)	127 (16%)
2014	795	639 (80%)	156 (20%)

Table 4.1.6. Vessel overlap between RS-IFQ and GT-IFQ.

Year	Percentage GT-IFQ vessels also landing RS-IFQ
2010	78%
2011	75%
2012	77%
2013	81%
2014	83%

The number of dealers participating in the GT-IFQ program is determined through the landings processed by the dealers. Dealers that did not process GT-IFQ species were not included in an

analysis even if they had opened an IFQ dealer account. The total number of dealers processing GT-IFQ species has increased each year (**Table 4.2.1.7**). Dealer size is determined by the percentage of annual GT-IFQ species landed with the dealer: small dealers processed less than 1% of GT-IFQ landings, medium dealers between 1-3% of annual GT-IFQ landings, and large dealers greater than 3% of annual GT-IFQ landings. The number of larger dealers increased slightly from 2010 with 7 dealers to 2014 with 11 dealers, while the number of medium size dealers decreased slightly. The number of small dealers has increased over time, and in 2014, 84% of the dealers were classified as small. The increase in small-sized dealers may be due to fishermen obtaining a dealer permit. Some fishermen may choose to obtain a dealer permit in order to eliminate the middleman, reduce costs, and increase profits. Personal communication with industry representatives indicated that there were fishermen who also owned dealer permits, but these were not limited to just small-sized dealers. Direct comparison of all shareholder and dealers accounts is currently not possible, as dealers are not required to submit ownership information for a business.

Table 4.1.7. Dealers landing GT-IFQ species.

Year	Total	Small <1% of landings	Medium 1-3% of landings	Large >3% of landings
2010	85	63 (74%)	15 (18%)	7 (8%)
2011	94	75 (80%)	12 (13%)	7 (7%)
2012	97	73 (75%)	16 (16%)	8 (8%)
2013	96	75 (78%)	11 (11%)	10 (10%)
2014	112	94 (84%)	7 (6%)	11 (10%)

Note: Dealer size determined by percentage of annual IFQ landings by each dealer and may include multiple facilities.

4.2 Operational Changes

This subsection provides a review of the effects of the GT-IFQ program on the commercial operations of the GT fleet including aspects of technical efficiency, overcapacity and effort consolidation. In the following analyses, a vessel is considered to be part of the fleet if it landed at least one pound of GT species in the Gulf from 2005-2014. Although this is a broad definition, the multispecies nature of the reef fish fishery does not readily provide for a clear definition of a GT vessel. The analyses utilize the Southeast Fisheries Science Center (SEFSC) Socioeconomic Panel (SEP) which integrates information from the SEFSC Coastal Logbook Program, Accumulated Landings System and SERO Permits Office.

4.2.1 Stochastic Frontier Analyses

IFQs have been demonstrated to be a successful regulatory instrument to improve economic efficiency (Weninger 1998; Grafton et al. 2000; Asche et al. 2009; Solis et al. 2014a) and reduce overcapitalization (Dupont et al. 2002; Squires et al. 2010; Solis et al. 2014b) in commercial fisheries. To investigate whether the GT-IFQ achieved these goals, stochastic distance frontier (SDF) methods were employed (Solis et al. 2014a; Solis et al. 2014b). Information detailing the

methodology and results associated with these analyses is in Appendices B1 and B2, which are summaries of Ropicki et al. (2018) and Perruso et al. (2018), respectively.

4.2.1.1 Increasing Economic Efficiency

One way to determine if the GT-IFQ has increased economic efficiency in the Gulf reef fish fishery is to analyze changes in the technical efficiency (TE) of the commercial fleet. Ropicki et al (2018) found statistically significant improvement in TE for the bottom longline (BLL) sector in four share categories (gag grouper (GG), red grouper (RG), other shallow-water grouper (SWG), tilefish (TF)) following the introduction of the GT-IFQ although the estimated improvement was of relatively small magnitude. Results for the deep-water grouper (DWG) category were inconclusive. The study also found statistically significant improvement in TE for the vertical line (VL) sector in three share categories (GG, RG, OSWG) although relatively small in magnitude. Results for the DWG category were inconclusive, and a model for TF was not estimated since VL gear is not typically used to catch those species. Furthermore, Ropicki et al (2018) found that pre-IFQ measures of TE were higher for those vessels that fished after introduction of the GT-IFQ than those vessels that exited the GT fleet. The study found that vessels which continued fishing for GT species had higher measures of TE in the five years after implementation of the GT-IFQ than before.

Under IFQs, the TE of the fleet is expected to improve because fishermen who continue fishing under the IFQ should take advantage of cost savings resulting from more control over adjustments to the mix of inputs and outputs. For example, under an IFQ, operators can freely choose the number and timing of their fishing trips and select the optimal combination of inputs (e.g., amount and type of gear, number of crew, etc.) to maximize the value of their harvest. Past regulations directed at the GT fleet, such as trip limits and shortened fishing seasons, tended to erode the operator's ability to harvest in a cost effective manner. Although the observed increase in TE for the GT fleet was of relatively small magnitude, statistically significant results show that implementation of the GT-IFQ increased TE for both gear sectors participating in the GG, RG and OSWG categories, and GT vessels that remained in the fishery after the IFQ reported higher measures of TE after implementation than before (Ropicki et al. 2018). It should be noted that regulations enacted from 2009-2010 resulting from interactions of BLL gear with endangered sea turtles may confound the direct relationship of the GT-IFQ and estimated changes in TE. This is due to in part to the reduction of the size of the BLL sector resulting directly from an endorsement requirement that likely caused an increase in catch per unit efforts (CPUE) for vessels that remained in the fishery.

4.2.1.2 Reducing Overcapitalization

To determine if the GT-IFQ has reduced overcapitalization in the Gulf reef fish fishery, we examine changes in fishing capacity, capacity utilization (CU), excess capacity (EC) and overcapacity (OC) associated with the GT fleet in the five years after implementation. Fishing capacity is defined as the potential (i.e. maximum) harvest given current levels of fixed inputs, technology and biomass. CU compares observed harvest to potential harvest indicating the proportion of fishing capacity that is effectively utilized. The proportion that is underutilized is

referred to as EC. OC is the difference between capacity output and a desirable sustainable catch level such as maximum sustainable yield (MSY). Perruso et al (2018) finds that fishing capacity in the GT component decreased after implementation of the GT-IFQ primarily due to the exit of less efficient vessels. The study also finds that CU increased marginally, 4.0% and 5.5% for the VL and BLL sectors, respectively, indicating modest decreases in EC. The study found that OC decreased significantly for all GT-IFQ share categories but TF (Table 4.2.1.2.1).

Table 4.2.1.2.1. Changes in average annual capacity for the GT fleet by share categories (1,000 lbs gw).

Period	GG*	RG	OSWG	DWG	TF
2005-2014	--	1,676	1,150	1,290	1,104
2005-2009	--	1,998	1,754	1,625	1,019
2010-2014	71	1,355	547	956	1,190
% change	**--**	***-32.2***	***-68.8***	***-41.2***	***16.8***

* Prior to 2009, GG was part of the OSWG species classification.

Although OC has decreased, the GT fleet may still be overcapitalized after the first five years of the program. Perruso et al estimate (2018) that 240 vessels (approximately 40% of the fleet on average) could harvest the entire 2014 GT commercial quota with large variations in the optimum fleet size depending on the individual GT-IFQ share category. Estimated optimal fleet size for each GT-IFQ category is reported in Table 4.2.1.2.2. It should be noted that the analysis assumes independence of fishing operations across GT-IFQ share categories. GT vessels are known to land multiple GT species in different share categories as well as other Gulf reef fish species; thus, the results may be biased such that the size of the overall optimal GT fleet is under estimated (i.e. more than 40% of the current fleet would be needed to efficiently harvest all GT-IFQ ACLs in 2014).

Table 4.2.1.2.2. Optimal fleet size to harvest GT-IFQ share categories in 2014 (595 active vessels).

Category	GG	RG	OSWG	DWG	TF
No. of Vessels	241	136	160	365	270
% of the Fleet	*40.5*	*22.8*	*27.9*	*61.5*	*45.4*

An important objective of the GT-IFQ program was to create incentives to balance the harvesting capacity of fleets with the productivity of fish stocks and market conditions. The expectation is that the GT-IFQ program would reduce excess capital and labor employed in the fishery. The presence of overcapitalization is economically undesirable because it signals the presence of unwarranted investments, which can have adverse consequences on the sustainability of the stocks and efficiency and profitability of the fleet. Although results show positive trends in reducing overcapitalization related to the GT fleet, namely decreases in excess fishing capacity

and OC as well as an increase in CU, it is not clear how close the fleet is to an optimum size five years after implementation of the GT-IFQ.

4.2.2 Fleet and Effort Consolidation

We further examine the effects of the GT-IFQ on overcapitalization in the Gulf reef fish fishery by studying its effects on different gear sectors of the GT fleet especially the number of active vessels and the amount of fishing effort. Ropicki et al. (2018) and Perruso et al (2018) indicate that overcapacity has been reduced in the commercial GT fleet. Further evidence of this consolidation is found by examining SEFSC Coastal Logbook data. Logbook trip reports indicate that the number of vessels landing at least one pound annually of GT-IFQ species (i.e. the GT fleet) decreased from 2005-2014 (Table 4.2.2.1). The number of active GT vessels decreased from 619 in 2009 to 467 in 2014, resulting in a net decline of 25%. Likewise, the number of fishing trips each year that landed at least one pound of GT-IFQ species (i.e. GT trips) decreased from 6,426 in 2009 to 4,379 in 2010 but increased to 5,073 in 2014, which was the largest number of reported GT trips annually since the implementation of the GT-IFQ, but still represented a net decline of 21% of GT trips from 2009 to 2014. When the average number of vessels and trips are compared, using five-year averages pre- and post-GT-IFQ (2005-2009 vs. 2010-2014), GT fleet size contracted by 14% and the number of GT trips decreased by 19%. The total number of days fished declined from 33,405 in 2009 to 22,686 in 2010 and reached a post-GT-IFQ high of 26,292 in 2014 resulting in a net increase of 16% over the first five years of the program but a net decrease of 21% from 2009 to 2014. Comparing five-year averages from (2005-2009) to (2010-2014), GT fishermen took longer trips with larger crew sizes. Average crew size per GT trip increased from 2.6 to 2.8 (8%), with the average GT trip length increasing from 4.9 to 5.2 days (7%).

Table 4.2.2.1. Number of active vessels, trips, days fished and average number of crew for trips that caught at least one pound of GT-IFQ species.

Year	Vessels	Trips	Days	Days/Trip	Crew/Trips
2005	851	8,091	34,517	4.27	2.6
2006	758	8,166	37,790	4.63	2.5
2007	650	6,610	33,828	5.12	2.6
2008	623	6,557	33,278	5.08	2.6
2009	619	6,426	33,405	5.20	2.6
2010	480	4,379	22,686	5.18	2.6
2011	460	4,616	23,990	5.20	2.8
2012	461	4,819	24,997	5.19	2.8
2013	436	4,592	24,216	5.27	2.8
2014	467	5,073	26,292	5.18	2.8

Fleet consolidation took place in both the VL and BLL sectors of the GT fleet. Logbook trip reports indicate that the number of vessels landing at least one pound annually of GT-IFQ

species and reporting VL gear (i.e. the GT-VL fleet) decreased from 2005-2014 (Table 4.2.2.2). The number of active GT-VL vessels decreased from 563 in 2009 to 387 in 2014, resulting in a net decline of 31%. Likewise, the number of fishing trips each year that landed at least one pound of GT-IFQ species and reported VL gear (i.e. GT-VL trips) decreased from 5,348 in 2009 to 3,504 in 2010 but increased to 3,957 in 2014, which was the largest number of reported GT-VL trips annually since the implementation of the GT-IFQ, but still representing a net decline of 26% of GT-VL trips from 2009 to 2014. In the five years prior to the GT-IFQ, the VL sector was already experiencing fleet and effort consolidation showing decreases in 2009 of 17% and 11% from the maximum number of active vessels (2005) and fishing trips (2006) during that time period, respectively. Comparing five-year averages from (2005-2009) to (2010-2014), GT-VL fleet size contracted by 33% and the number of GT-VL trips decreased by 32%. The total number of days fished on GT-VL trips declined from 24,946 in 2009 to 15,894 in 2010 and reached a post-GT-IFQ high of 18,339 in 2012 resulting in a net increase of 15%. Number of days fished declined 4% from 2012 to 2014. Comparing five-year averages from (2005-2009) to (2010-2014), GT-VL fishermen took longer trips with larger crew sizes. Average crew size per GT-VL trip increased from 2.4 to 2.6 (8%), with the average GT-VL trip length increasing from 4.1 to 4.5 days (10%). Comparing five-year averages from (2005-2009) to (2010-2014), the average amount of GT landings per VL trip (lbs gw) and dockside revenues per VL trip (2014 adjusted dollars) increased from 535 to 600 (12%) and $1,853 to $2,248 (21%), respectively. These results support the conclusions from the SDF analyses that the GT-IFQ reduced OC (Perruso et al. 2018) and increased TE (Ropicki et al. 2018) for the GT-VL sector from 2010-2014.

Table 4.2.2.2. Number of active vessels, trips, days fished and average number of crew for vertical line trips that caught at least one pound of GT-IFQ species.

Year	Vessels	Trips	Days	Days/Trips	Crew/Trips	GT LBS/Trip	GT REV/Trip
2005	676	5,971	20,750	3.5	2.4	537	1,783
2006	619	6,017	22,661	3.8	2.4	416	1,453
2007	535	5,057	21,557	4.3	2.4	507	1,852
2008	508	4,959	20,623	4.2	2.4	609	2,167
2009	563	5,348	24,946	4.7	2.5	604	2,010
2010	417	3,504	15,894	4.5	2.5	531	1,920
2011	393	3,676	16,610	4.5	2.7	563	2,021
2012	385	3,869	18,339	4.7	2.7	741	2,699
2013	366	3,670	16,504	4.5	2.6	568	2,239
2014	387	3,957	17,576	4.4	2.6	596	2,360

Logbook trip reports indicate that the number of vessels landing at least one pound annually of GT-IFQ species and reporting BLL gear (i.e. the GT-BLL fleet) decreased from 2005-2014 (Table 4.2.2.3). The number of active GT-BLL vessels decreased from 97 in 2009 to 66 in 2014, resulting in a net decline of 32%. Likewise, the number of fishing trips each year that landed at least one pound of GT-IFQ species and reported BLL gear (i.e. GT-BLL trips) decreased from

701 in 2009 to 483 in 2010 but increased to 717 in 2014, which was the largest number of reported GT-BLL trips annually since the implementation of the GT-IFQ, representing a net increase of 2% of GT-BLL trips from 2009 to 2014. In the five years prior to the GT-IFQ, the BLL sector was already experiencing fleet and effort consolidation showing decreases in 2009 of 37% and 56% from the maximum number of active vessels (2005) and fishing trips (2006) during that time period, respectively. Comparing five-year averages from (2005-2009) to (2010-2014), GT-BLL fleet size contracted by 48% and the number of GT-BLL trips decreased by 49%. The total number of days fished on GT-BLL trips declined from 7,424 in 2009 to 5,004 in 2010 and reached a post-GT-IFQ high of 7,808 in 2014 resulting in a net increase of 5% from 2009 to 2014. Comparing five-year averages from (2005-2009) to (2010-2014), GT-BLL fishermen took longer trips. Average GT-BLL trip length increased from 9.1 to 10.3 days (13%) while average crew size per GT-BLL trip remained constant at 3.3. Comparing five-year averages from (2005-2009) to (2010-2014), the average amount of GT landings per BLL trip (lbs gw) and dockside revenues per BLL trip (2014 adjusted dollars) increased from 3,502 to 6,011 (72%) and $11,223 to $21,551 (92%), respectively. These results support the conclusions from the SDF analyses that the GT-IFQ reduced OC (Perruso et al. 2018) and increased TE (Ropicki et al. 2018) for the GT-BLL sector from 2010-2014.

Table 4.2.2.3. Number of active vessels, trips, days fished and average number of crew for bottom longline trips that caught at least one pound of GT-IFQ species.

Year	Vessels	Trips	Days	Days/Trips	Crew/Trips	GT LBS/Trip	GT REV/Trip
2005	155	1,556	11,669	7.5	3.2	3,559	10,803
2006	133	1,604	12,914	8.1	3.2	3,050	9,828
2007	125	1,239	11,707	9.4	3.2	3,173	10,995
2008	116	1,244	12,075	9.7	3.3	3,779	12,300
2009	97	701	7,424	10.6	3.4	3,948	12,187
2010	69	483	5,004	10.4	3.3	4,474	15,110
2011	61	679	6,867	10.1	3.2	5,983	20,131
2012	65	651	6,135	9.4	3.3	6,312	21,911
2013	62	691	7,229	10.5	3.4	6,403	23,978
2014	66	717	7,808	10.9	3.4	6,881	26,624

In addition to the SDF and logbook analyses described above, Watson et al (2017) also found increases in efficiencies associated with the BLL sector after implementation of the GT-IFQ. Using a stylized data set that combined the SEFSC SEP with vessel monitoring systems and onboard observer data, they compared fishing performance and behavior of the BLL sector in two time periods before (2007-2008) and after (2011-2012) implementation of the GT-IFQ. Results revealed a large-scale reduction in capacity, accompanied by reduced fishing effort, shorter trips, lower operational expenses on a vessel-by-vessel basis, higher catch rates, and more earnings for those vessels that remained in the fishery.

4.2.3 Stakeholder Surveys

In this subsection we present results from surveys of GT-IFQ participant (QuanTech 2015) and dealer (Keithly and Wang 2016) account holders (See Appendices B2 and B3 for a detailed description of these surveys). A number of questions in both surveys investigated the changes in business operations for operators and dealers resulting from implementation of the GT-IFQ including changes in fishing behavior, business relationships among vessel owners, dealers and crew, investment and disinvestment decisions, and future business plans. Results associated with operational changes are summarized here while additional survey results related to attitudes and perceptions about the GT-IFQ, share and allocation transactions, prices, safety, enforcement and customer service are interspersed throughout the rest of this document. A third survey (LaRiviere 2016) also investigated some operational dynamics of the labor sector of the GT fishery (see Appendix B4).

Participants

One section of the participant survey primarily examined the effect of the GT-IFQ on the operations of the account holder's commercial fishing business. Note that percentages reported in this section regarding capital expenditures are derived by dividing by the total number of survey respondents (n=272); however, many of the respondents opted not to answer these questions (up to 75% in some cases). Thus, the reported percentages assume that if a respondent skipped the questions then non-responders did not purchase or sell capital due to the GT-IFQ.

One question asked if the GT-IFQ resulted in any major purchases of capital. 40 (15%) respondents indicated that they had purchased a vessel due to the GT-IFQ. These purchases averaged $139,325 while the median vessel purchased cost $77,500. Likewise, 35 (13%) respondents reported making major equipment purchases, including engines, due to the GT-IFQ. Equipment purchases averaged $39,414 among these operators with the median equipment purchase reported as $25,000. 49 (18%) respondents reported purchasing new permits due to the GT-IFQ at an average and median cost of $24,603 and $10,000, respectively, while 76 (28%) program participants reported purchasing GT-IFQ shares spending an average of $162,686 with median cost listed as $50,000.

Another question asked if the GT-IFQ resulted in any major sales of capital. 36 (13%) respondents indicated that they had sold a vessel due to the GT-IFQ. These sales averaged $45,319 while the median vessel sold at $37,500. 10 (4%) respondents reported selling equipment due to the GT-IFQ. Equipment sales averaged $5,600 with the median equipment sale reported as $3,250. 29 (11%) respondents reported selling permits due to the GT-IFQ at an average and median amount of $13,448 and $5,000, respectively, while 33 (12%) program participants reported selling GT-IFQ shares receiving an average of $59,817 with median revenue listed as $50,000.

This section of questions also examined the effect of the GT-IFQ on labor dynamics. 30% of respondents found it difficult to maintain skilled crew after implementation of GT-IFQ compared to 18% who thought maintaining skilled crew was difficult before the GT-IFQ. Similarly, 31% reported that it was difficult to hire skilled replacement crew after the implementation of GT-IFQ

compared to 21% with the same sentiment prior to GT-IFQ. Conversely, the amount of respondents that found it easy to maintain and hire skilled crew fell after GT-IFQ from 30% to 25% and 27% to 20%, respectively. 27% of respondents indicated that they generally hired a captain to fish some or all of their GT-IFQ allocation. Of the 68 respondents that hired captains to fish GT-IFQ allocation, over 80% still paid hired captains a share of total revenues after deductions rather than a share of revenue with no deductions or a flat rate. These expenses included fuel, bait, grocery, payments to crew and other expenses while 69% reported deducting IFQ allocation expenses from revenue before paying the captain. 59% of respondents indicated that they generally employed crew when fishing their GT-IFQ allocation. Of the 145 respondents that hired crew to fish GT-IFQ allocation, over 80% still paid crew a share of total revenues after deductions rather than a share of revenue with no deductions or a flat rate. These expenses included fuel, bait, grocery, and other expenses while 63% reported deducting IFQ allocation expenses from revenue before paying the crew. Remuneration payouts did not change due to GT-IFQ as the median amount of the distribution of payments to vessel owners, captains and crew remained at 50%, 30% and 25%, respectively.

Dealers and Processors

Keithly and Wang (2016) investigate whether the GT-IFQ resulted in any significant changes for dealers in their arrangements with fishermen. The following question was asked to survey participants: "Have your arrangements with fishermen from whom you purchased grouper/tilefish changed significantly as a result of the GT-IFQ program?" Out of the 54 applicable responses, 25 (46%) indicated 'yes' while the remaining 29 indicated 'no.' The survey also investigated whether implementation of the GT-IFQ culminated in significant changes in GT sales. 25 observations were used in the analysis with the mean GT sales pre-IFQ equaling $1.01 million per firm compared to $1.24 million per firm post-IFQ; representing an increase of approximately 12% when adjusted for inflation. Overall, about 62% of responding firms were of the opinion that the GT-IFQ program contributed to a change in GT sales pre-and-post GT-IFQ implementation. Survey participants were also queried as to their respective gross sales of other finfish and shellfish species pre-and-post GT-IFQ. Based on 20 firms who provided relevant information for both periods, pre-GT-IFQ sales averaged $375 thousand per responding firm versus $515,000 post-GT-IFQ. Caution in using these numbers is warranted, however, given that (a) the sample is relatively small and (b) a few firms with apparently very large sales skewed the averages for both periods. When queried as to whether the GT-IFQ program contributed to the change in GT sources, 13 of the 33 respondents replied affirmatively while 15 indicated that the program did not result in a change in supply sources. Sales by product form were not perceived to have changed significantly nor did the alternative outlets to which product was sold.

To examine whether implementation of the GT-IFQ resulted in any significant changes in employment among dealers, survey participants were asked the following question: "Approximately how many people were employed at this seafood business pre –and post GT-IFQ (excluding captains and crew on vessels)?" Thirteen of the 37 responding establishments (40%) were of the opinion that implementation of the GT-IFQ contributed to a change in employment while about 45% of the firms were of the opinion that it did not result in a change in employment activities.

The question "Has this business, or you personally, ever owned any vessels used in the harvesting of grouper/tilefish in the Gulf of Mexico?" was answered by 54 respondents. Thirty-five of the 54 (65%) responded affirmatively to this question. Of those that responded affirmatively, about 45% (16 of 35) also indicated that implementation of the GT-IFQ led to no changes in the number or size of vessels owned. One-third of these respondents indicated that the program allowed them to decrease the number or size of vessels. About 20% reported that that they had increased the number or size of vessels as a result of the implementation of the GT-IFQ program. With respect to future plans among this group, approximately 60% indicated that they had no future plans to either increase or decrease the number or size of vessels owned over the next five years.

The question "Excluding vessels and GT-IFQ shares, have you made MAJOR INVESTMENTS or DISINVESTMENTS in your seafood business that you attribute to the implementation of the GT-IFQ program?" was also asked and answered by 54 respondents. Two-thirds responded 'no' to this question. Investments commonly cited were purchasing additional quota and leasing allocation while long-term infrastructure improvements (e.g., trucks, freezers, purchasing on water facility to offload boats) were cited relatively infrequently.

The question "Excluding real estate, vessels, and any GT-IFQ shares owned by the business, what would you estimate as the CURRENT MARKET VALUE of this seafood business?" was also queried from the survey participants. Thirty-seven individuals completed this question with approximately one-half (19) reporting the current market value to be less than $1 million and another 13 (about 35%) reporting a value of between $1 million and $7million. Five individuals (15%) indicated a value in excess of $7 million. While only 37 individuals responded to the question regarding current market value, 52 provided an opinion regarding whether or not implementation of the GT-IFQ resulted in a change in the current market value of the seafood business. 65% were of the opinion that implementation of the GT-IFQ resulted in no change in the current value of their respective businesses.

Hired Captains and Crew

LaRiviere (2016) reports that captains and crew perceived work availability, labor choice and labor mobility to be lower in the GT fishery since the implementation of the GT-IFQ program. This is expected and consistent with one stated goal of the GT-IFQ, the reduction of overcapacity in the fishery. Fewer total vessels fishing implies reduced firms and therefore less choice for hired labor.

The survey asks respondents whether their current income was in one of several income ranges. All but one respondent reported their current income. Most responses for crew were between $15,000 and $50,000. Captains earn significantly more than crew, with many earning above $75,000. While some crew earn that much, the overwhelming majority earn less. Furthermore, for captains and crew who stayed active, respondents reported that income measures were roughly unchanged. For captains, there was a mild increase in average annual income while crewmembers reported a very slight reduction in stability of annual income. Both captains and crew reported a slight decreased ability to earn a large income. In each case, roughly one third of subjects reported greatly decreased stability, average and upside of income measures implying

that a subset of industry participants were made worse off after implementation of the GT-IFQ. These distributional issues could result from natural fluctuations in stock correlated with IFQ implementation, for example. Finally, the survey showed clear evidence that labor specialization increased after implementation of the GT-IFQ. The average number of targeted species fell slightly with one in every four fishermen targeting one fewer species post-IFQ. Results indicated captains and crew often focus on a single gear type with some movement toward bandit gear since implementation.

4.3 Social Effects

The issue of fairness in the initial allocation of catch shares has been framed as a social equity issue (Macinko 1997) that may at times be in conflict with economic benefits (McCay et al. 1998; Matulich and Sever 1999). Amendment 26, which established the Gulf's Red Snapper IFQ program (GMFMC 2006), acknowledged that "many people are concerned about the fairness of initial allocations that would result in windfall profits to a select few." In their review of the literature, Griffith et al. (2016; Appendix B1) also point to the fairness of the initial allocation as a source of controversy for many IFQ programs. This concern was echoed in the National Research Council's report (1999), requested by Congress following the 1996 reauthorization of the MSA.

A related criticism of catch share programs is that the first generation of quota holders are considered to have been "gifted" their shares, while future entrants must purchase shares or lease allocation to participate in the program (Macinko 1997). Furthermore, some have considered "distributing the initial quota allocation for free is a mistake because it produces a windfall for recipients and allows them to lease without adding any value or innovation to the process" (Griffith et al. 2017, p10). These views were expressed in all Gulf regions of this recent research as some participants questioned both NMFS's right to allocate a public resource to private citizens and how initial allocations were established (Griffith et al. 2016).

Griffith (2018) reported complaints by fishermen regarding the threshold for eligibility to participate in the referendum to implement the GT-IFQ program, which excluded many fishermen from participating if their historical landings were below the threshold. Fishermen with the highest landings were allowed to vote, i.e., those who were considered to have substantially fished, and were also the ones who received the most shares. The complaints centered on how NMFS defined "substantially fished." Further, Griffith (2018) argued that by distributing the more shares to fishermen who had fished the hardest, those fishermen who most contributed to creating the derby-like fishing conditions that brought about the decision to move to an IFQ program were rewarded. In contrast, those fishermen who had a diversified fishing strategy in which many species were harvested had lower landings of the grouper tilefish species and thus, received little to no shares. However, subsequent to the program, a multi-species fishing strategy became the practice by those who received the most shares and were now targeting an array of species, using their quota when necessary, and building up landings histories for other species that may one day be put under an IFQ program (Griffith 2018). Yet, the multi-species strategy fishermen pre-program implementation were now required to buy allocation to continue harvesting the smaller quantities of grouper tilefish they had previously landed (Griffith

2018). Griffith further argues that the IFQ program converts historical participation into an economic commodity that incentivizes fishermen to behave as businessmen, and that participation under the IFQ program is no longer representative of historical participation.

While Griffith et al. (2016) did not provide a breakdown of responses by participation role (e.g., crew member, hired captain, shareholder, etc.) in their report, Boen and Keithly (2012) found that in the red snapper IFQ program, smaller shareholders, or those who did not receive shares through the initial distribution, express the strongest views of inequity in the distribution of IFQs, while the large shareholders expressed the most satisfaction. In a survey prior to implementation of the GT-IFQ Program, Tokotch et al. (2012) predicted that there would be differences between larger and smaller sized commercial fishing businesses and their anticipated effects of the IFQ program. Those with large operations, such as owning multiple vessels, expected some substantial benefits from the program, while many smaller operators expected to be driven out of the fishery. Crosson (2011) found that among North Carolina fishermen, loss of flexibility was the primary reason other forms of management were preferred to IFQs. Loss of flexibility referred to the ability to switch targeted species; in an IFQ program, a fishermen must obtain allocation to be able to land an IFQ-managed species. This loss of flexibility may be reflected in a decrease in the number of targeted IFQ species reported by captain and crew, as quota is either unavailable or too expensive for harvesting IFQ-managed species (QuanTech 2015).

Another point of dissatisfaction with the GT-IFQ program expressed by respondents in the Griffith et al. (2016) research concerned the Gulf of Mexico Fishery Management Council's (Council) decision to allow the requirement that shareholders possess a reef-fish permit to expire. Many participants felt it was unfair that individuals who own shares and/or lease allocation, but do not participate directly in the fishery, do not assume any of the physical or economic risks of being on the water while commercial fishing (Griffith et al. 2016).

Other related social issues pertaining to the initial allocation of harvest privileges identified in the literature include an increase in "social divisiveness ... between [the] haves and have-nots" and that crew were not included in the initial allocation, despite their contribution to the fish that earned permit holders their shares (Macinko 1997; Copes and Charles 2004; Griffith 2018). From the perspective of fishery management, crew were essentially "invisible;" most received no tangible benefits from implementation of the IFQ program, as landings histories were associated with a permit and benefits went to the permit holders. Although the state trip tickets record the number of crew on a trip, none of the data collection systems that monitor commercial landings in the reef fish fishery record information about crew which could be used for an initial distribution of catch shares. Nor does crew receive any benefits if the permitholder who received those shares sells them, or leases the allocation to other vessels (Copes and Charles 2004). Griffith et al. (2016) found mixed results with some participants suggesting that the IFQ program gave more power to the dealers, while others said the fishermen gained more power because of the program.

As with the implementation of the RS-IFQ program, new participation roles have arisen including "brokers" of allocation, i.e., those who buy and sell allocation to make a profit without landing the fish represented by that allocation. Brokers may participate in the GT-IFQ program in additional participation roles (e.g., dealers) and some may own vessels. Although this new role of "virtual fishermen" (Macinko 1997) has been raised as a potential problem, this type of ownership has not

become pervasive within the program to date. It is worth noting that accounts that simply transfer allocation in and out of the account are not necessarily "broker" accounts as they can be used for transfers among related accounts. While price data is collected on allocation transfers, not all transferors complete this field or complete it with invalid data. Both the related accounts and price data may make it difficult to determine how many accounts are transferring allocation to make a profit. There is also evidence of IFQ shareholders being "gatekeepers" for accessing allocation. Non-shareholding fishermen have complained of having to go through particular shareholders, i.e., gatekeepers, to obtain allocation and expressed fear of criticizing the program, lest they be denied access to buying allocation (Griffith 2018).

In summary, the social effects on the eligibility and participation in the GT-IFQ program are similar to effects identified in other IFQ-type programs. These effects center on social equity concerns in the initial distribution of shares, social changes in how people participate, and changes in relationships that are tied to ownership of capital (i.e., shares).

4.3.1 Stakeholder Survey Results

Support among program participants increased over time as 45% of respondents indicated that they supported the GT-IFQ in 2014, while only 38% supported the program at the time of implementation. However, when explicitly asked if they were satisfied with the GT-IFQ in 2014, only 39% agreed while 48% exhibited some level of dissatisfaction. Thus, there are approximately 6% of participants that support the GT-IFQ but are not satisfied with the program five years after implementation.

Insights into participant satisfaction with the GT-IFQ include the following perceptions regarding program outcomes associated with business operations while other survey results relating satisfaction to other aspects of the participants' experiences with the GT-IFQ are interspersed throughout the rest of the report:

- 39% of respondents thought that the profitability of their business increased due to increasing ex-vessel prices while only 23% thought an increase in profits was due to decreased operating expenses.

- There was majority agreement that the GT-IFQ provided more flexibility in timing trips (54%), reduced derby-fishing conditions (67%) and decreased crowding on fishing grounds (52%).

- Only 18% of respondents agreed that the GT-IFQ reduced the loss of gear.

Keithly and Wang (2016) report almost 40% of dealers indicated opposition to the GT-IFQ prior to implementation, 30% voiced support for the program and 30% of the respondents were 'neutral' or had 'no opinion'. Approximately five years after implementation of the GT-IFQ program, almost 40% of the respondents continued to voice opposition to the program while support for the program increased to almost 50%. Much of this increase may reflect a change among those who

expressed 'no opinion' of the program prior to its implementation, potentially because they were not involved in the fishery.

Investigating further, those operations expressing 'no opinion' either prior to implementation of the GT-IFQ or after its implementation were deleted from consideration leaving 52 observations. Based on this smaller sample, approximately 20% of the responding dealers were 'strongly opposed' to the GT-IFQ program at the time of its implementation with the percentage increasing only marginally (from 21% to 23% approximately five years later). The proportion 'opposed' to the program, by comparison, fell from 23% to 15%. Those expressing 'strong support' for the program increased from 17% to 29% while those expressing 'support' for the program equaled 21% both at the implementation of the program and approximately five years after the program was implemented.

Among those respondents considering their operation to be primarily that of commercial fishing (15 in total), almost one-half of them indicated that they were opposed to the program prior to its implementation compared to one-third of them who expressed support for the program. At the time the survey was conducted in 2016, the proportion among this type of operation who expressed support for the GT-IFQ program had increased to two-thirds (i.e., 10 out of 15) while those expressing opposition had fallen to a third.

Among those respondents considering their operation to be primarily that of a dealer/distributor, nine of the twenty-eight (or about a third of the total) expressed opposition to the program prior to its implementation while 11 of the 28 (about 40%) expressed support for the program. In 2016, more than one-half of the dealers/distributors (15 of 28) voiced support for the GT-IFQ while ten of the twenty-eight dealers/distributors expressed opposition to the program. A large number of dealers/distributors (5 of the 28) expressed 'no opinion' with respect to the GT-IFQ program prior to its implementation in 2010 and this number fell to zero in 2016.

LaRiviere (2016) reports that captains and crew reported similar modest decreases in satisfaction from fishing post-IFQ implementation. It is unclear what caused this decrease. The satisfaction results are most similar to responses from decreased ability to earn a large income. Captains and crew also reported a lack of perceived fairness that IFQ ownership was not linked to active IFQ participation.

In sum, labor reports a decreased availability of work. Conditional on working there is less choice and flexibility to move across vessels. It is important to note that these labor outcomes by their nature also implicitly reflect local market conditions: if there was a wide variety of well-paying jobs locally, it is likely that labor would have more bargaining power in the GT fishery.

4.4 Conclusions

One of the primary goals of the GT-IFQ program was to reduce OC. Fishing capacity refers to the maximum harvest over a period by a fishing fleet that is fully utilizing inputs given existing biomass and available technology. OC is the difference between capacity and a desired level of harvest such as a quota. Prior to the implementation of the GT-IFQ, OC led to inefficient fishing operations among the GT fleet in both the BLL and VL sectors (Perruso et al 2018; Ropicki et al

2018). Stochastic frontier analyses (SFA) indicate that since implementation of the GT-IFQ fishing capacity and OC have declined, capacity utilization has increased and the technical efficiency of the fleet has increased for remaining vessels fishing in most GT-IFQ species categories for both gear sectors (Perruso et al 2018; Ropicki et al 2018). However, Perruso et al (2018) reports that further consolidation is possible as fishing capacity remains large relative to the available commercial quota. The GT-IFQ program, in conjunction with other regulations, especially the enactment of a BLL endorsement, has resulted in consolidation and efficiency gains within the BLL and VL sectors, which have seen a reduction in 5-year average number of active vessels by 48% and 33% respectively, but further reductions in fleet capacity may still be desirable.

After the first five years of the GT-IFQ program, there has been a decrease in the number of shareholders and allocation holders, but the number of dealers increased. The decrease in the shareholders and allocation holders was an expected consequence of the program's goal of reducing overcapacity. In more recent years, not reviewed here, the number of shareholders and allocation holders has increased slightly since 2014, indicating an increase in participation. This increase may be related to the expiration of some of the eligibility requirements to obtain a GT-IFQ account. During the first five years, to maintain an account and retain your shares and annual allocation, an account needed to be associated with a Gulf reef fish permit. This requirement expired at the end of 2014, and now any U.S. citizen or permanent resident alien could obtain an account and obtain shares and allocation, although a reef fish permit is still required to harvest GT-IFQ species. The Gulf Council is currently considering certain restrictions on the ownership of shares in Amendment 36B. To address concerns in relation to share and allocation privileges, the Council could investigate an adaptive catch share program, changing the duration of share privileges, loan programs, or quota banks.

CHAPTER 5. ALLOCATIONS, TRANSFERABILITY, AND CAPS

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires initial allocations to be fair and equitable under all limited access privilege programs (LAPP). Section 303A(c)(7) of the Magnuson-Stevens Act requires a Council to establish a policy and criteria for the transferability of limited access privileges (shares and allocation). Transferability is generally thought to improve technical efficiency and thus aid in achieving economic efficiency in a fishery (i.e., National Standard 5). Restrictions on transferability may serve to meet other objectives, such as equity (i.e., National Standard 4), providing for the sustained participation of and minimizing adverse economic effects on fishing communities (i.e., National Standard 8), or reducing adverse effects on particular types of habitat. Section 303A(c)(5)(D) of the Magnuson-Stevens Act requires Councils and the National Marine Fisheries Service (NMFS) to establish limits or caps to prevent the excessive accumulation of harvesting privileges. The accumulation of excessive shares is thought to potentially create market power in the product market, input markets (e.g., gear, bait, labor, etc.), and/or the markets for shares and allocation. Market power creates economic inefficiency, and excessive shares should be avoided for equity/distributional reasons. One of the anticipated effects of limits and caps is to limit the degree of consolidation within the fleet. Consolidation would typically be expected to result in a reduction in capacity and overcapacity, which is a goal of most catch share programs (CSP).

Since allocation between entities in the program, transferability, and caps are explicitly linked together and changes in one may have potential changes in the others, they are reviewed together in this section. Sector allocations are not analyzed in this section or in this Review because the Gulf of Mexico Fishery Management Council (Council) has not yet established its triggers for reviewing sector allocations,[24] and because of analytical and legal uncertainties arising from the recent court decision regarding sector allocations for red snapper as proposed in Amendment 28 to the Fishery Management Plan for the Reef Fish Resource of the Gulf (Reef Fish FMP).[25] Thus, this section will review:

- allocations between individuals or entities within the program and the allocations between subgroups within the program
- if the equity/distributional impacts of existing caps and the impacts those caps have had on the creation of market power by affected entities
- whether existing transferability provisions are conducive to achieving the specified objectives, keeping in mind that trade-offs often exist between objectives.

Shares are fully transferable within the grouper-tilefish individual fishing quota (GT-IFQ) program. Share transfers are a two-step process, with the transferor initiating the process and the

[24] See http://www.nmfs.noaa.gov/op/pds/documents/01/119/01-119-01.pdf
[25] Guindon v. Pritzker, 240 F. Supp. 3d 181 (D.D.C. 2017)

transferee completing the process by accepting or rejecting the share transfer. Therefore, share transfers may start on one day and not be completed until another day.

Allocation can be transferred from a shareholder account to their own vessel account(s), another shareholder account, or another shareholder's vessel account. Only allocation transfers between shareholder accounts (shareholder account to *another* shareholder's account or shareholder account to *another* shareholder's vessel account) were analyzed in this report. Within account transfers were not analyzed as these transfers simply result from a shareholder moving allocation between their own shareholder account and any associated vessel accounts. The transferor initiates the allocation transfers and the transfer is completed immediately upon submission, with no action from the transferee. This process was created to allow allocation to be transferred to vessel accounts while the vessels were still at sea with limited internet availability. Allocation units cannot be individually tracked in the system as each pound of allocation is not uniquely identified. The system tracks the amount of allocation transferring between accounts. All allocation transfers record the transferor, transferee, share category, pounds transferred, and price, although a $0 value may be entered in the price field. Allocation prices are analyzed as a price per pound.

5.1 Share transfers

Shares were distributed at the start of the program to participants based on landings history and can only be increased or decreased in an account through share transfers. The number of share transfers and total amount of shares transferred were greatest in the first year of the program, with 970 share transfers (**Table 5.2.1.1**). Between 24-32% of the shares were transferred in each category within the first year. Thereafter, the amount of total shares transferred decreased to 5.5-19.2%. Average amount of share transferred was less than 1%.

Table 5.2.1.1. Number and volume of share transfers.

DWG	N	Total Shares	Average Shares
2010	161	25.8	0.16
2011	96	7.0	0.07
2012	78	9.3	0.12
2013	53	7.3	0.14
2014	62	12.6	0.20

GG	N	Total Shares	Average Shares
2010	256	24.0	0.09
2011	138	18.8	0.14
2012	129	14.8	0.12
2013	88	5.5	0.06
2014	106	19.2	0.18

RG	N	Total Shares	Average Shares
2010	267	24.3	0.09
2011	168	13.5	0.08
2012	202	17.2	0.08
2013	145	13.7	0.09
2014	144	14.2	0.10

SWG	N	Total Shares	Average Shares
2010	195	25.6	0.13
2011	104	8.4	0.08
2012	97	6.9	0.07
2013	82	12.2	0.15
2014	63	10.6	0.17

TF	N	Total Shares	Average Shares
2010	91	31.6	0.35
2011	59	9.0	0.15
2012	44	11.8	0.27
2013	29	5.5	0.19
2014	34	16.3	0.48

ALL	N	Total Shares	Average Shares
2010	970	131.30	0.14
2011	565	56.62	0.10
2012	550	59.97	0.11
2013	397	44.34	0.11
2014	409	72.94	0.18

QuanTech (2015) reported that 76 (28%) program participants responding to the survey purchased GT-IFQ shares spending an average of $162,686 with median cost listed as $50,000 while 33 (12%) program participants reported selling GT-IFQ shares receiving an average of $59,817 with median revenue listed as $50,000.

5.2 Allocation transfers

In the first year of the program there were more than 3,000 allocation transfers (**Table 5.2.2.1**). The number of transfers has increased to over 6,000 transfers in 2014. For all share categories except shallow water grouper (SWG), in at least one year, the amount of allocation transferred exceed in the quota (**Table 5.2.2.1**). Allocation transfers can exceed the quota because the allocation is transferred multiple times before being used for landings. As expected, the average pounds per transfer were greater in share category's that had higher quotas. Typically, over time the number and amount of allocation transferred increased. This could not be simply correlated to simply increases in quota, as the amount of allocation transferred increased even at times when the quota decreased. More likely the amount of allocation transferring increased, as networks between participants increased allowing for more access to the allocation across the Gulf of Mexico (Gulf).

Table 5.2.2.1. Total pounds (gw) of allocation transferred, average amount transferred, and percentage of quota transferred.

DWG	N	Lb.	Avg. lb.	% quota
2010	490	1,027,477	2,097	101%
2011	632	1,447,229	2,290	142%
2012	764	1,524,618	1,996	135%
2013	608	1,762,344	2,899	158%
2014	846	2,370,757	2,802	214%

GG	N	Lb.	Avg. lb.	% quota
2010	945	743,266	787	53%
2011	1,250	332,049	266	77%
2012	1,745	503,899	289	89%
2013	1,718	621,594	362	88%
2014	2,232	1,236,126	554	148%

RG	N	Lb.	Avg. lb.	% quota
2010	1,065	3,217,048	3,021	56%
2011	1,550	4,260,483	2,749	81%
2012	1,906	4,736,612	2,485	88%
2013	1,752	5,579,299	3,185	101%
2014	2,317	7,187,959	3,102	128%

SWG	N	Lb.	Avg. lb.	% quota
2010	616	315,042	511	77%
2011	568	272,816	480	67%
2012	900	365,563	406	72%
2013	911	493,144	541	95%
2014	1,000	506,556	507	97%

TF	N	Lb.	Avg. lb.	% quota
2010	268	489,585	1,827	111%
2011	328	765,586	2,334	174%
2012	385	685,980	1,782	118%
2013	291	933,105	3,207	160%
2014	430	1,255,737	2,920	216%

ALL	N	Lb.	% quota
2010	3,384	5,792,418	64%
2011	4,328	7,078,163	94%
2012	5,700	7,816,672	96%
2013	5,280	9,389,486	111%
2014	6,825	12,557,135	145%

Accounts transferring allocation were categorized by the account's actions (e.g., landing and transferring allocation). Some accounts only transfer allocation and do not have landings. There are a variety of reasons why an account holder may only transfer allocation: account holder could not harvest allocation (e.g., no permit, vessel inoperative), allocation was transferred to a related account, account holder had insufficient allocation to harvest (e.g., shares resulted in only a few pounds of allocation), and/or greater profit could be earned from selling than harvesting the allocation. Accounts without a reef fish permit may not land GT-IFQ species nor receive allocation from another account. Therefore, these accounts can only transfer allocation to another account.

Even in the first year of the program, there were accounts that only transferred allocation (**Table 5.2.2.2**). The highest percentages of accounts only transferring allocation occurred in the tilefish (TF) share category, where nearly half of the accounts with allocation were only transferring allocation. Red grouper (RG), gag grouper (GG), and SWG all had lower percentages (23-30%) of accounts only transferring allocation. The percentage of accounts only transferring allocation has remained similar, with just minor fluctuations (6-7%), within each share category over time. All share categories had an initial increase in accounts only transferring allocation in 2011, as well as a decrease in 2013 (**Figure 5.2.2.1**). The increase in 2011 is likely correlated with permit status, as in all share categories, the number of accounts only transferring allocation that did not hold a permit more than doubled in 2011. Accounts without a permit can only transfer allocation out of their account and cannot receive allocation nor land GT-IFQ species. The drop in the percentage of allocation holders only transferring allocation in 2013 coincides with a drop in the number of these accounts with shares and a permit. This would indicate that these types of accounts either transferred their permit, transferred their shares, began harvesting GT-IFQ species, or some combination of these actions. Further investigation shows very little change in the number of shareholders with permits in 2013, compared to previous years, as greater than 95% of all shareholders also held permits (**Table 4.2.1.4**), only a small decrease in shareholders (**Table 4.2.1.1),** and a continued decrease in those accounts landing also having shares (**Table 5.2.2.3**). Therefore, this is most likely due to a combination of activities and cannot be attributed to one specific change in participation.

Table 5.2.2.2. Accounts only transferring allocation, by share and permit status.

		Shares		No Shares	
DWG	N*	Permit	No permit	Permit	No permit
2010	182 (36%)	148	7	27	NA
2011	212 (41%)	142	30	40	NA
2012	209 (42%)	147	30	32	NA
2013	182 (39%)	126	24	32	NA
2014	186 (41%)	128	29	29	NA

		Shares		No Shares	
GG	N*	Permit	No permit	Permit	No permit
2010	183 (23%)	156	14	13	NA
2011	223 (29%)	164	35	24	NA
2012	215 (29%)	156	37	22	NA
2013	174 (24%)	123	33	18	NA
2014	199 (27%)	137	38	24	NA

		Shares		No Shares	
RG	N*	Permit	No permit	Permit	No permit
2010	174 (23%)	144	12	18	NA
2011	211 (29%)	156	37	18	NA
2012	191 (27%)	136	34	21	NA
2013	180 (26%)	122	31	27	NA
2014	187 (27%)	127	39	20	NA

		Shares		No Shares	
SWG	N*	Permit	No permit	Permit	No permit
2010	203 (27%)	172	14	17	NA
2011	227 (30%)	162	36	29	NA
2012	214 (29%)	155	37	22	NA
2013	190 (26%)	121	34	35	NA
2014	190 (26%)	126	39	25	NA

TF	N*	Shares		No Shares	
		Permit	No permit	Permit	No permit
2010	132 (44%)	105	3	24	NA
2011	164 (53%)	111	20	33	NA
2012	146 (50%)	105	18	23	NA
2013	136 (48%)	97	11	28	NA
2014	142 (51%)	98	18	26	NA

* N indicates the number of accounts only transferring allocation. The percentage next to the N is the percentage of accounts only transferring allocation from all accounts with allocation.

Table 5.2.2.3. Amount of pounds landed by accounts with and without shares.

DWG	w/ shares		w/o shares	
2010	602,749 lb	96%	22,013 lb	4%
2011	701,273 lb	90%	78,246 lb	10%
2012	806,041 lb	84%	157,794 lb	16%
2013	562,498 lb	62%	350,425 lb	38%
2014	576,636 lb	55%	471,506 lb	45%

GG	w/ shares		w/o shares	
2010	473,362 lb	96%	20,576 lb	4%
2011	286,560 lb	90%	33,577 lb	10%
2012	436,556 lb	83%	88,510 lb	17%
2013	470,701 lb	81%	108,963 lb	19%
2014	450,465 lb	65%	239,048 lb	35%

RG	w/ shares		w/o shares	
2010	2,800,064 lb	96%	113,794 lb	4%
2011	4,397,093 lb	92%	385,101 lb	8%
2012	4,513,535 lb	87%	703,670 lb	13%
2013	3,688,461 lb	80%	906,211 lb	20%
2014	3,609,728 lb	66%	1,888,265 lb	34%

SWG	w/ shares		w/o shares	
2010	155,091 lb	98%	3,143 lb	2%
2011	170,156 lb	91%	16,079 lb	9%
2012	256,643 lb	85%	43,724 lb	15%
2013	242,464 lb	79%	65,382 lb	21%
2014	193,570 lb	74%	69,681 lb	26%

TF	w/ shares		w/o shares	
2010	246,987 lb	99%	2,721 lb	1%
2011	330,997 lb	86%	55,137 lb	14%
2012	350,670 lb	78%	100,451 lb	22%
2013	219,869 lb	50%	220,222 lb	50%
2014	214,600 lb	41%	302,668 lb	59%

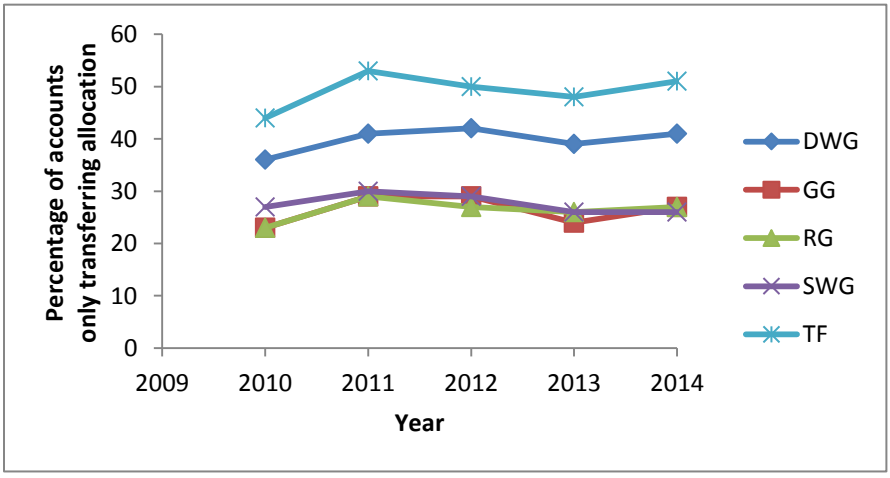

Figure 5.2.2.1. Percentage of accounts only transferring allocation.

5.3 Distributions of Landings, Revenues, and Shares

One of the GT-IFQ program's explicit objectives was to reduce overcapacity. If overcapacity is reduced by reducing capacity as opposed to increasing the target level of catch (e.g., the quota or sector annual catch limit (ACL), one of the expected effects is a reduction in the number of vessels, fishermen, and businesses participating in the fishery. This reduction in the number of participants may or may not change how landings and revenues are distributed across vessels and participants remaining in the fishery. However, if certain types of vessels or participants exit the fishery upon or after implementation of the program, then changes in the distributions of landings and revenues are likely to occur. Similarly, the distribution of shares and thus the annual allocations of quota would also be expected to change over time.

For example, economic theory suggests that less efficient and typically smaller businesses are expected to leave the fishery either as a result of receiving an insufficient amount of quota or because they cannot compete with their larger and more efficient counterparts. Regardless, their shares are expected to be bought by those with the greatest willingness to pay, which again are expected to be those operating at the lowest cost with the highest profits. In turn, those larger, more efficient entities will also accrue the landings and revenues associated with those shares. If this actually occurs, then the distributions of landings, revenues, and shares would be expected to become less equal over time.

The Gini coefficient is commonly used to measure distributional changes over time. The value of the Gini coefficient ranges between 0 and 1. A Gini coefficient of 0 indicates that all entities in the program have an equal or the same percentage of what is being measured (e.g., landings, revenues, shares, etc.), while a Gini coefficient of 1 indicates that a single entity possesses or controls 100% of what is being measured, which in market structure terms is commonly known as a monopoly. Thus, if the Gini increases over time, the distribution is becoming more unequal; if the Gini decreases over time, the distribution is becoming more equal.

The level at which the analysis is conducted (i.e., the unit of analysis) can be at the vessel, business, lowest known entity (LKE), or some other level. It is advisable to analyze distributional changes at various levels to ensure that choosing a particular level or unit of analysis does not obscure distributional effects that are actually occurring and may be of importance to fisheries managers. It is also advisable to look at changes in the distribution of various economic performance indicators (e.g., landings, revenues, and shares) as their distributional changes may differ over time (i.e., changes may not be of the same magnitude or even in the same direction).

With respect to comparing distributions before and after implementation of the GT-IFQ program, the only unit of analysis that can be used is the vessel. Although some additional data regarding business ownership and structure started to be collected when the red snapper individual fishing quota (RS-IFQ) program was implemented, complete data of this nature was not collected until the GT-IFQ program was implemented. Thus, Gini coefficients at the business and LKE level cannot be estimated prior to 2010. Further, vessels do not possess shares, and so it is not feasible to look at the distribution of shares at the vessel level.

Nonetheless, as illustrated in Table 5.3.1, NMFS has produced a suite of Gini coefficient estimates that provide some indication of how certain distributions have changed as a result of or at least since the GT-IFQ program was implemented (J. Agar, 2017, pers. comm.). Specifically, for landings of all species in the GT program, the Gini coefficient estimated at the vessel level was 0.71 in the baseline period (i.e., 2007-2009). The Gini increased to 0.75 by the end of 2010 and to 0.77 by the end of 2014, representing a 10% increase from the baseline, most of which occurred in the first year. The Gini coefficients for all GT revenues at the vessel level are nearly identical. Thus, as economic theory would suggest, the distributions of GT landings and revenues have become somewhat more unequal since the IFQ program was implemented.

Table 5.3.1 Gini Coefficients for the GT-IFQ Program, 2010-2014

	Baseline	**2010**	**2011**	**2012**	**2013**	**2014**
ALL GT landings, vessel level	0.71	0.75	0.77	0.73	0.76	0.77
ALL GT revenues, vessel level	0.70	0.74	0.77	0.73	0.76	0.77
RG revenues, vessel level	0.71	0.76	0.77	0.74	0.77	0.77
GG revenues, vessel level	0.70	0.71	0.67	0.67	0.68	0.69
OSWG revenues, vessel level	0.73	0.73	0.67	0.69	0.70	0.71
DWG revenues, vessel level	0.74	0.82	0.84	0.83	0.86	0.85
TF revenues, vessel level	0.83	0.87	0.89	0.87	0.89	0.92
RG landings, LKE level	N/A	0.81	0.81	0.78	0.80	0.79
GG landings, LKE level	N/A	0.75	0.71	0.71	0.73	0.75
OSWG landings, LKE level	N/A	0.75	0.74	0.72	0.73	0.75
DWG landings, LKE level	N/A	0.82	0.83	0.83	0.84	0.84
TF landings, LKE level	N/A	0.82	0.82	0.82	0.83	0.86
RG shares, LKE level	0.83	0.84	0.83	0.84	0.84	0.84
GG shares, LKE level	0.77	0.79	0.79	0.79	0.79	0.79
OSWG shares, LKE level	0.82	0.84	0.83	0.83	0.82	0.82
DWG shares, LKE level	0.87	0.88	0.88	0.88	0.88	0.88

Somewhat similar trends are seen in the Gini estimates for revenues at the vessel level by share category. For example, the baseline, 2010, and 2013 estimates for red grouper are exactly the same as for GT in the aggregate. However, although the Gini coefficients for GG and OSWG revenues at the vessel level were at similar levels in the baseline period (0.7 for GG and 0.73 for OSWG), they were relatively unchanged from their baseline levels in 2014 (0.69 and 0.71, respectively), indicating the IFQ program had no effect on those distributions.

Conversely, the IFQ program has had a more noticeable effect on the distributions of revenues for DWG and TF at the vessel level, though their Gini coefficients were also slightly, to somewhat higher, in the baseline period. Specifically, the Gini coefficient for DWG revenues at the vessel level was 0.74 in the baseline period, but increased to 0.82 by the end of 2010 and .85 by the end of 2014, representing a 15% increase, most of which occurred in the program's first year. The Gini coefficient for TF revenues at the vessel level was 0.83 in the baseline period, the highest for any species group in the program. The Gini increased to 0.87 by the end of 2010 and continued to increase to 0.92 by the end of 2014, representing an 11% increase since the baseline. So, not only are the distributions of DWG and TF revenues highly unequal at the vessel level, they have becoming increasingly unequal under the IFQ program.

Again, because landings cannot be estimated at the LKE level prior to the GT-IFQ program's implementation, only limited observations can be made with respect to distributional changes in landings at the LKE level by share category. For example, the Gini coefficient for GG and OSWG landings at the LKE level were 0.75 at the end of 2010 and remained at that level at the end of 2014. Thus, they are only slightly higher than the Gini coefficients estimated at the vessel level. For red grouper, the Gini coefficient for landings at the LKE level actually decreased slightly from .81 to .79 between the end of 2010 and the end of 2014. These estimates are also slightly higher than the estimates for red grouper revenues at the vessel level. For DWG, the Gini coefficient for landings at the LKE level between the end of 2010 and the end of 2014 are practically identical to those for DWG revenues at the vessel level. For TF, the trend in the Gini coefficient for landings at the LKE level is nearly identical to the trend in the Gini for DWG revenues at the vessel level, though the absolute values are slightly less; .82 at the end of 2010 and .86 at the end of 2014.

Similarly, the distribution of shares at the LKE level can only be examined from the time the program was first implemented (e.g., January 1, 2010 for the GT-IFQ program and January 1, 2007 for the RS-IFQ program). The Gini coefficients for shares at the beginning of the two IFQ programs range from 0.77 for gag and 0.8 for red snapper up to .87 for both DWG and TF, while RG and OSWG are between those values. For RG, GG, DWG, and OSWG, the Gini coefficients changed by 0.02 or less from the time of implementation till the end of 2014, suggesting that shares in these categories did not consolidate to any discernible degree since the GT-IFQ program was implemented. The Gini coefficient did increase for TF shares by about 3.5%, from 0.87 to 0.9, and the Gini for red snapper shares increased by 5%, from 0.8 to 0.84. The Gini for red snapper shares actually decreased slightly from 2007 to 2011, down to 0.78 in 2011, but has increased noticeably since then. The increase from 2011 to the end of 2014 was about 7.7%.

To provide additional context for these estimates, Brinson and Thunberg (2016) estimated Gini coefficients for the distribution of revenues at the vessel level for all U.S. catch share programs.

Although there was some variability in the effect each program's implementation had on the distribution of revenue and thus the Gini coefficients, the effects of implementing the GT-IFQ program as well as the RS-IFQ program did not differ significantly from the effects seen in most other catch share programs. Interestingly, the distributions in some programs actually became more rather than less equal over time, including in the RS-IFQ program to a very limited degree (Gini coefficient was 0.81 in the baseline period and 0.79 in 2013). However, the most striking result in their analysis is how unequal the revenue distributions across vessels were in the baseline period for the GT-IFQ and RS-IFQ programs relative to the other fisheries managed by catch shares. For all other fisheries in their analysis, the Gini coefficient averaged 0.45 in the baseline period, ranging from 0.25 to 0.62. Depending on whether you compare these programs with the GT-IFQ as a whole, or with certain species categories in the program, the Gini coefficients in the GT-IFQ program were 58%-84% higher in the baseline period compared to the other U.S. fisheries. Thus, the distributions of revenues across vessels in the GT and RS fisheries were considerably more unequal when the IFQ programs were implemented relative to all other U.S. fisheries where catch share programs have been put in place. Because the effect of the RS-IFQ and GT-IFQ programs' effects were not significantly different from most other programs, the revenue distributions at the vessel level are still much more unequal in the RS-IFQ and GT-IFQ programs compared to their distributions in other U.S. catch share programs.

5.4 Market Concentration and Market Power

5.4.1 Landings Markets

When estimates of marginal cost are available, it is generally a straight-forward matter to determine if market power exists, i.e., if price exceeds marginal cost, market power exists. However, the marginal cost estimates necessary for this type of analysis were not available when Mitchell (2016) conducted his analyses of concentration and market power.

An alternative way to detect market power is to examine the structure of the industry. Industries that are more concentrated, or situations with a large dominant firm, have some individual suppliers for whom elasticity is low due to a lack of competitive activity. Low elasticity allows for the exercise of market power. One commonly used measure of concentration is the Herfindahl-Hirschman Index (HHI). Other measures include C5 and C3, the share of the market controlled by the top five or three suppliers, respectively. A sufficiently large share for the largest supplier can also indicate potential market dominance.

According to joint guidance from the Department of Justice and the Federal Trade Commission, a market with an HHI above 2,500 is considered "highly concentrated" (exercise of market power is likely, particularly if concentration increases further)," a market with an HHI between 1,500 and 2,500 is considered "moderately concentrated" (possible concern with market power being exercised given a sufficient increase in concentration)," and a market with an HHI below 1,500 is considered "unconcentrated" (no concerns over the exercise of market power). Further, a regulatory action raises potential "significant competitive concerns" if it produces an increase in the HHI of more than 100 points in a moderately concentrated market or between 100 and 200

points in a highly concentrated market. A regulatory action is presumed "likely to enhance market power" if it produces an increase in the HHI of more than 200 points in a highly concentrated market.

Mitchell's analysis measured concentration at three levels: the IFQ account, LKE, and the affiliated business/entity level. The affiliated business/entity (supplier) level is the closest approximation of units of independent economic control and the basis for the analysis of market power. Affiliation exists when one business controls or has the power to control another or when a third party (or parties) controls or has the power to control both businesses. Control may arise through ownership, management, or other relationships or interactions between the parties. This level of analysis is most consistent with the Small Business Administration's (SBA) regulations for assessing ownership affiliation, which stipulate that control or the power to control should be presumed if one entity owns 50 percent or more of another entity (see 13 CFR 121.103(c)). Ownership percentages were based on ownership data for IFQ accounts provided by NMFS (J. Stephen, pers. comm., Jan. 13, 2016). In the case of "joint" IFQ account holders, for which ownership percentage data is not collected, the joint owners of the IFQ account were assumed to control equal percentages of the account in accordance with SERO's internal practices.

Mitchell also provided concentration estimates at the individual IFQ account level and the LKE level. At the LKE level, ownership is aggregated across IFQ accounts for each individual. The LKE (individual) level underestimates actual concentration because it ignores the ability of individuals to exercise control over a business' operations when they have a majority or substantial minority ownership interest. The IFQ account level underestimates actual concentration even more than the LKE level because it does not account for affiliated ownership at all. Thus, estimates at the LKE level come closer than estimates at the IFQ account level to approximating the appropriate measure of concentration for assessing market power. But unlike estimates at the affiliated business/entity level, estimates at the LKE level do not account for control of affiliated businesses that do not have a single common owner (e.g., where the same individual is not the sole owner of multiple businesses but does have a majority ownership interest in multiple businesses).

Based on the multiple measures of market concentration (e.g., HHI, C3, and C5), market concentration was found to be low in all species groups' markets for landings, with the exception of TF, and DWG to a much lesser degree, suggesting markets are likely competitive. More specifically, the market for red snapper (RS) landings has been Unconcentrated since the start of the IFQ program, with the largest supplier (i.e., the largest group of affiliated individuals and businesses) garnering no more than 11.5 percent of RS landings in any year, and the largest five suppliers garnering less than one third of the RS landings in any year. Similarly, the market for red grouper and gag grouper combined (RGG), the market for DWG, and the market for OSWG are also Unconcentrated and without any dominant suppliers or group of suppliers. Concentration decreased in the market for TF landings from 2010 to 2012, and then increased during 2013 and 2014 to a level of Moderate Concentration in both years, along with potentially dominant shares controlled by a small group of suppliers every year, especially in 2010 and 2014. However, an examination of monthly average prices for all of the species groups revealed no relative upward trend for either of those species groups during these years. In fact, TF had a relative price increase between 2010 and 2012, during which concentration was declining and

output was increasing. Absent a strong argument why prices should have been declining in 2013 and 2014, the stability in prices indicates that the increased concentration has not created market power at this time.

A firm producing multiple substitutable products faces lower aggregate demand elasticity (i.e., has more opportunity to exercise market power) than the individual elasticity for each product. This means that a single entity accounting for large shares of multiple species groups would be more of a concern than if different entities produced the largest shares of each different species group. For example, in 2013 and 2014, the entity that produced the highest RS landings also produced the most DWG and TF landings. However, concentration in terms of revenue across all Gulf reef fish is quite low, and no firm produced as much as 8 percent of the total revenue in any given year.

Based on the above findings, there is no evidence that market power exists in any of the relevant markets for landings. However, market power can also be created through collusive activity between presumably competing suppliers (e.g., such as was apparently the case between the major producers of canned tuna in recent years). Identifying specific conduct that only makes sense as cooperative activity to increase prices, and not as individual profit-maximizing behavior, would demonstrate the existence of market power. Collusive activity would be unlikely to have much effect unless the market was moderately or highly concentrated. Mitchell's analysis found no evidence of collusion in any of the markets for landings.

5.4.2 Annual Allocation and Shares Markets

With respect to estimating concentration in the markets for annual allocation and shares, the approach used in Mitchell's analysis was to measure allocation held at the beginning of each quarter, specifically January 1 (which is the same as measuring the concentration of shares), April 1, July 1, and October 1. Distribution of allocation occurs on January 1 according to the percentage of shares held and the amount of quota for each species group. The holder of allocation can transfer, use, or acquire allocation. Occasional mid-year increases in quota can also result in new distributions of allocation.

With respect to shares, the largest producers (i.e., the largest groups of affiliated individuals and businesses) in every species group had landings that were almost always higher than the volume associated with the cap on shares. This means that they were able to obtain sufficient allocation through market transactions such that their landings were not only above their initial shares/annual allocation but also above the share cap for each species group.

Landings can exceed the volume related to share caps because the regulatory constraints on accumulating allocation during the year are looser than the share caps. Specifically, there is no cap on the accumulation of RS allocation, while the cap on GT allocation restricts the level of allocation aggregated across all species to approximately 6 percent of the aggregate total GT allocation on an annual basis. For example, the annual allocation cap in 2013 was 529,300 pounds, and the total GT allocation across all species groups was 8,456,000 pounds. So, the annual allocation cap was 6.25 percent of the quota for all GT species. An aggregated GT

market with 16 firms that have just a bit above a 6 percent market share would have an HHI of 625, which would be Unconcentrated. It would be even less concentrated if RS was part of the market.

Mitchell's analysis concludes that the existing GT allocation cap does not effectively control concentration in a manner that is meaningful for the relevant markets of IFQ landings and allocation for the following reasons. First, it matters how a supplier spreads their production across species groups. For example, the 2013 quotas were 6,238,000 pounds for RGG, 1,118,000 pounds for DWG, 518,000 pounds for OSWG, and 582,000 pounds for TF. Given an allocation cap of 529,300 pounds, if a supplier held the aggregate cap all in one species group, which is currently allowable, then the supplier could hold about 8.5 percent of the quota for RGG, 48 percent of DWG quota, over 100 percent of the OSWG quota, or 92 percent of the TF quota.

Second, the ability of a single entity to potentially control multiple IFQ accounts means that, if the allocation cap is effectively applied at the IFQ account or the LKE level, it is possible for concentration to exceed what the cap allows. For example, in 2013, each of the entities responsible for the largest share of production in each of the GT species groups, which was a different entity for each group, landed a total amount of GT production well below the cap of 529,300 pounds. In fact, the combined production of those four different entities was under 520,000, which is just below the cap. The allocation cap would not have constrained any of these entities from increasing their production. If these entities were affiliated, only a small increase from each would have put their combined production over the allocation cap.

Finally, the GT allocation cap does not include RS. It is possible that there is a broad market including both GT and RS, as well as other reef fish species, but there is no indication that a relevant market exists for the specific group delineated by the cap (i.e., all GT regulated species excluding RS). Only a cap on all IFQ species would address the relevant market for all IFQ species or all Gulf reef fish. The largest aggregate supplier of IFQ species in 2013, also a combination of multiple permit holders, produced over 800,000 pounds across all species groups (about 6.8 percent of all IFQ landings that year), including over 500,000 pounds of RS, or about 10 percent of all RS landings that year.

The distribution of allocation and shares at the LKE level is much less concentrated than landings at the LKE level. Three of the species groups (RS, RGG, and OSWG) as well as the aggregate quantity of all species groups has always been Unconcentrated. Also, the largest suppliers have always had small shares not consistent with market dominance. Market share has usually been less than 20 percent, though rising above 30 percent in a few recent years for species groups that constitute less than 5 percent of the total IFQ landings (i.e., TF and DWG). The only species group with concentration measures above those consistent with an Unconcentrated market in multiple years, TF, is the same species group that had higher concentrations for landings. This appears not to be a concern for market power based on the price movements occurring during these periods of increased concentration.

DWG has a notable increase in concentration in the second half of 2010. This is mostly due to a large increase in holdings by a particular market participant caused by a small number of low-

price transactions (i.e., transactions that were priced considerably below the average price of the other transactions in the data for DWG that year), and failure to use or transfer all of those holdings as the season progressed. This conduct could be consistent with an attempt to exercise market power. However, the modest rise in prices for DWG in 2010 is not substantially different from price fluctuations at other times, nor was there any noticeable impact on allocation prices. Absent any effect on prices, it is evident that either this was not an attempt to exercise market power, or, if it was, then there was no market power to exercise because of competition from substitute products.

There is a more consistent pattern of concentration for TF. Notably, the allocation market for TF starts out Unconcentrated at the beginning of each year and becomes more concentrated during the year, becoming Moderately Concentrated in July 2010, October 2013, and April, July and October 2014. These concentration patterns occur with a mixture of different suppliers in different years and, absent any evident price effect downstream and given the allocation prices were about average, appear to be more consistent with a small number of harvesters chasing a relatively small amount of fish that likely is not by itself a relevant market, rather than an attempt to exercise market power.

Absence of market power may mean that the existing share and allocation caps have been effective in preventing market power or may be due to strong competition between industry participants and from products in adjacent markets (e.g., non-IFQ Gulf reef fish and South Atlantic snapper-grouper). There is no evidence of market power even when participants (or, strictly speaking, groups of individuals and businesses with affiliated ownership) accumulate large and concentrated shares of allocation or landings. However, because NMFS does not collect ownership data for seafood dealers and processors in the Southeast Region, concentration levels may be underestimated if there is vertical integration in the industry (i.e., one business controls multiple levels of production, such as when a seafood processor owns an ice house or tackle/bait shop, vessels, a dock, and a retail market).

The analysis also shows that the share caps are not be constraining landings, as there have consistently been some entities (groups of affiliated individuals and businesses) harvesting a percentage higher than prescribed by the existing share caps (e.g., up to as much as 7-11 percent for red snapper, 6-8 percent for red/gag grouper, 8-12 percent for deep-water grouper, 5-8 percent for other shallow water grouper, and 14-20 percent for tilefish). For all Gulf IFQ reef fish, the largest producer each year has only been responsible for 3-8 percent of the landings revenue since 2010. These findings suggest that, while some small sets of commonly controlled entities may dominate landings in certain species categories, landings are substantially more dispersed when looked at from the perspective of the IFQ program(s) as a whole. The higher levels of concentration at the species category level suggest certain businesses specialize in harvesting particular species, which should result in improved technical efficiency (i.e., lower average costs per unit of output). Further, there is no evidence that allocation caps are necessary at this time to prevent the exercise of market power in the landings markets or markets for allocation.

5.4.3 Caps and Minimum Efficient Scale (MES)

Mitchell's (2016) analysis also looked at whether producers in the GT-IFQ and RS-IFQ programs are minimizing their average costs of production (i.e., achieving all economies of scale) and, if not, whether the share caps or the GT allocation cap were preventing them from doing so. The analysis shows that current individual vessel harvesting levels fall well below the MES level of production, i.e., harvesters could reduce average costs by increasing production (landings). However, the caps are not responsible for preventing harvesters from achieving lower costs because efficient levels of production are technically feasible within the limitations of those caps.

More specifically, the MES level of output per trip (where average costs are minimized) is estimated to be approximately 5,000 pounds per trip.[26] In contrast, the average trip only harvested 2,077 pounds in the 2010-2014 time period. Thus, the MES level of production is about 2.5 times the average volume of landings per trip for all of the trips in the logbook data. Even when considering the narrower harvesting target of RS only, for example, 5,000 pounds would be 4 times the average RS landings per trip in 2014 (excluding trips with no RS landings). In both cases, there are many vessels that exceed the 5,000 pound level per trip on average, so there is clear evidence that some configurations of vessel, gear, captain, and crew can harvest at the minimum cost level of production.

There is a theoretical upper bound on the number of trips that each individual vessel can take per year (approximately 26, given 5 days out, 5 days of rest and maintenance, and few or no weather interruptions), but the maximum and average number of trips observed in the IFQ data suggest that typical vessel operations fall well below that upper bound, with most vessels operating only 10-15 trips per year. A hypothetical vessel at the upper end of that range (15 trips), producing at the MES per trip, would be landing about 75,000 pounds per year (15 trips * 5,000 pounds per trip). This amount of harvest (75,000 pounds) would constitute a substantial portion of the landings for some of the GT species groups: approximately 25-30 percent of OSWG, 15-25 percent of TF, or 7-10 percent of DWG. These levels of production are above the share caps for each of these species groups, but this would only apply to vessels that limited their production to one species group, which is rare, especially for the species groups with smaller quotas. For GT in the aggregate, 75,000 pounds would only be about 1 percent of the landings, well below the annual allocation cap for GT, and for RS it would be only 1.5 to 2.5 percent of landings, which has no cap on annual allocation.

Given the flexibility to combine species within a trip or across multiple trips and/or reduce the number of trips, vessel operators could achieve 75,000 pounds of landings well within the existing share and annual allocation caps. Entities controlling vessel operations have historically been quite able to accumulate allocation and generate landings well in excess of the share caps. Every year since the GT-IFQ program was implemented, there have been scores of entities producing more than 750,000 pounds of IFQ landings, or ten times the amount of landings generated by the hypothetical, cost-efficient vessel landing 75,000 pounds per year. This means

[26] These are "quality-adjusted" pounds that take into account the different valuations of variations among species and fish size.

that the share and allocation caps are not restricting entities from achieving higher levels of landings that would result from operating vessels in a cost-efficient manner.

5.5 Social effects

Transferability of shares and allocation is generally viewed as a positive component of IFQ programs as it allows for quota to move to where it is needed most. However, Griffith et al. (2016) point out that in the early stages of development, IFQ markets can retard trading or transferability. Because the GT-IFQ Program and the Red Snapper IFQ Program are closely tied through common participants, the market established through the latter program in 2010 likely mitigated many delays or negative impacts of market development in the GT-IFQ program. Transferability allows for allocation to be bought by another fisherman when needed to land IFQ managed species. Many holders of leased, or bought allocation do pass on at least a portion of that cost to hired captains and crew. Griffith et al. (2016) found many participants complained about vessel owners who own shares, but require their hired captains and crew to lease the allocation associated with those shares. These participants found this practice to be highly unfair, especially when prior to implementation of the IFQ program, the hired captains and crew bore none of those costs and in many cases, caught the fish for which the permit holder received the shares (Griffith 2018). The participant study conducted by QuanTech (2015; Appendix B2) did not inquire about this practice, but only asked about whether the expense of buying allocation was passed on to the captain and crew; 69% of respondents reported that allocation expenses were deducted "from revenue before paying the captain," who receives a share of total revenue. It is not clear if the survey respondent reported sharing in the cost of buying allocation. This has been labeled a "usury fee," adding that passing this cost on to crew further increased "the divisions between those who own and those who work" (Macinko 1997). Even with higher prices for their fish, it is unclear that the increase would offset these new costs borne by the captain and crew. This may be why Perruso (2017) found decreases in satisfaction from fishing and a decreased ability to earn a large income. There was also a large percentage of those surveyed who saw their share of revenue decrease since implementation of the GT-IFQ Program. This has been documented in other IFQ-type programs (Copes and Charles 2004; Pinkerton and Edwards 2009; Olson 2011). Notably, Pinkerton and Edwards (2009) found that the cost of buying allocation has actually decreased economic efficiency and worsened wealth inequities in the fishery.

Another study looked at the market for trading allocation (Stocks 2016; Appendix B5). Using social network analysis, transfers of GT allocation were visualized. Several conclusions can be drawn from the visualizations (Appendix B5, Figure 3). First, the largest nodes represent entities that own shares, rather than non-shareholders. Thus, program participants who transfer large amounts of allocation to other program participants are not transacting allocation, only. That is, they are not participating in the program as allocation brokers, profiting from buying and selling allocation among other participants. Second, although entities represented by the largest nodes are not landing allocation associated with that particular account, Entity 1 and Entity 3 are associated with at least one permitted reef fish vessel. Entities 2, 4, and 5 may be dealers, although further inquiry into the IFQ online system is needed to confirm this. Although it is not clear if any of the individuals behind these accounts actively engage in the activity of fishing,

these participants appear to have other investments or involvement in the fishery besides as shareholders. This raises the question of how to define "active participation in the fishery." Does active participation include both fishermen who actually catch the fish as well as dealers and vessel owners? It is important to note that prior to IFQ program implementation, there were vessel owners who hired captains and did not fish their own permitted vessels.

The visualizations suggest another apparent trend resulting from the IFQ program, that of vertical integration. Dealers, both with and without vessels, have bought shares and transferred the allocation to vessels with the understanding that the vessel will land those fish with the dealer who provided the allocation. This integrates the first level of production (i.e., the vessel) with the next level of production (i.e., the dealer). This trend has been noted in several other IFQ-type programs as a social consequence (Olson 2011), as dealers control access to quota and thus the price paid. This could limit a captain and crew's flexibility to negotiate better prices and to sell fish to the dealer of their choice.

5.6 Conclusions

Based on the various Gini coefficient estimates, the distributions of shares at the LKE level have changed little if at all since the IFQ programs were implemented, though the Gini for TF shares did increase by more than 3% and thus the distribution did become slightly more unequal. The distributions of landings by share category at the LKE level have also changed little since the first year of the GT-IFQ program, again with the potential exception of the Gini for TF landings which did increase by about 5% and thus the distribution became slightly more unequal. However, landings at the LKE level could only be examined since the end of the program's first year and therefore may not be indicative of the program's actual effects.

Based on the vessel level estimates, the distributions of GT landings and revenues in the aggregate did become somewhat more unequal since the baseline period, increasing by about 8-10% by the end of 2014. When broken down by share category, there are distinct differences in the patterns. While the change in the distribution of RG revenues follows the same pattern as for all GT species in the aggregate, the distribution of gag and OSWG revenues at the vessel level did not change at all since the baseline period. Conversely, the distribution of TF and particularly DWG revenues became noticeably more unequal since the baseline period, increasing by about 11% and 15% respectively. Most importantly, all of the Gini estimates in the GT-IFQ and RS-IFQ programs are significantly higher than the Ginis for all other U.S. catch share programs, by between 58% and 84% depending on which specific estimates are compared. These findings may explain some of the concerns that have been expressed with respect to whether the programs are "fair and equitable." However, the distributions of landings and revenues in these fisheries were highly unequal when the programs were implemented. Thus, the IFQ programs are not the primary cause of these highly unequal distributions, though they did serve to reinforce those unequal distributions. Other regulatory, economic, and social factors must have caused the highly unequal distributions that existed prior to the IFQ programs.

Mitchell's analysis concludes that market power does not exist in any of the markets for landings, shares, or annual allocation and that economies of scale are not being exhausted (i.e.,

average costs of production are not being minimized). Further, the share and annual allocation caps are not effective in constraining landings. Retaining the current share and annual allocation caps would still prevent participants from exercising market power and would not preclude businesses from achieving economies of scale under current market conditions. However, some additional leeway from expanding the size of some of the smaller caps would create no additional risk of market power being exercised, and would provide even more flexibility for the type of consolidation that would improve cost efficiency. In the event that market conditions ever change to the point where the caps become more binding, then moderate changes to the caps could improve their effectiveness. The moderate changes involve aligning the caps more closely with the way the markets operate rather than with how the Gulf Council originally chose to regulate operations. Specifically, an aggregate cap on allocation and aggregate cap on shares across all species groups, to include RS together with GT, should be considered. A single aggregate cap in each case would also be less costly for NMFS to monitor.

There are a few findings and trends that should be monitored for issues in the future. Specifically, in the case of TF, the largest firm has consistently controlled about 20% of the landings and the largest three firms have controlled around 50% of the landings. Although TF is not a major component of the GT-IFQ program or the reef fish fishery, this could be cause for concern if a "niche" market for TF was ever developed. Of more likely concern for management are trends regarding red snapper landings. Specifically, the largest firm controlled 6.8% of the red snapper landings in 2007; that percentage increased to 9.6% in 2014. The share of the landings controlled by the three largest firms increased from about 15% to 24% between 2007 and 2014, while the share of the RS landings controlled by the five largest firms increased from about 20% to 30% during that time. While no market power has been detected as of yet, the trend is clear and may be of some concern if it continues.

As a result of these findings, Mitchell also determined the highest share and annual allocation caps that would continue to prevent the exercise of market power but also allow economies of scale to be fully achieved. His analysis concludes that share caps at the species group level are not necessary to prevent market power, though market power would be prevented with species group share caps equal to 7 percent or the highest percentages of landings by entity observed to date. Market power would also be prevented under an aggregate share cap of 15 percent for all Gulf IFQ species combined. Further, no additional market power will be created and no scale efficiencies will be lost under an annual allocation cap of 7 percent for all Gulf IFQ species combined or allocation caps of 8-10 percent for each species group.

Mitchell's analysis also concludes that any allocation caps intended to constrain the exercise of market power in the markets for annual allocation requires monitoring the amount of allocation held periodically during the year (e.g., at least Quarterly). Further, if there are concerns with the percentage of landings being controlled by particular entities, or the distribution of those landings, a landings cap would be a more effective way to prevent the exercise of market power in the annual allocation and landings markets as it would only require monitoring of landings during the year, which NMFS already does. Landings caps are more commonly employed in U.S. catch share programs than allocation caps (e.g., Pacific coast groundfish trawl rationalization program, Atlantic Sea Scallop General Category IFQ program, Bering Sea Pollock Cooperatives, Bering Sea Groundfish Cooperatives, and Bering Sea King and Tanner

Crabs). The Gulf RS-IFQ and GT-IFQ programs are the only US catch share programs with annual allocation caps.

In addition, because the determination of common economic control over the use of multiple permits is of paramount importance, Mitchell also recommended that detailed ownership data be collected for dealers and other vertically related entities and that joint owners of IFQ accounts be required to provide their ownership percentage data, including accounts jointly owned by multiple individuals that do not identify themselves as being joint owners of a partnership or other type of business. In addition, the best level at which to measure caps is the same as the best level for measuring concentration. The most appropriate level for measuring concentration and determining if market power exists is the affiliated business/entity level. Thus, Mitchell also recommended that caps be applied at the affiliated business/entity level rather than only at the LKE and IFQ account levels.

CHAPTER 6. PRICE ANALYSES

Share, allocation, and ex-vessel price information is important for evaluating the economic performance of catch share programs, particularly when estimates of profitability are not available (Holland et al., 2014). Theoretically, allocation prices should reflect the expected annual profit from landing one pound of quota, whereas share prices should reflect the net present value of the expected profit from landing one pound of quota in the long-run. In addition, economic theory suggests that, when fishermen no longer have to engage in a "race for fish" or "derby fishing," they will adjust their operations to better take advantage of weather and market conditions. Market gluts are expected to be reduced and product quality is expected to improve. As a result, ex-vessel prices are expected to increase, resulting in higher gross revenues and profits. Markets for landed product are also expected to be more stable. Specifically, if market gluts are reduced, landings would be expected to be more evenly dispersed over the course of the year, which in turn would be expected to result in more stable ex-vessel prices over the year (i.e., less variability from week to week, month to month, etc.). Further, if profits increase, operators will likely be willing to pay higher prices for shares and allocation, which in turn would be expected to result in higher share and allocation prices. All inflation-adjusted values in the analysis below were calculated based on the Gross Domestic Product (GDP) deflator.[27] The GDP deflator was chosen as the measure of inflation because it includes prices for all domestically produced goods and services and so is broader than other indexes.

Reporting of share transfer prices was not required until mid-2010, when a minimum transfer price of $0.01 was required for all share transfers. Share transfers report a value for the total share transfer, not a value per equivalent pound. Allocation transfer prices are collected on a per pound basis, but are not required to complete a transfer. Each year, there are share and allocation transactions that are either missing price information or have under-reported price information (e.g., $0.01/lb). Transactions that had reported low or no value could be due to, but not limited to, any of the following: entering a price per pound equivalent[28] instead of transaction price (only applicable to share transfers), reluctance to enter price information, gifts, transferring to a related accounts, part of a package deal (e.g., sale of shares with a permit, vessel, and/or other equipment), and/or unrecorded bartering of shares or allocation within the grouper-tilefish individual fishing quota (GT-IFQ) or red snapper individual fishing quota (RS-IFQ) programs. This misreporting of prices led to a 2012-2013 mail survey to participants about share prices. The survey was mailed to both the transferor and transferee for all past transfers where information was incomplete or possibly incorrect. Participants were asked to verify or correct the price information and select one of seven share transfer reasons: "Barter trade for allocation," "Barter trade for shares," "Gift," "Transfer to a related account," "Sale to another shareholder," "Package deal," and "No comment." Beginning in 2013, a submission of one of these transfer

[27] http://www.bea.gov/national/index.htm#gdp

[28] A price per pound equivalent is the share percentage that would equal one pound for that particular period. The exact share percentage that is equivalent to one pound depends on the total commercial quota and will change as the quota changes from year to year or within a year for any quota increases.

reasons was required to complete every share and allocation transfer to better monitor the performance of the program.

For share price analysis, the data were limited to share transfers with "valid" price per pound equivalents. From 2013 onward, when prices differed between the transferor and transferee, a final price was decided based on the more representative total price entered. For example, a total price was selected over a value that was more representative of a price per pound. For the allocation price analysis, the data were limited to "valid" prices. All allocation statistics were computed by weighting pounds transferred and not on a transactional basis. All values for share and allocation were weighted by the pounds instead of on a transactional basis.

While ex-vessel prices are required to complete a landing transaction, prices have been variable, with prices as low at $0.01/lb reported. They may also be under-reported for a variety of reasons: to minimize cost recovery fees and/or capital gains, contractual arrangements between dealers and shareholders, and deductions for transferred allocation, goods (e.g., bait, ice, fuel), and/or services (e.g., repairs, machinery replacement). In June of 2011, regulations modified the definition for ex-vessel price and explicitly prohibited the deduction of allocation, goods, and/or services when reporting the ex-vessel price. For the ex-vessel price analysis in the annual reports, the data were limited to valid ex-vessel prices. All statistics were weighted by pounds rather than on a transactional basis. All ex-vessel prices prior to the start of the program were calculated using the Southeast Fisheries Science Center (SEFSC) Accumulated Landings System (ALS) database. After the start of the grouper-tilefish individual fishing quota (GT-IFQ) program, ex-vessel prices are reported to both the ALS and GT-IFQ systems, but IFQ submitted prices are used in this analysis.

6.1 Share prices

Reporting of share transfers reasons reveals that most share transfers are considered a sale to another shareholder account, both in number of transfers and amount of shares transferred (**Table 2.2.1.2**). The large number of transfers to a related account illustrates the complicated nature of accounts in the GT-IFQ system. In the two years where share transfer reasons were tracked, transfers to a related account was the second greatest amount of shares transferred. The other share reasons with a larger number of transfers and amount of shares transferred was "No Comment."

Obtaining representative share prices has been a challenge, with only 40-67% of the transfers with representative prices (**Table 6.1.2**). The percentage of representative share prices has increased over time, partly due to outreach efforts in 2012 and 2013, highlighting the need and usefulness.

Table 6.1.2. Statistics for share transfer prices.

DWG	N	%	Avg.	Median	Inf.-adj. avg
2010	53	33%	$8.19	$9.00	$8.90
2011	44	46%	$11.35	$12.02	$12.08
2012	34	44%	$10.78	$12.00	$11.27
2013	30	57%	$12.58	$12.00	$12.94
2014	38	61%	$13.04	$13.00	$13.18

GG	N	%	Avg.	Median	Inf.-adj. avg
2010	107	42%	$5.35	$6.00	$5.81
2011	47	34%	$24.24	$25.00	$25.81
2012	68	53%	$25.91	$30.00	$27.09
2013	52	59%	$31.41	$30.02	$32.32
2014	78	74%	$30.18	$30.02	$30.50

RG	N	%	Avg.	Median	Inf.-adj. avg
2010	111	42%	$3.73	$3.30	$4.05
2011	76	45%	$6.24	$5.97	$6.64
2012	124	61%	$8.02	$8.00	$8.38
2013	106	73%	$13.16	$13.70	$13.54
2014	107	74%	$13.06	$13.00	$13.20

SWG	N	%	Avg.	Median	Inf.-adj. avg
2010	76	39%	$6.91	$6.49	$7.51
2011	42	40%	$9.93	$11.99	$10.57
2012	41	42%	$7.80	$7.99	$8.15
2013	49	60%	$8.30	$7.25	$8.54
2014	33	52%	$7.36	$7.50	$7.44

TF	N	%	Avg.	Median	Inf.-adj. avg
2010	38	42%	$3.11	$2.15	$3.38
2011	24	41%	$5.77	$5.14	$6.14
2012	14	32%	$8.22	$9.00	$8.59
2013	13	45%	$8.44	$8.00	$8.68
2014	17	50%	$8.75	$8.50	$8.84

ALL	N	%
2010	385	40%
2011	233	41%
2012	281	51%
2013	250	63%
2014	273	67%

6.2 Allocation prices

The most commonly selected reasons for allocation transfers were “No comment”, “Sale to another shareholder”, and “Transfer to a related account.” These reasons were substantially greater than all other reasons by an order of magnitude (Table 2.2.1.4). The greatest amount of pounds were also transferred under these same three reasons. As with the share transfers, the large number of transfers and amount of pounds transferred under the “transfer to a related account” illustrates the analysis of allocation transfers can be complicated.

Table 6.2.2. Statistics for allocation transfer prices.

DWG	N	%	Avg.	Median	Inf.-adj. avg
2010	68	14%	$1.32	$1.50	$1.43
2011	116	18%	$1.36	$1.40	$1.45
2012	213	28%	$1.19	$1.25	$1.24
2013	215	35%	$1.14	$1.15	$1.18
2014	325	38%	$1.11	$1.10	$1.13

GG	N	%	Avg.	Median	Inf.-adj. avg
2010	150	16%	$1.18	$1.00	$1.28
2011	303	24%	$1.74	$1.50	$1.85
2012	631	36%	$2.27	$2.25	$2.38
2013	705	41%	$2.40	$2.50	$2.47
2014	1,015	45%	$2.04	$2.00	$2.06

RG	N	%	Avg.	Median	Inf.-adj. avg
2010	153	14%	$0.92	$1.00	$1.00
2011	482	31%	$0.54	$0.50	$0.58
2012	746	39%	$0.79	$0.75	$0.82
2013	827	47%	$0.97	$1.00	$1.00
2014	1,337	58%	$0.97	$1.00	$0.98

SWG	N	%	Avg.	Median	Inf.-adj. avg
2010	75	12%	$1.15	$1.00	$1.25
2011	117	21%	$1.25	$1.40	$1.33
2012	279	31%	$1.15	$1.00	$1.20
2013	354	39%	$0.83	$0.75	$0.86
2014	443	44%	$0.73	$0.60	$0.74

TF	N	%	Avg.	Median	Inf.-adj. avg
2010	35	13%	$0.65	$0.50	$0.70
2011	62	19%	$0.67	$0.70	$0.71
2012	93	24%	$0.66	$0.65	$0.69
2013	88	30%	$0.67	$0.65	$0.69
2014	153	36%	$0.72	$0.75	$0.73

ALL	N	%
2010	481	14%
2011	1,080	25%
2012	1,962	34%
2013	2,188	41%
2014	3,273	48%

6.3 Ex-vessel prices

The majority of ex-vessel prices submitted through the IFQ system are thought to be representative of actual market prices, with greater than 93% of the transactions having representative prices (**Table 6.3.1**). Overall, ex-vessel prices increased from 2010 to 2014, with consistent increases seen in deepwater grouper (DWG) and red grouper (RG). Gag grouper (GG), shallow water grouper (SWG), and tilefish (TF) overall increased, but from year to year may have increased or decreased. Increases were greatest for DWG ($0.57/lb) and RG ($0.50/lb). Since ex-vessel share category prices are averages of the species caught in that share category, ex-vessel prices were also analyzed by species, which can reveal if one species is driving the average ex-vessel price. When ex-vessel prices were calculated at the species level rather than the landing share category, there will be slight differences for species that can be landed in multiple categories (i.e., red grouper or gag multiuse, DWG and SWG flexibility measures) when compared to the category average prices.

In comparison to pre-GT-IFQ ex-vessel prices and adjusting for inflation, nearly all species ex-vessel prices increased (**Table 6.3.2**). In the DWG share category, yellowedge grouper had the greatest ex-vessel price in all years both pre and post GT-IFQ. In SWG, the specie with the greatest ex-vessel price varied annually, but typically consisted of either black grouper or scamp. In the TF share category, typically golden tilefish had the greatest ex-vessel prices and was greater blueline tilefish by more than $1/lb. Pre-IFQ annual average ex-vessel prices from the

SEFSC's ALS were adjusted for inflation based on the GDP deflator[29]. The GDP deflator was chosen as the index to measure inflation because it includes prices for all domestically produced goods and services and thus is broader than other indexes. In general, ex-vessel prices were fairly stable for most species since the late 1990s onward and then increased with the start of the GT-IFQ program (**Figure 6.3.1**). The exceptions were yellowmouth grouper, which had highly variable prices, and blueline tilefish, which decreased slightly each year until the GT-IFQ program began.

Table 6.3.1. Statistics for ex-vessel prices by share category.

DWG	N	%	Avg.	Median	Inf.-adj. avg
2010	1,529	94%	$3.61	$3.70	$3.92
2011	1,961	96%	$3.80	$3.75	$4.05
2012	2,450	96%	$4.06	$4.00	$4.24
2013	2,006	97%	$4.30	$4.50	$4.42
2014	2,090	97%	$4.44	$4.50	$4.49

GG	N	%	Avg.	Median	Inf.-adj. avg
2010	3,226	99%	$4.27	$4.25	$4.64
2011	2,811	98%	$4.59	$4.75	$4.89
2012	3,562	98%	$4.69	$4.75	$4.90
2013	3,509	99%	$4.90	$5.00	$5.04
2014	3,940	98%	$4.83	$5.00	$4.88

RG	N	%	Avg.	Median	Inf.-adj. avg
2010	3,803	99%	$3.05	$3.00	$3.31
2011	4,563	99%	$3.15	$3.24	$3.35
2012	4,587	99%	$3.21	$3.25	$3.36
2013	4,383	100%	$3.54	$3.55	$3.64
2014	4,891	99%	$3.77	$3.80	$3.81

SWG	N	%	Avg.	Median	Inf.-adj. avg
2010	2,282	98%	$4.06	$4.10	$4.41
2011	2,782	97%	$4.14	$4.00	$4.41
2012	3,273	97%	$4.33	$4.25	$4.53
2013	2,954	98%	$4.48	$4.50	$4.61
2014	3,188	98%	$4.50	$4.50	$4.55

TF	N	%	Avg.	Median	Inf.-adj. avg
2010	357	100%	$2.07	$2.11	$2.25
2011	411	100%	$2.31	$2.40	$2.46
2012	529	99%	$2.27	$2.25	$2.37
2013	447	98%	$2.58	$2.75	$2.65
2014	512	94%	$2.61	$2.80	$2.64

Note that prices are based on the category under which a species was landed. Under flexibility measures, when a species is landed under its secondary category, the price is captured for that category (e.g., red grouper landed under gag multi is counted in the GG price per pound.) Inflation-adjusted prices used 2015 as the base year using the GDP deflator.

[29] http://www.bea.gov/national/index.htm#gdp

Table 6.3.2. Statistics for ex-vessel prices by species.

Cat.	Species	Pre-IFQ	2010	2011	2012	2013	2014
DWG	Snowy grouper	$3.46	$3.41	$3.68	$3.61	$3.82	$3.92
	Speckled hind	$3.25	$3.30	$3.39	$3.41	$3.64	$3.76
	Warsaw grouper	$3.20	$2.83	$2.87	$3.25	$3.69	$3.79
	Yellowedge grouper	$4.05	$4.16	$4.27	$4.57	$4.65	$4.71
GG	Gag	$4.32	$4.65	$4.89	$4.90	$5.05	$5.03
RG	Red grouper	$3.21	$3.30	$3.35	$3.36	$3.64	$3.82
SWG	Black grouper	$4.21	$4.33	$4.43	$4.54	$4.63	$4.76
	Scamp	$4.18	$4.44	$4.47	$4.60	$4.68	$4.62
	Yellowfin grouper	$3.41	$3.69	$3.36	$3.75	$4.26	$4.47
	Yellowmouth grouper	$3.14	$4.27	$4.13	$4.63	$3.80	$4.07
TF	Blueline tilefish	$1.11	$1.02	$1.20	$1.38	$1.54	$1.36
	Golden tilefish	$2.15	$2.36	$2.66	$2.61	$2.80	$2.84
	Goldface tilefish	$1.97	$2.46	$2.27	$2.17	$2.50	$3.05

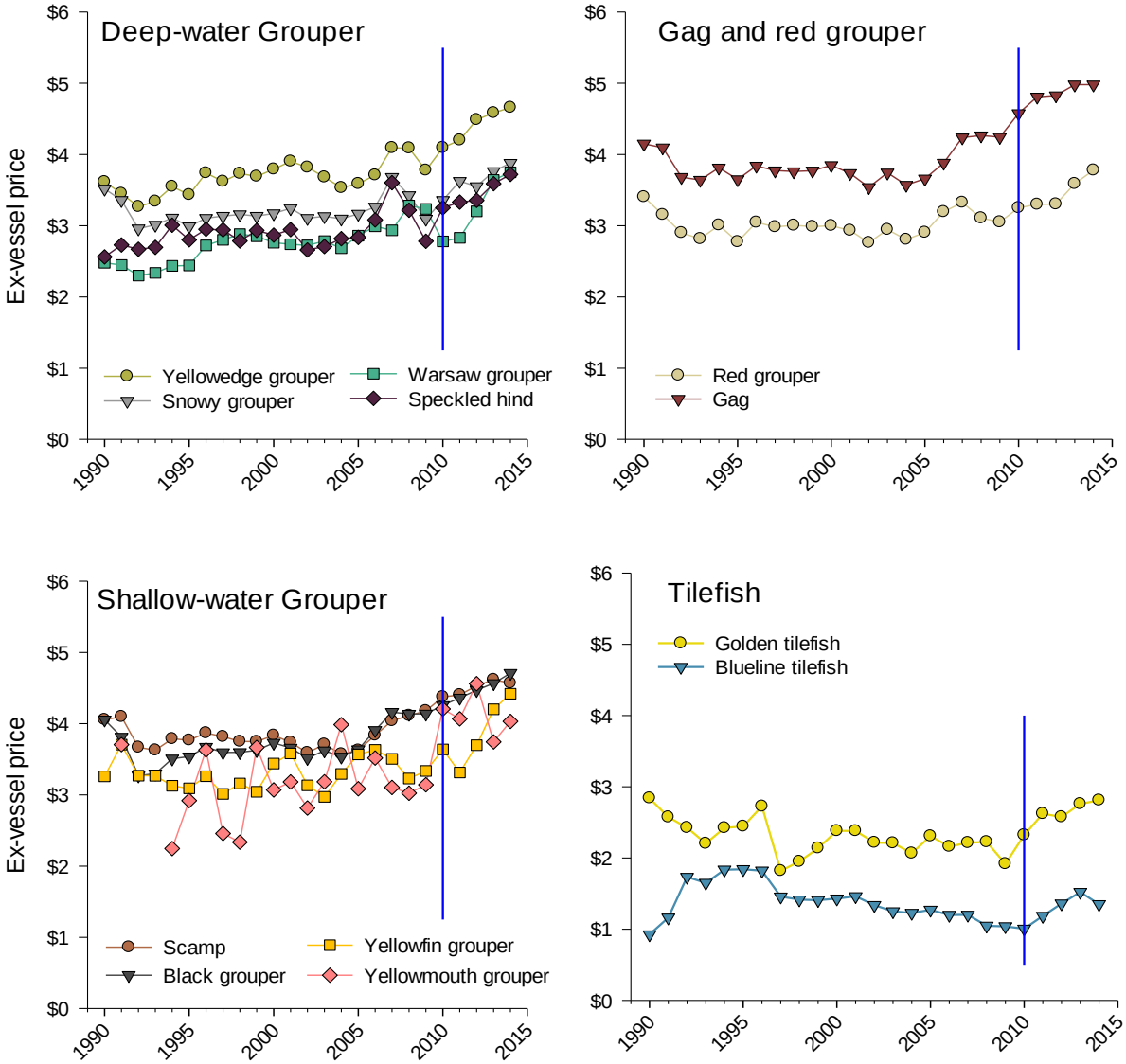

Figure 6.3.1. Annual (inflation-adjusted) ex-vessel prices by species since 1990.

6.4 IFQ Program Effects on Prices

Additional research has been conducted to determine whether implementation of the IFQ program has affected prices, particularly ex-vessel prices, and, if so, to what extent. As discussed in section 5.2, Mitchell (2016) hypothesized that increases in market concentration could lead to market power (i.e., the ability of some producers to increase prices above marginal cost). Because all quota share markets were found to be unconcentrated, market power does not exist in these markets and thus cannot explain the changes in quota share prices that have occurred since the IFQ program was implemented. In the aggregate, markets for annual allocation were also found to be unconcentrated. On the other hand, the market for DWG annual

allocation was moderately concentrated for part of the year in 2010 and the market for TF annual allocation has been moderately concentrated throughout most of the 2010-2014 time period. However, prices for annual allocation did not increase as concentration levels increased, and thus market power does not explain changes in the prices of annual allocation that have occurred since the IFQ program was implemented. Finally, with the exception of TF in 2014, all markets for GT landings were also found to be unconcentrated and thus market power cannot explain changes in ex-vessel prices since the IFQ program was implemented.

Although economic theory suggests that IFQs and catch share programs in general will increase ex-vessel prices, and thereby gross revenues and profits, Birkenbach et al (2017b) found mixed evidence to support that hypothesis. Their study assessed changes in ex-vessel prices for all U.S. catch share fisheries using differences-in-differences and synthetic control methods. Thus, they attempted to control for all other factors that could have potentially explained changes in ex-vessel prices after the implementation of a catch share program in order to isolate the effect of the program. Although ex-vessel prices did increase following the implementation of catch shares in some fisheries, prices did not increase for all species after controlling for other factors. In general, ex-vessel price increased for the higher-value species within each complex or program. But even when the ex-vessel price did increase, the increase was not as significant as what may have been expected based on estimates that do not control for the effects of other factors (e.g., the estimates presented in section 6.3).

With respect to the Gulf IFQ programs, implementation of the RS-IFQ program was found to cause a statistically significant and rather sizable increase in the ex-vessel price of red snapper. The mitigated effect of the program on the ex-vessel price of red snapper was likely caused by the shift to 10 day monthly mini-seasons in the years just prior to the IFQ program's implementation. Their analysis also found that implementation of the GT-IFQ program did not cause a statistically significant increase in the ex-vessel price for any species in the GT fishery and, in fact, the ex-vessel price of red grouper decreased slightly as a result of the IFQ program. Some of the reasons for this finding can be found in a study conducted by Keithly (2017).

While many catch share programs are initiated only after the "race for fish" has developed in the fishery, Keithly finds this was not the situation in the major components of the GT fishery. With the exception of some relatively short seasonal closures in the DWG and TF components of the fishery, the GT fishery was a year-round fishery prior to the IFQ program being introduced.[30] Thus, reasons cited in the literature for why ex-vessel prices are often depressed in a regulated open-access fishery may not be valid when considering the GT fishery.[31]

Studies that have empirically examined the influence of an IFQ system on ex-vessel prices have traditionally done so using a set of structural equations with relevant market clearing prices to estimate demand and supply functions for the species being examined. Given the large number of species in the GT fishery in conjunction with the paucity of literature associated with the

[30] A list of temporal closures can be found at: http://sero.nmfs.noaa.gov/sustainable_fisheries/acl_monitoring/commercial_gulf/reef_fish_historical/index.html

[31] A recent analysis by Keithly and Wang (2017) found no appreciable changes in product form and market outlets when comparing dealer/processor activities both before and after introduction of the GT-IFQ program.

markets for these species, which may differ among species, Keithly specified a complete demand system to examine whether introduction of the GT- IFQ program resulted in higher ex-vessel prices.

Keithly's analysis used seven species or species groups: (1) grouper imports, (2) snapper imports, (3) dolphin imports, (4) Gulf of Mexico (Gulf) red grouper, (5) Gulf "Other" groupers, (6) Gulf red snapper, and (7) Gulf and South Atlantic dolphin. Grouper imports are an obvious substitute for Gulf grouper. Snapper and dolphin were considered to be the other most likely substitutes for grouper and thus were also included in the analysis. Both of these species have significant imports and therefore imports and local harvest of both species were included.[32] Given its relatively large landings, Gulf red grouper were treated separately in the model, while other grouper species (black, warsaw, yellowedge, and gag) were aggregated.[33] The raw data indicates a large increase in prices, in general, among all species for both domestic and imported product. This strong increase likely reflects, at least in part, a recovering economy after a steep recession. Though there are no studies which examine the final outlet, the seafood products being considered in this study are likely largely consumed in the away-from-home market which is heavily influenced by the general state of the economy.[34]

The model results indicate there is little seasonality in the demand for either the imported products or the domestic products. There appears to be a small increase in demand, and thus a higher price for Gulf red snapper in February likely associated with Lent. Somewhat unexpectedly though, the demand for Gulf red grouper appears to be relatively low in February and March, possibly because of the higher demand for red snapper in February. In addition, there appears to be no seasonal changes in the demand for any of the imported products.

Consistent with Birkenbach et al's findings, Keithly's results indicate that the IFQ program did not appear to have influenced the ex-vessel prices of Gulf grouper species. This is not unexpected given that, unlike analyses in other catch share programs, the "race to fish" and related shortened seasons were not a reason for implementing the GT-IFQ program. Keithly expanded the analysis by including "habit formation" into the static model to determine if it produced different results.[35] However, the inclusion of habit formation did not affect the conclusion that the introduction of the GT-IFQ program has had no appreciable effect on ex-vessel prices for Gulf groupers.

On the other hand, monthly ex-vessel prices appear to have become more stable during the period after the GT-IFQ program was implemented. This can be seen by examining data for Gulf

[32] Commercial harvest of red snapper in the South Atlantic has been prohibited in recent years and thus was not included.

[33] TF were not included given their relatively small contribution to landings in the fishery, particularly in relation to domestic harvest and imports of groupers, snappers, and dolphin. Further, their price trends follow those for Gulf red grouper and other groupers.

[34] A recent analysis by Keithly and Wang (2017) suggests that more than a third of Gulf GT sales by dealers are directed to the restaurant trade.

[35] Habit formation is based on the idea that current consumption is based on past consumption.

red grouper. Specifically, average monthly red grouper harvests during the 2005-09 period ranged from a low of 191,000 pounds, or 4.2% of the annual landings, in March to 536,000, or 11.8% of the annual landings, in June. Further, ex-vessel price ranged from a low of $2.63 per pound (gutted weight) to $3.04 per pound with a rather definite negative relationship between average monthly landings and the ex-vessel price per pound. Further, during the five-year period after the introduction of the GT-IFQ program, the percentage of landings by month fell in a much more narrow range (i.e., from 6.1% in August to 10.5% in December) and the ex-vessel price also fell in a much more narrow range (i.e., from $3.25 per pound in February to $3.47 in April). To the extent that the GT-IFQ program caused monthly landings to be more stable, the program has also resulted in more stable ex-vessel prices.

6.5 Conclusions

Holland et al (2014) made several recommendations with respect to the collection of price data in IFQ programs. First, information on sale price and/or other compensation received should be collected on all arm's-length share and annual allocation transfers, and systems should be implemented to validate and correct the data. In addition to price information when applicable, other characteristics of transfers should be collected including: whether the transfer is internal to a company; whether there is in-kind compensation for the transfer and what that compensation is; and if there is some contractual form of compensation and what it is (e.g., a proportion of the landed value of the fish once it is sold). Second, information on ownership ties between different quota account owners should be collected so that arm's-length transactions can be differentiated from transfers between related business entities. Third, if dealers/processors provide annual allocation to fishermen, care should be taken to ensure that ex-vessel prices and annual allocation prices reported do not reflect discounts associated with an agreement to deliver fish to that processor/buyer. Fourth, share and annual allocation prices should be evaluated to determine whether they appear to reflect reasonable values and are useful for informing policymaking (i.e., care should be taken when calculating average prices to exclude transactions with prices that appear to be misreported or errors). Fifth, councils, stakeholders and fishery managers should be made aware of the potential value of catch share market information, particularly share and annual allocation prices, and Councils should be asked to consider making provision of annual allocation and share price information mandatory when transfers are made. Finally, to the extent sufficient non-confidential information about prices and volume of activity in quota markets is available, it should be made readily accessible to the public, preferably online and updated regularly. Information should be provided in as disaggregated a form as possible without compromising confidentiality of individuals' transactions (e.g., monthly rather than annual average prices and prices by Sector and/or area if applicable), and information should be as rich as possible (e.g., report median prices and measures of dispersion as well as averages (means)).

The findings of this review suggest that the Gulf GT-IFQ program has dealt with many of the issues addressed in these recommendations and followed the vast majority. In fact, the GT-IFQ and RS-IFQ programs most likely have some of the best annual allocation and share price data and thus among the most accurate price estimates in U.S. catch share programs. The annual reports for both programs play a major role in addressing the last two recommendations.

On the other hand, a few improvements could be made to better meet these recommendations. First, the Gulf of Mexico Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) could consider making the reporting of all price data mandatory, particularly for share and annual allocation transfers, such that provision of that data would be a condition of the transfer (i.e., transfers would not be processed unless and until the transfer price is provided by one of the transacting parties). At present, NMFS only has a sample of the price data for these transfers. Because this sample is not the result of a random sampling design, it is unclear whether the price estimates are biased as a result of response bias (i.e., prices are being reported, or not reported, for certain types of transactions and/or by certain types of entities). Second, estimates of share and annual allocation prices are only provided to the public in the annual reports. As these reports come out several months after the conclusion of the previous calendar year, they are not "real-time" estimates and thus may be somewhat outdated and of limited use to participants in the program when they become available. The feasibility of providing estimates on a more "real-time" basis has not been evaluated.

With respect to the goals and objectives of the program, although derby fishing has been eliminated, derby fishing was not a major issue for most species or species groups in the GT fishery prior to implementation of the IFQ program. Further, the findings above suggest that the GT-IFQ program has not led to a statistically significant increase in the ex-vessel prices of GT species. However, because landings are more evenly distributed over time within a year, ex-vessel prices have been more stable under the IFQ program relative to the years just prior to its implementation.

CHAPTER 7. CATCH AND SUSTAINABILITY

Section 303(a)(15) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires the Councils and National Marine Fisheries Service (NMFS) to establish mechanisms for specifying annual catch limits (ACLs), as well as accountability measures (AM) to ensure those ACLs are not exceeded, for most federally managed species in their fishery management plans (FMPs). ACLs must be set at a level that prevents overfishing from occurring. This section will review if the grouper-tilefish individual fishing quota (GT-IFQ) has helped to keep harvests/landings within the applicable limits, if the program is encouraging full utilization of the quota, and describe and analyze changes in the status of stocks within the GT-IFQ. The section will also review if changes in bycatch and discard mortality are consistent with National Standard 9.

Each share category has a commercial quota that may be adjusted annually or during the fishing year, based on stock assessments and other new information (**Table 7.1**). The GT-IFQ program tracks landings in pounds of gutted weight (gw) and landings are reported in this report as such. Some share categories had in-season quota increases within a year. In-season increases occurred as early as January and as late as November. The quotas have generally increased for deepwater grouper (DWG), tilefish (TF), and shallow water grouper (SWG). Both red grouper (RG) and gag grouper (GG) quotas decreased in 2011, followed by gradual increases each year thereafter

Table 7.1. GT-IFQ commercial quotas.

DWG	Jan 1	Quota Increase	Increase Date	Dec 31
2009[1]	1,020,000			1,020,000
2010	1,020,000			1,020,000
2011	1,020,000			1,020,000
2012	1,020,000	107,000	1/30	1,127,000
2013	1,118,000			1,118,000
2014	1,110,000			1,110,000

GG	Jan 1	Quota Increase	Increase Date	Dec 31
2009[1]	1,320,000[2]			1,320,000
2010	1,410,000			1,410,000
2011	100,000	330,000	6/1	430,000
2012	430,000	137,000	3/12	567,000
2013	708,000			708,000
2014	835,000			835,000

RG	Jan 1	Quota Increase	Increase Date	Dec 31
2009[1]	5,750,000[2]			5,750,000
2010	5,750,000			5,750,000
2011	4,320,000	910,000	11/2	5,230,000
2012	5,370,000			5,370,000
2013	5,530,000			5,530,000
2014	5,630,000			5,630,000

SWG	Jan 1	Quota Increase	Increase Date	Dec 31
2009[1]	410,000[2]			410,000
2010	410,000			410,000
2011	410,000			410,000
2012	410,000	99,000	1/30	509,000
2013	518,000			518,000
2014	523,000			523,000

TF	Jan 1	Quota Increase	Increase Date	Dec 31
2009[1]	440,000			440,000
2010	440,000			440,000
2011	440,000			440,000
2012	440,000	142,000	1/30	582,000
2013	582,000			582,000
2014	582,000			582,000

[1] Indicates the quota in the year prior to the GT-IFQ program.

[2] The total shallow-water grouper quota in 2009 (7.48 mp gw) was an aggregate of the other shallow-water species, red grouper, and gag. Within this aggregated red grouper had a quota of 5.75 mp gw and gag had a quota of 1.32 mp gw. The remained of the total shallow-water grouper quota (0.410 mp gw) is listed as the other shallow water grouper quota (SWG).

The GT-IFQ program has several built-in flexibility measures to accommodate the multi-species nature of the commercial reef fish fishery and to reduce bycatch. Two share categories, GG and RG, have a multi-use provision that allows a portion of the red grouper quota to be harvested under the gag allocation, or vice versa. The three remaining categories (SWG, DWG, and TF) are multiple-species categories designed to capture species complexes that are commonly caught together (Table 1). Three grouper species (scamp, warsaw grouper, and speckled hind) are found in both the shallow and deep-water complexes. Flexibility measures in the GT-IFQ program allow these species to be landed under both share categories. Scamp are designated as a SWG species, but may be landed using DWG allocation once all SWG allocation in an account has been harvested. Warsaw grouper and speckled hind are designated as DWG species and may be landed using SWG allocation after all DWG allocation in an account has been harvested. The GT-IFQ program has a built-in 10% overage measure to allow a once-per-year allocation overage per share category for any GT-IFQ account that holds shares in that share category. For shareholder accounts with shares, a vessel can land 10% more than their remaining allocation on the vessel once during the year. NMFS deducts this overage from the shareholder's allocation in the following fishing year. Because overages need to be deducted in the following year, GT-IFQ accounts without shares cannot land an excess of their remaining allocation in that share category and GT-IFQ accounts with shares are prohibited from selling shares that would reduce the account's shares to less than the amount needed to repay the overage in the following year.

A portion of the gag or red grouper allocation may be reserved each year for multi-use allocation, which may be used to land either gag or red grouper. The multi-use provision is to ensure that there may be allocation to use if either gag or red grouper are landed as incidental catch. The percentage of multi-use may change each year and may even be zero (**Table 7.2**). Since 2013, the red grouper multi-use (RGM) and gag multi-use (GGM) allocation was based on formulas (see below) utilizing the commercial quota and the annual catch limits for gag and red grouper. If either stock is under a rebuilding plan, the percentage of the other species multi-use allocation will equal zero. Multi-use allocation cannot be used until all the species-specific allocation has been landed or transferred, including allocation in shareholder and all associated vessel(s) accounts. For example, gag may not be landed under GGM or RGM unless there is no GG allocation remaining in the shareholder and associated vessel(s) accounts. Similarly, multi-use allocation may only be transferred after landing or transferring all the corresponding species-specific allocation in the shareholder and associated vessel(s) accounts. There was no RGM allocation from 2011-2014 because gag was under a rebuilding plan.

Table 7.2. Red grouper and gag multi-use allocations.

Year	GGM	RGM
2010	8%	4%
2011	8%	NA
2012	8%	NA
2013	70%	NA
2014	47%	NA

$$RGM\ allocation = 100 * \frac{(Gag\ ACL - Gag\ Commercial\ Quota)}{Red\ Grouper\ Commercial\ Quota}$$

$$GGM\ allocation = 100 * \frac{(Red\ Grouper\ ACL - Red\ Grouper\ Commercial\ Quota)}{Gag\ Commercial\ Quota}$$

7.1 Landings

The percentage of the quota landed varies yearly for each share category (**Table 7.1.1**). The first year of the program, which also coincided with the Deepwater Horizon oil spill, had only 49% of the program's entire quota landed. This was due mostly to closures of fishing areas throughout the Gulf of Mexico (Gulf) and perception of Gulf seafood. Excluding SWG, the percentage of quota landed for the share categories from 2011-2014 were between 74-98%. The overall pounds of fish landed by share category has increased since the start of the program.

Table 7.1.1. GT-IFQ annual landings (pounds [gw] and percentage of quota).

	2010	2011	2012	2013	2014
DWG	624,762 (61%)	779,519 (76%)	963,835 (86%)	912,923 (82%)	1,048,142 (94%)
GG	493,938 (35%)	320,137 (74%)	525,066 (93%)	579,664 (82%)	689,528 (83%)
RG	2,913,858 (51%)	4,782,194 (91%)	5,217,205 (97%)	4,594,672 (83%)	5,498,754 (98%)
SWG	158,234 (30%)	186,235 (45%)	300,367 (59%)	307,846 (59%)	263,251 (50%)
TF	249,708 (57%)	386,134 (88%)	451,121 (78%)	440,091 (76%)	517,268 (89%)
ALL	4,440,500 (49%)	6,454,219 (86%)	7,457,594 (91%)	6,835,196 (81%)	8,016,943 (92%)

Three of the share categories (DWG, SWG, and TF) contain multiple species. One species within each of these categories comprises the majority of the landings for that share category (**Figure 7.1.1**). Landings may be strongly influenced by social and economic factors such as, share price, allocation price, allocation availability, market desirability, and ex-vessel price for these species within the IFQ program. All the species in a category use the same shares and allocation, although landings and ex-vessel prices may differ among these species. Differences in ex-vessel price among species within the same share category may influence the fishing behavior as fishermen target species that receive a higher ex-vessel price. While this may occur in non-catch share fisheries, this behavior may be magnified due to the allocation costs and availability. If a fishermen has limited allocation available, they may change effort to harvest the fish with a higher ex-vessel value to maximize their economic benefits.

The DWG share category contains four species: snowy grouper, speckled hind, warsaw grouper, and yellowedge grouper. During the program, yellowedge grouper accounted for 69-73% of the DWG landings, followed by snowy grouper which accounted for 12-17% of the landings (**Table 7.1.2, Figure 7.1.1**). Both warsaw grouper and speckled hind landings were typically between 3-11% each year.

The SWG share category contains four species: black grouper, scamp, yellowfin grouper, and yellowmouth grouper. During the program, scamp accounted for 73-87% of the SWG landings,

followed by black grouper with 12-26 % of the landings, while yellowfin grouper and yellowmouth grouper are each less than 1% of the landings (**Table 7.1.2, Figure 7.1.1**). The landings of species within SWG have changed with the start of the GT-IFQ program, with an increased proportion of scamp landings and decreased proportion of black grouper and yellowfin grouper landings. Yellowfin grouper landings pre-IFQ consisted of 2% of the SWG landings but decreased to less than 1% during the GT-IFQ years. Black grouper landings pre-IFQ consisted of 36% of the SWG landings, but decreased at the start of the GT-IFQ program to 12%.

The TF share category contains three species: golden tilefish, blueline tilefish, and goldface tilefish. During the program golden tilefish accounted for 81-88% of the TF landings, followed by blueline tilefish with 9-18%, and goldface tilefish with less than 1% to 7% (**Table 7.1.2, Figure 7.1.1**). The landings of species within TF have changed with the start of the GT-IFQ program, with a decrease in the proportion of blueline tilefish over time and subsequent increase in golden tilefish landings. Prior to the GT-IFQ program, blueline tilefish composed 26% of the TF landings, but this dropped to 9% at the start of the program. Since the start of the program, blueline tilefish have not comprised more than 18% of the TF landings. In contrast, golden tilefish pre-IFQ comprised 74% of the TF landings, but increased to 84% in the first year of the GT-IFQ program.

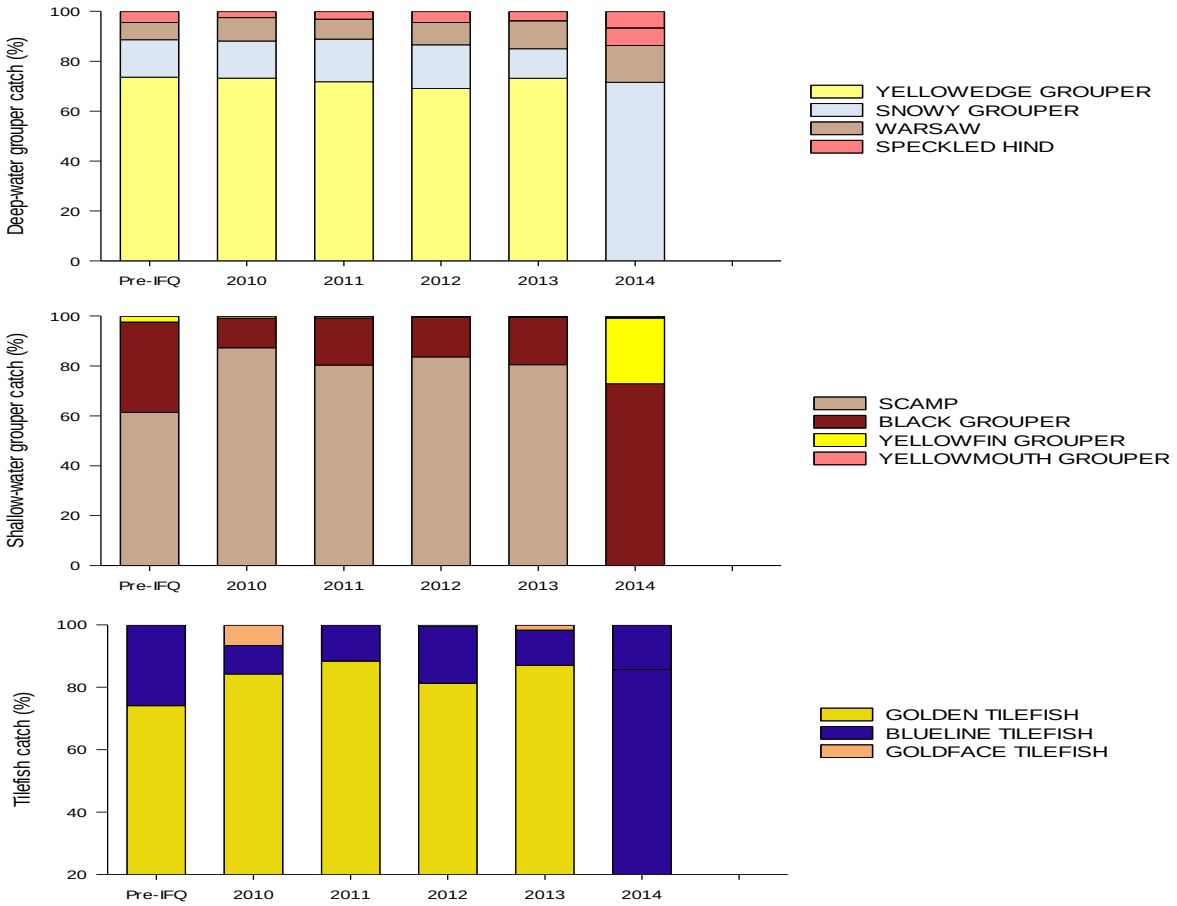

Figure 7.1.1. Species landings within share categories.

Table 7.1.2. Landing by species.

	Species	Pre-IFQ[1]	2010	2011	2012	2013	2014
DWG	Snowy grouper	161,175	90,180	132,971	168,759	108,689	159,857
	Speckled hind	47,913	15,359	24,925	43,344	34,922	72,241
	Warsaw grouper	74,476	56,496	61,661	86,212	103,074	75,426
	Yellowedge grouper	792,055	443,887	558,908	667,785	673,349	773,621
GG	Gag	952,555	496,826	318,663	523,138	575,335	586,377
RG	Red grouper	3,910,083	2,910,970	4,783,668	5,219,133	4,599,001	5,601,905
SWG	Black grouper	156,778	20,905	34,970	47,537	56,750	60,555
	Scamp	266,193	153,533	149,286	249,320	242,170	167,840
	Yellowfin grouper	10,122	1,394	945	739	856	568
	Yellowmouth grouper	466	85	548	506	959	1,285
TF	Blueline tilefish	123,072	22,555	44,841	82,025	49,454	74,221
	Golden tilefish	352,080	169,031	311,848	356,846	381,947	436,921
	Goldface tilefish[2]	NA	57,169	29,445	12,250	8,690	6,126

In 2010, the only year to have both red grouper and gag multi-use, the RGM category was mostly used to land red grouper (73%). Likewise, the GGM was mainly used to land gag (72%). In the following years, the only use multi-use category was GGM. In the GGM category, gag accounted for the majority of the landings (65-99%). In 2014, the percentage of red grouper in the GGM category increased to 35%, considerably greater than in past years.

Table 7.1.3. Multi-use landings.

	RGM		GGM	
Year	**Red Grouper**	**Gag**	**Red Grouper**	**Gag**
2010	73% (13,833 lb)	27% (5,091 lb)	28% (2,203 lb)	72% (5,654 lb)
2011	NA	NA	14% (1,474 lb)	86% (8,700 lb)
2012	NA	NA	6% (1,928 lb)	94% (32,230 lb)
2013	NA	NA	1% (4,329 lb)	99% (376,528 lb)
2014	NA	NA	35% (103,151 lb)	65% (188,950 lb)

At the end of each year on December 31, any remaining allocation in an account expires. For the program as a whole, the amount of allocation remaining has decreased over time as have the number of accounts that held the unused allocation. The majority of the unused allocation resided in accounts that were active; that is, accounts that had either allocation transfers in or out of the account and/or landings. Similar trends were seen in most share categories, with the overall amount of unused allocation decreasing over time and the bulk of the unused quota from active accounts. The one exception is SWG, which had a consistent amount of unused allocation (41-61% of the quota) remaining each year.

Table 7.1.4. Remaining allocation (2010-2014).

DWG	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	395,615	390	39	64,601	169
2011	240,703	283	24	15,731	140
2012	163,126	235	14	11,177	103
2013	205,088	253	18	14,192	115
2014	62,405	195	6	5,406	103

GG	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	916,034	706	65	114,277	257
2011	109,780	531	26	17,991	259
2012	41,981	425	7	11,808	221
2013	128,169	467	18	21,471	217
2014	145,486	418	17	17,536	196

RG	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	2,835,405	666	49	343,665	235
2011	448,926	501	9	64,216	184
2012	152,249	356	3	38,159	167
2013	935,526	441	17	62,605	171
2014	132,651	317	2	46,907	153

SWG	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	251,503	630	61	33,961	277
2011	223,743	513	55	22,514	261
2012	208,450	441	41	22,711	220
2013	210,129	493	41	20,999	233
2014	259,689	461	50	20,948	208

TF	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	190,857	219	43	59,798	101
2011	53,920	142	12	5,343	77
2012	130,903	130	22	5,951	59
2013	141,968	148	24	11,614	70
2014	64,855	113	11	2,380	54

ALL	Lb	Acct	% quota	Inact. lb	Inact. Acct
2010	4,589,414	750	51	453,584	245
2011	1,077,088	667	14	96,463	260
2012	696,709	596	9	75,785	254
2013	1,620,880	608	19	110,513	244
2014	665,086	561	8	85,800	232

7.2 Discards

Dead discards can significantly contribute to the overexploitation of stocks and thereby reduce sustainable yield. Prior to implementation of the GT-IFQ program, discards were primarily due to size limits, trip limits, and seasonal closures. Five species in the GT-IFQ program have minimum size limits: gag, red grouper, black grouper, scamp, and yellowfin grouper. After the implementation of the GT-IFQ program, trip limits and seasonal closures were eliminated except for the restriction of longline gear inside the 35-fathom contour from June through August in the eastern Gulf. However, fishers are now constrained by the GT-IFQ allocation they possess. Fishers without large amounts of shares or allocation must discard GT-IFQ species when the allocation in their account is exhausted or obtain additional allocation from other allocation holders to continue to harvest GT-IFQ species. The GT-IFQ program's built-in multi-use

provisions and flexibility measures were intended to reduce discards and discard mortality. Despite these measures, discards may still occur due to minimum size limits, high-grading for a species, or grading among a species group (share category). High-grading refers to selective harvesting by fishers for a species usually influenced by price differences based on fish size, i.e., increased discards of less valuable fish sizes. High-grading among a species group is often due to price differentials between species in multi-species GT-IFQ categories, e.g., retaining more valuable species and discarding less valuable ones. Data from recent stock assessments through the Southeast Data Assessment and Review (SEDAR) process, the Southeast Fisheries Science Center's (SEFSC) Reef Fish Observer Program (RFOP), and the Supplemental Discard Logbook (self-reported discard information) were used to evaluate changes in discards associated with the GT-IFQ program.

The SEDAR process is a cooperative effort to improve the quality and reliability of fishery stock assessments for providing the best available science. Species are selected by a steering committee based on short-term and long-term assessment priorities. The mandatory RFOP began in mid-2006, and the data for these analyses included longline (LL) and vertical line gear (VL; primarily handlines and bandit reels, but also includes buoy and spearfishing effort). For the RFOP, vessels were randomly selected quarterly each year to carry an observer (NMFS 2016). Sampling effort was stratified by season and gear in the eastern and western Gulf based on annually updated vessel logbook data (Scott-Denton et al. 2011). Beginning in February 2009, increased observer coverage levels were directed at the bottom longline fishery in the eastern Gulf due to concerns regarding sea turtle interactions. Additionally, in 2011, increased funding allowed enhanced coverage of both the vertical line and bottom longline fisheries through 2014. RFOP observer coverage levels were not consistent throughout the years (< 1 to ~5% by sea day). Despite these variations in coverage levels, RFOP data (accessed May 2017) are believed to be representative of the fishery. The Supplemental Discard Logbook database (accessed May 2017) contains self-reported discard reports from a 20% sub-sample (by region and gear fished) of all commercial vessels with federal fishing permits (SEFSC 2016).

Red Grouper

Discard estimates for red grouper from SEDAR 42 (2015) were only available from 1993 to 2013 and the assessment noted that discards were not consistent across fleets. Discards were stratified by gear and region. SEDAR 42 used the ratio of observer reported red grouper discard to kept rate multiplied by the landings to estimate total discards. Red grouper discards across all years and gears, decreased post GT-IFQ (**Table 7.2.1**). Pre-GT-IFQ the number of red grouper discards from LL trips was considerably greater than from VL trips (**Table 7.2.1**). In 2010, the discards from LL trips were less than VL trips, but this may have been influenced by the emergency longline closure intended to protect sea turtles and the Deepwater Horizon (DWH) oil spill, thus not typical of the fishery. Since the start of the GT-IFQ program, the estimated number of red grouper discards from VL gear has been decreasing. Similarly, the LL fishery had much lower estimates of discards in the terminal year of 2013 compared to the rest of the time series. Data from the RFOP was used to calculate the discard ratio (number discarded: one landed) stratified by year, gear, and region (**Table 7.2.2**). A larger value indicates that more fish are being discarded. The RFOP discard ratios have the same trend as SEDAR 42 with lower red grouper discards observed in the most recent years of the GT-IFQ program.

In May 2009, the commercial minimum size limit for red grouper was reduced from 20 to 18 inches total length (TL) to reduce discards (GMFMC 2008). Based on length data collected by the RFOP, the current size limit is likely the principle reason discards are occurring post-GT-IFQ, although some discarding may be due to lack of allocation. Most of the legal sized red grouper discarded were between 18 and 20 inches TL. The discards in that size range may be due to anecdotal evidence from fishers that fish will shrink once placed on ice, thus only fish typically greater than the size limit by a specific margin will be retained, e.g. only fish greater than 19 in TL being retained. In addition to the number of self-reported discards per trip, the discard logbook attempts to quantify the reason why discarding occurs using four categories: 1) not legal size, 2) other regulation, 3) market conditions, and 4) out of season. Using these categories, the discard logbook reported greater than 94% of the self-reported discards of red grouper were due to the legal size limit from 2010-2014 (**Table 7.2.3**). This differs from the pre-IFQ period from 2005-2009 in which other regulations (~71%) was the most common discard reason selected.

Table 7.2.1. Red grouper commercial discards (thousands of fish) by gear from 1990-2013. Shading in gray denotes years prior to the GT-IFQ program.

Year	VL	LL	Trap	Total Commercial
1990			69.050	69.050
1991			131.400	131.400
1992			87.500	87.500
1993	510.274	3188.763	169.870	3868.907
1994	487.564	2024.416	53.900	2565.880
1995	459.256	1885.655	124.730	2469.641
1996	338.619	2308.812	732.740	3380.171
1997	370.695	2336.638	598.570	3305.903
1998	290.808	2053.713	50.190	2394.710
1999	474.742	2926.611	106.190	3507.543
2000	674.094	2186.000	234.980	3095.074
2001	728.260	2479.017	167.620	3374.898
2002	853.126	2296.999	146.060	3296.185
2003	549.732	2194.268	134.700	2878.700
2004	709.340	2497.772	81.900	3289.012
2005	829.348	2359.919	122.090	3311.357
2006	612.745	2216.679	139.270	2968.695
2007	553.145	1511.243		2064.388
2008	975.072	1275.026		2250.098
2009	1289.459	793.207		2082.665
2010	994.088	616.223		1610.311
2011	593.650	1408.009		2001.659
2012	599.240	1133.235		1732.476
2013	405.278	840.290		1245.567

Source: SEDAR 42 (2015)

Table 7.2.2. The discard ratio (number discarded: one landed) for red and gag grouper by gear and region. Shading in gray denotes years prior to the GT-IFQ program.

Red Grouper	VL	LL	FL Peninsula	Other Gulf	Gag Grouper	VL	LL	FL Peninsula	Other Gulf
2007	0.75	1.45	1.07	0.63	2007	0.63	0.03	0.51	0.22
2008	0.81	1.17	0.95	0.38	2008	0.34	0.00[1]	0.49	0.10
2009	0.83	1.15	1.06	1.12	2009	1.45	0.08	0.86	0.28
2007-09 Average	0.80	1.26	1.03	0.71	2007-09 Average	0.81	0.04	0.62	0.20
2010	0.93	1.18	1.09	0.64	2010	1.45	0.04	0.61	0.10
2011	0.64	0.89	0.86	0.40	2011	1.13	2.16	1.67	1.05
2012	0.44	0.88	0.64	0.13	2012	0.47	0.44	0.62	0.12
2013	0.42	0.50	0.52	0.09	2013	0.23	0.52	0.49	0.14
2014	0.25	0.55	0.49	0.02	2014	0.15	0.05	0.13	0.03
2010-14 Average	0.54	0.80	0.72	0.26	2010-14 Average	0.69	0.64	0.70	0.29

[1] Indicates that all fish were landed and no fish were discarded.
Source: SEFSC RFOP (2017)

Table 7.2.3. The number of discards and percentage for each discard reason out of the total number of each species reported to the Supplemental Discard Logbook.

2010-2014	Number Reported	Not Legal Size	Other Regulations	Market Conditions	Out of Season
Red Grouper	341,822	94.2%	4.8%	0.8%	0.1%
Gag Grouper	33,582	51.8%	44.6%	1.4%	2.3%
Longline	5,695	15.9%	77.1%	3.5%	3.6%
Other Gear	27,887	59.1%	37.9%	0.9%	2.0%
Shallow-water Grouper					
Scamp	2,960	53.1%	45.9%	0.6%	0.4%
Black Grouper	1,488	40.0%	53.9%	0.3%	5.9%
Deep-water Grouper					
Yellowedge Grouper	871	45.5%	13.2%	41.3%	0.0%
Snowy Grouper	501	67.1%	13.0%	20.0%	0.0%
Speckled Hind	230	16.1%	53.9%	29.1%	0.9%
Warsaw Grouper	14	14.3%	78.6%	7.1%	0.0%
Tilefishes					
Golden Tilefish	2,386	45.1%	22.0%	33.0%	0.0%
Blueline Tilefish	8,250	0.0%	21.7%	77.9%	0.4%

2005-2009	Number Reported	Not Legal Size	Other Regulations	Market Conditions	Out of Season
Red Grouper	221,504	28.6%	70.9%	0.1%	0.4%
Gag Grouper	30,632	45.4%	53.9%	0.2%	0.5%
Longline	303	48.5%	51.2%	0.3%	0.0%
Other Gear	30,329	45.3%	53.9%	0.2%	0.6%
Shallow-water Grouper					
Scamp	2,100	30.9%	67.7%	1.4%	0.0%
Black Grouper	4,664	44.3%	54.1%	0.2%	1.5%
Yellowfin Grouper	108	0.0%	100.0%	0.0%	0.0%
Deep-water Grouper					
Yellowedge Grouper	1,560	1.2%	55.8%	0.5%	42.5%
Snowy Grouper	892	2.5%	54.5%	0.6%	42.5%
Speckled Hind	169	2.4%	84.6%	0.0%	13.0%
Warsaw Grouper	839	1.1%	44.9%	0.0%	54.0%
Tilefishes					
Golden Tilefish	4,490	0.0%	11.3%	5.6%	83.1%
Blueline Tilefish	2,613	0.0%	42.2%	0.2%	57.6%

Source: SEFSC Supplemental Discard Logbook (2017)

Gag Grouper

Discard estimates for gag grouper from the SEDAR 33 Update (2016) included information through 2014 (**Table 7.2.4**). The SEDAR 33 Update annual discards were calculated using the ratio of discard to kept rates multiplied by the landings. Total gag discards under the GT-IFQ program have been much lower years before the program was established. Since the inception of the GT-IFQ program, vertical line gag discards have declined from 59,162 fish in 2010 to less than 14,000 by 2014. The longline gag discards were very low (less than 500 fish) between 2007 and 2010, but peaked at 6,202 fish in 2011, and have declined since. The increase in discards in 2011 was likely due to a substantial decrease in the quota of 430,000 pounds in 2011 from 1,410,000 pounds in 2010. Following 2011, the gag grouper quota was increased annually back up to 835,000 pounds in 2014. The RFOP discard ratios have the same trend as the SEDAR 33 Update with higher estimated gag discards observed with reduced quotas (primarily 2011), but since then estimated discards have gradually decreased (**Table 7.2.2**).

In 1999, prior to the GT-IFQ program, gag had a commercial minimum size limit of 24 inches TL. In March 2012, the minimum size limit was reduced to 22 inches TL to reduce discard mortality (GMFMC 2011). Based on length and discard disposition data collected by the RFOP, the size limit is likely the principle reason discards are occurring for vessels using VL gear. A small number of discards were above the size limit in 2011 and 2012 when the quota was reduced. In 2013, the quota increased to 708,000 lb gw and discards above the minimum size

limit were infrequent. For LL gear, discards were primarily above the minimum size limit and therefore most likely due to lack of allocation. There was no dominant discard reason selected in the discard logbook. Instead the legal size limit (~52%) and other regulations (~45%) discard reasons were nearly equally selected from 2010-2014 (**Table 7.2.3**). When the gag discard reason is broken down by gear type the legal size limit was the most common reason for VL (~59%) compared to LL in which was other regulations was chosen >77% of the time and the size limit was reason only ~16% of the time. It is likely the other regulation selected in the discard logbook refers to limited allocation available to fishers, especially during years with reduced quotas. The pre-IFQ discards reasons for gag stratified by gear were nearly identical to each other.

Table 7.2.4. Gag grouper commercial discards (thousands of fish) by gear from 1990-2014. Shading in gray denotes years prior to the GT-IFQ program.

Year	VL	LL	Total Commercial
1990		5.278	5.278
1991		9.366	9.366
1992		5.782	5.782
1993	100.590	4.910	105.500
1994	90.412	6.137	96.549
1995	91.162	5.157	96.319
1996	86.744	5.524	92.268
1997	86.427	6.443	92.870
1998	145.092	6.065	151.157
1999	115.200	7.048	122.248
2000	125.405	7.911	133.316
2001	162.047	8.126	170.173
2002	148.333	7.142	155.475
2003	113.678	7.672	121.350
2004	136.922	7.610	144.532
2005	121.254	5.612	126.866
2006	62.723	6.710	69.433
2007	56.755	0.526	57.281
2008	92.543	0.000	92.543
2009	106.361	0.592	106.953
2010	59.162	0.259	59.421
2011	32.189	6.202	38.391
2012	27.802	4.029	31.831
2013	13.939	4.049	17.988
2014	13.560	0.365	13.925

Source: SEDAR 33 Update (2016)

Shallow-Water Grouper

No recent assessment information was available for estimating total discards for any shallow-water grouper species post-2010. The only discard information available for the other shallow-water groupers comes from the RFOB and Supplemental Discard Logbook datasets. Black grouper and yellowfin groupers had a minimum size limit of 20 inches TL prior to and in the first few years of the GT-IFQ program. In 2012, the minimum size limit for black grouper increased to 24 inches TL, and scamp had a 16 inch TL minimum size limit. The disposition by species is reflected in data collected by the RFOP from 2010-2014 (**Table 7.2.5**). For all four species, greater than 90% were kept and for two species (yellowfin and yellowmouth grouper) no discards were observed. Commercial fishers cited both the minimum size limit and other regulations as the most common reason discarding occurs for scamp and black grouper (**Table 7.2.3**). It is unknown if the other regulation refers to limited allocation available, but that does not seem likely since greater than 40% of the shallow-water grouper quota was unharvested annually from 2010-2014 (SERO 2016), thus allocation should have been available to fishers. If the species were discarded due to lack of allocation, this may imply a lack of knowledge on how to contact participants with allocation available and not due to the cost of allocation, which is less than $1.50/lb.

Table 7.2.5. The number of captures and percentage for each disposition observed by the RFOP from 2010-14 for GT-IFQ species.

	Number Observed	Kept	Discarded	Unknown
Red Grouper	350,400	59.0%	41.0%	0.0%
Gag Grouper	14,001	64.3%	35.7%	0.0%
Shallow-water Grouper				
Scamp	10,121	94.4%	5.5%	0.1%
Black Grouper	311	90.0%	10.0%	0.0%
Yellowmouth Grouper	24	100.0%	0.0%	0.0%
Yellowfin Grouper	3	100.0%	0.0%	0.0%
Deep-water Grouper				
Yellowedge Grouper	19,802	98.8%	1.2%	0.0%
Snowy Grouper	4,068	97.8%	2.2%	0.0%
Speckled Hind	1,608	68.8%	31.2%	0.0%
Warsaw Grouper	186	96.8%	3.2%	0.0%
Tilefishes				
Golden Tilefish	22,541	81.4%	18.6%	0.0%
Blueline Tilefish	7,256	56.4%	43.6%	0.0%
GoldfaceTilefish	71	35.2%	64.8%	0.0%

Source: SEFSC RFOP (2017)

Deep-Water Grouper

There is currently no commercial minimum size limit for any of the deep-water grouper species, but fishers self-reported the minimum size limit as the discard reason for 67% and 45% of the snowy and yellowedge grouper discarded, respectively (**Table 7.2.3**). Yellowedge grouper have not been assessed since 2010, but snowy grouper and speckled hind were two of the data-limited species included in SEDAR 49. Discards for both species were calculated similar to red grouper using the ratio of observer reported discard to kept rate multiplied by the landings to estimate total discards. Snowy discards in the years immediately preceding the GT-IFQ program were low, and this was most likely due to the short seasons and seasonal closures (**Table 7.2.6**). In 2010, there was a peak in snowy discards by vessels using either VL or LL. These high discards can be due to the start of GT-IFQ program and/or the DWH oil spill event. LL snowy discards were considerably lower in the later GT-IFQ years than discards from 2000-2006, while VL snowy discards were more similar to discards in 2005-2006. Speckled hind discards were similar to snowy grouper's with very few discards in the years immediately prior to the GT-IFQ, and a spike in discards during the first year of the program. Discards from vessels with LL gear were initially lower in the IFQ years than previously, but increased considerably in 2014. Speckled hind discards from VL trips initially increased after the IFQ program began, but by 2014 were similar to pre-IFQ years (1997-2006). According to RFOP data, very little discarding is occurring for yellowedge, snowy, and warsaw grouper from 2010-2014 with greater than 96% of captures being retained (**Table 7.2.5**). Fishery observers did record a much higher percentage (greater than 30%) of speckled hind being discarded. Fishers reported other regulations (54%) and market conditions (29%) as the two most common reasons speckled hind were discarded from 2010-2014. For the pre-IFQ period, out of season was selected a much higher percent of the time for the discard reason all deep-water grouper species

Table 7.2.6. Snowy grouper and speckled hind total discards (pounds whole weight) calculated using reef fish and shark bottom LL observer data. Discards calculated using reef fish VL observer data also provided. Shading in gray denotes years prior to the GT-IFQ program.

Year	Snowy grouper LL discards	Snowy grouper VL discards	Speckled hind LL Discards	Speckled hind VL discards
1997	4,713	832	12,348	3,837
1998	3,111	856	10,265	2,403
1999	3,405	868	11,258	3,162
2000	7,904	755	16,520	2,818
2001	6,934	1,031	16,718	3,760
2002	4,861	841	12,675	2,414
2003	6,834	2,192	20,415	5,034
2004	5,084	3,641	24,978	3,772
2005	4,184	1,539	23,112	3,018

2006	5,227	1,576	16,737	6,752
2007	26	145	166	880
2008	1,290	0	0	643
2009	6,711	0	1,167	2
2010	8,192	10,322	7,380	12,981
2011	3,379	148	8,349	1,439
2012	470	1,463	4,270	5,069
2013	1,949	1,453	13,278	7,094
2014	862	1,837	21,862	4,052
Total	92,108	31,701	221,499	69,129

Source: SEDAR 49 (2016)

Tilefishes

Golden tilefish have not been assessed since 2010, but overall estimated discards were available through 2014 for blueline tilefish from a joint assessment currently underway (SEDAR 50 2017). Blueline tilefish discard calculations were similar to red grouper using the discard to kept rate multiplied by the landings to estimate total discards. The amount of blueline tilefish discarded from LL trips decreased considerably at the start of the GT-IFQ program, and was slightly greater for VL trips (**Table 7.2.7**). Since the start of the GT-IFQ program, the estimated discards have generally been increasing for both gear types. Discards for VL trips are greater than previous years, while discards for LL trips are similar to pre-GT-IFQ years (2000-2007). This is similar to the overall RFOP data that recorded greater than 40% of blueline tilefish were discarded (**Table 7.2.5**).

RFOB data recorded 19% of the observed golden tilefish as discards. There is currently no commercial minimum size limit for golden tilefish, but fishers self-reported the minimum size limit as the most common discard reason (45%) followed by market conditions (**Table 7.2.3**). Length data collected by the RFOP confirms smaller fish were discarded at a higher rate with greater than 50% of golden tilefish under 25 inches TL being discarded in some years. Price data collected from 2012-2016 for golden tilefish in the mid-Atlantic revealed higher prices for larger size categories (MAFMC 2017). The small category for golden tilefish averaged $2.77 per pound compared to $4.23 per pound for the large category. Similar dynamics may be present in the Gulf of Mexico (Gulf) causing the increased discards of smaller golden tilefish due to price differentials. For blueline tilefish, other factors may be influencing discarding since fishers self-reported market conditions as the discard reason 78% of the time (**Table 7.2.3**). Additionally, no patterns in discards were present in size frequency distribution observed by the RFOP for blueline tilefish indicating size selection. Anecdotal evidence from fishers suggests multi-species quota discarding may be occurring since the ex-vessel price for golden tilefish is nearly twice the price for blueline tilefish (SERO 2016). Thus, fishers are choosing to use their allocation on the higher valued of the species in the same GT-IFQ category. For the pre-IFQ

period, out of season was selected as the most common discard reason for both golden and blueline tilefish.

Table 7.2.7. Blueline tilefish discards and kept discards (bait) in numbers of fish from the US Gulf of Mexico commercial fishery. Shading in gray denotes years prior to the GT-IFQ program.

Year	Bottom LL discards	Bottom LL kept for bait	VL discards	VL kept for bait
2000	7,014	10,321	0	0
2001	3,943	5,801	0	0
2002	3,440	5,061	0	0
2003	5,872	8,641	0	0
2004	8,094	11,910	0	0
2005	5,129	7,548	0	0
2006	8,989	13,227	0	0
2007	9,494	13,907	347	0
2008	22,301	14,351	665	0
2009	6,346	9,033	205	0
2010	2,800	246	868	245
2011	4,392	1,020	678	202
2012	8,047	1,942	2,100	500
2013	4,971	1,234	2,872	930
2014	8,854	2,441	2,980	990
2015	5,783	2,786	1,827	539

Source: SEDAR 50 (2017)

Singh and Weninger (2018) analyze whether the flexibility (multi-use) provisions written into the GT-IFQ program were effective in meeting the stated goals of reducing bycatch mortality and discards in the GT component of the Gulf reef fish fishery. The study is primarily a theoretical investigation of the effectiveness of quota balancing mechanisms (i.e. flexibility measures) in general with an empirical assessment of the multi-use provisions associated with the GT-IFQ program in particular.

The GT IFQ is defined by five categories with a cross species flexibility (CSF) multi-use provision. Singh and Weninger (2018) found no evidence that CSF provisions associated with the GT-IFQ directly reduced GT discards. According to the theoretical work of this study, CSF on the other hand invites fishermen to target and land higher-profit species against their flexible quota holdings. The analysis shows that harvest choices are impacted in complex ways by a flexibility provision; harvests, landings and discards vary with prices, stock conditions, the structure of the multi-species technology and the extent of flexibility allowed.

The results highlight the main shortcoming of a CSF provision. Allowing fishermen flexibility to harvest their preferred mix of species constrains the regulators ability to control aggregate harvest and discard outcomes under decentralized management. CSF limits the ability of the regulator to steer the multi-species stock along a path that maximizes long-term fishery value. A balance must be struck between the discard-reducing benefits of a CSF provision and the long-term rent losses due to reduced control over stock abundance and growth.

Empirical evidence suggests that commercial reef fish fishermen participating in the GT-IFQ program adjusted harvesting operations to manage the mix of species that are harvested with their gear. The analysis finds that prior to the GT-IFQ discarding was prevalent under the command and control regulation which limited, severely for some vessels, the quantity of individual species that could be legally landed on each trip. Discarding dropped significantly under quota regulations. The role of CSF provision in the decline in discards could not be fully determined. Analysis of raw data, and trip-level analysis of discard events found no evidence that CSF played an important role in reducing over-quota discards. Calibration of their costly targeting model finds that the discards that did persist in the Gulf reef fish fishery were likely caused by regulations that set skewed annual landings limits for key reef fish species. Regulators who sought to rebuild gag stocks were wise to limit CSF in a way that limited additional gag grouper harvests and landings; their analysis suggests such flexibility, if offered, would have been directed at vulnerable gag grouper stocks. It is crucial to view these empirical results with the knowledge that the discard data are self-reported. There is evidence that fishermen, to some extent, may report "zero" discards to just fulfill the mandatory reporting requirement.

A broader policy message that is strongly supported by their empirical results is that harvest/cost complementarity must be considered when setting annual total allowable catch limits in multiple-species fisheries, particularly when one or more stocks are threatened by overfishing. Evidence from the Gulf reef fish fishery suggests that gag grouper stock rebuilding during 2011-14 was impacted by a decision to tightly constrain the gag grouper total allowable catch (TAC) in isolation, i.e., while concurrently maintaining relatively large red grouper and other reef fish species TAC's. Their results suggest the skewed TACs may have increased gag grouper discards. Regulators in turn did suspend the ability of fishermen to use the multi-use provision to land additional gag using red grouper allocation. Allowing reef fish fishermen to land over-quota harvests of gag grouper under a CSF provision would have increased revenue, but would have also changed the mix of targeted and landed species across multiple species or species groups.

7.3 Season Length and Quota Closures

The GT-IFQ program was intended to mitigate the effects of derby fishing, increase the flexibility of fishing operations, and eliminate quota closures. As indicated in the previous section, no quota closures have occurred since the program was implemented, mainly because fishermen are not allowed to harvest more than their annual allocation (i.e., their initial allocation at the beginning of the year plus allocation purchased during the year). According to Agar (2017, pers. comm.), the average season length for the GT fishery in the 3 years prior to the IFQ program varied by species group/category as follows: 365 days for shallow water groupers (which includes red grouper and gag), 153 days for deep-water grouper DWG, and 124 days for TF. Because there have been no closures since the program was implemented, the season length for all species in the program has been extended to a 365 day season (i.e., fishermen can fish throughout the year as long as they have sufficient annual allocation to cover their landings).

Birkenbach et al (2017b) conducted an analysis across all U.S. catch share programs to determine how effective they are at increasing the length of fishing seasons, or rather reducing or

eliminating the "race for fish." Their analysis compares each fishery treated with catch shares to an individually matched control fishery before and after implementation of the program, thereby isolating the effect of the program as opposed to other potential factors (e.g., increasing quotas), and then estimates the average effect on season length as a result of the program. Consistent with economic theory, they find strong evidence that catch share programs in the U.S. have extended fishing seasons after controlling for other factors.

Specifically with respect to the GT-IFQ program, after controlling for other factors, their analysis indicates that the program had a statistically significant and sizable effect on the length of the fishing season for all species and species categories in the GT fishery, particularly for TF which had the most closures and the shortest seasons prior to implementation of the program. Extending the fishing season is important because it provides incentives to reduce costs, improve product quality, time the catch to better meet market demand, and avoid safety risks. They also found that the effect of the RS-IFQ program on season length was more muted. As previously discussed, this was likely because monthly 10-day mini-seasons were implemented just prior to implementation of the IFQ program, and these mini-seasons had already extended the length of the fishing season for red snapper relative to the time before the mini-seasons were put in place.

7.4 Conclusions

As expected following the establishment of an IFQ program, the GT-IFQ program has been successful in providing year-round fishing opportunities to participating commercial fishermen. Closures have not been recorded post-IFQ; for all grouper and tilefish species included in the program, there is a 365-day season.

During the review period, annual GT-IFQ landings across all share categories increased from 49% of the aggregate quota in 2010 to 92% in 2014. The low percentage of the quotas harvested in 2010 is primarily due to the Deepwater Horizon Oil spill. In addition to the five share categories established by the GT-IFQ program, commercial fishermen can rely on GGM and RGM shares to land GT-IFQ species. GGM and RGM convert a portion of the gag and red grouper quotas into multi-use shares that can be used to land either gag or red grouper. Although multi-use shares are expected to add flexibility and contribute to reducing discards by balancing catch and quota ownership, the GGM and RGM shares distributed were mainly used to land gag and red grouper, respectively. This would suggest that the multi-use shares have not been as effective as initially thought and that the IFQ program could be simplified by eliminating these multi-use shares and distributing red grouper and gag shares exclusively as red grouper and gag, respectively.

The evaluation of the estimated number of discards by gear type suggests that the GT-IFQ program has successfully met its objectives relative to discard reduction for red grouper. Following the establishment of the GT-IFQ, red grouper discards across all years and for both vertical lines and longlines decreased. Furthermore, the post-IFQ red grouper discard ratio, i.e., number discarded per landed fish, significantly decreased throughout the Gulf and for all gear types. For gag, estimated discards and discard ratios suggest a more nuanced progression during

the review period. Due to a drastic quota reduction, discards increased in 2011 but gradually decreased afterwards as the quota increased.

CHAPTER 8. SAFETY AT SEA

Commercial fishing is one of the most dangerous occupations in the U.S., second only to logging, because of harsh weather, long hours, laborious work, and dangerous work conditions. In the U.S., the 2014 death rates in the commercial fishing industry are significantly above the average fatal occupational injury rate: 80.8 deaths per 100,000 full-time equivalent (FTE) workers for fishers and related fishing workers as compared to the national average of 3.3 per 100,000 FTE (BLS 2015).

Several legislative U.S. Coast Guard (USCG) changes are likely to have affected the level of occupational injuries in fisheries. The Commercial Fishing Industry Vessel Safety Act of 1988 was the first legislation specifically dealing with commercial fishing vessel safety. Later, enforcement of the 1991 Commercial Fishing Industry Vessel Regulations is believed to have reduced the rate of casualties. Then, a USCG regulatory change known as the Coast Guard Authorization Act of 2010 imposed stronger regulations requiring training of commercial fishing vessel operators as well as design, construction, and maintenance standards for new vessels. The USCG has used several strategies to mitigate safety risks in commercial fishing, including training, vessel structural considerations, operational factors, and equipment issues.

It is widely believed that the individual fishing quota (IFQ) programs in the Gulf of Mexico (Gulf) not only promoted efficiency, but also successfully put an end to fishing derbies, thereby reducing the rate of commercial fishing accidents and fatalities (see, for example, the National Oceanic and Atmospheric Administration's (NOAA) annual Gulf red snapper IFQ program reports). The underlying intuition is that when fishermen operate with personal quota allocations on one hand, and with significantly more time on the other, they do not need to rush out to sea, but can be selective and choose to fish during the most favorable weather conditions. In contrast to the common quota regime, fish not caught today can still be caught later during the year, making it less costly to postpone a trip when weather conditions are poor. Furthermore, the transferability of IFQ allocation may also have contributed to a lower rate of accidents, as operators of smaller vessels have been able to sell or lease their allocation to operators of larger and arguably safer vessels. However, while larger vessels can withstand larger waves and stronger winds, they also tend to stay at sea for longer periods of time, not only increasing the likelihood of running into foul weather, but also inducing more fatigue among crewmembers.

In a recent study, Marvasti and Dakhlia (2017) considered a two-step model to establish a link between a captain's decision to take a red snapper/grouper-tilefish commercial fishing trip and the likelihood of a fatal injury incident. The authors introduced a group of control variables capturing geographic, market, and regulatory-specific factors such as weather, unemployment rate, and quota levels, as well as price lag and vessel-specific factors. Various specifications of the model produced consistent results. In their model 1, Marvasti and Dakhlia find that the probability of taking a trip after the introduction of the red snapper IFQ program, all else the same, is approximately 0.06 lower than over the period prior to the introduction of the red snapper IFQ program. This is consistent with the fact that the institution of the red snapper and grouper tilefish IFQ programs led to a faster drop in the number of trips than in the number of registered vessels. The effect of introducing the grouper-tilefish (GT) IFQ program is more significant (7.0 fatalities per 100,000 FTE), perhaps in part due to its overlap with the

introduction of the Coast Guard Authorization Act of 2010. The interaction effects between weather condition and the two IFQ programs have opposite signs, suggesting that after the introduction of the red snapper IFQ program, the probability of taking a commercial fishing trip during poor weather fell, whereas after the introduction of the GT-IFQ program, the probability of taking a commercial fishing trip during poor weather rose.

Since the IFQ programs have allowed captains to make trip decisions without a seasonality constraint, they are expected to take fewer risks with respect to poor weather conditions. The results from the Marvasti and Dakhlia's study show that the red snapper IFQ program reduced the number of fatalities by 1.25 per 100,000 FTE. The effect of introducing the grouper-tilefish IFQ program is more significant (7.0 fatalities per 100,000 FTE), perhaps in part due to its overlap with the introduction of the Coast Guard Authorization Act of 2010.

The authors also experimented with an alternative set of models, in which they separated the dataset into two groups--pre- and post-red snapper IFQ program. They then followed the same process to estimate the parameters for the trip decision and fatal injuries equations. An intriguing result from the trip decision equation is the response to poor weather conditions. Comparing the size of the coefficient across the models suggests that captains give more weight to wind speed in making their trip decision after the IFQ than they did before the IFQ. This implies that their attitude towards risk associated with poor weather conditions has changed. Also, in the sub-sample after the IFQ, the role of poor weather conditions in causing fatal accidents is significantly reduced.

8.1 Conclusions

As stated in the purpose and need for Reef Fish Amendment 29, which established the GT-IFQ program, the transition from a traditional command and control management approach to the establishment of an incentive-based management system such as the GT- IFQ program was expected to result in significant safety-at-sea improvements for commercial fishermen in the Gulf of Mexico. A study conducted by Marvasti and Dakhlia (2017) suggested that the introduction of the GT-IFQ has afforded fishermen the flexibility to select more favorable weather conditions to schedule fishing trips. The study also indicated that the role of adverse weather conditions as a cause of fatalities was lessened following the implementation of IFQ programs in the Gulf. Overall, the GT-IFQ has resulted in a significant decrease in the number of fatalities. Based on the findings of this study (Marvasti and Dakhlia, 2017), which were corroborated by survey responses provided by captains and crewmembers, it is concluded that the GT-IFQ program has successfully met its objectives relative to improving the safety-at sea of participating commercial fishermen.

CHAPTER 9. NEW ENTRANTS

To harvest reef fish commercially, the Gulf of Mexico Fishery Management Council (Council) has required federal commercial reef fish permits since 1990 (Reef Fish Amendment 1; GMFMC 1989). A moratorium on the issuance of new commercial reef fish permits was initially implemented in 1992 (Reef Fish Amendment 4) and subsequently extended in 1994 (Reef Fish Amendment 9), 1996 (Reef Fish Amendment 11), and in 2000 (Reef Fish Amendment 17). The Council then established an indefinite limited access system for commercial reef fish permits in 2005 (Reef Fish Amendment 24; GMFMC 2005). Therefore, since 2005, the acquisition of an existing commercial reef fish permit is the only avenue available to commercial fishermen considering entry into commercial fishing for grouper and tilefish, a subset of the reef fish fishery.

The grouper-tilefish individual fishing quota (GT-IFQ) program was established January 1, 2010 and required IFQ annual allocation in addition to a valid commercial reef fish permit to harvest grouper and tilefish species. The universe of potential initial participants in the GT-IFQ program, as measured by the number of valid or renewable commercial reef fish permits as of August 31, 2008 was estimated at 1,028. Because some permit holders did not harvest grouper or tilefish to qualify for initial distribution, 766 permit holders received IFQ shares during the initial apportionment of shares.

Share and allocation transferability provisions included in the GT-IFQ program contribute to improving new entrants' access to grouper and tilefish allocation. During the first 5 years of the program, only U.S. citizens or permanent residents with a valid commercial reef fish permit could acquire IFQ shares or annual allocation through transfer[36]. Beginning January 1, 2015, any U.S. citizen or permanent resident can open a shareholder account and acquire shares and allocation, although a commercial reef fish permit is still required to harvest IFQ allocation. New entrants can opt for long term participation in the program by acquiring shares and receiving the corresponding annual allocation yearly or participate on a short term basis by purchasing annual allocation as needed. Although the numbers of accounts acquiring shares for the first time (Table 4..1.2), allocation holders with transfers (Table 4..1.5) and, pounds of grouper and tilefish landed by accounts without shares (Table 5.2.2.3) are partially determined by activity in related accounts, they also suggest that the program has experienced a sustained level of new entrants.

Although improvements in new entrants' access may be a part of the long term performance of successful IFQ programs, significant new entries (well above replacement fishermen) may run counter to the reduction of overcapitalization, one of the main objectives of the IFQ program. Additional assistance, in the form of loan programs and quota banks, would allow potential new entrants to participate in the GT-IFQ. A national loan program currently in development is expected to offer opportunities to Gulf fishermen. The Council is also developing management measures to distribute shares collected from inactive actions to new entrants and/or fishermen

[36] After the first five years, any US citizen or permanent resident alien could acquire IFQ shares and annual allocation; a valid commercial reef fish permit is no longer needed.

with limited IFQ holdings. Although the Council has previously considered quota banks, quota bank initiatives in the Gulf are currently limited to private organizations.

Barriers to new entrants has long been a recurring problem within IFQ programs (Copes 1997; GAO 2004; Carothers et al. 2010; Szymkowiak and Himes-Cornell 2015). Griffith et al. (2017) noted that it is most often the second generation of fishermen who bear the burden of significant barriers to entry. These sentiments were reinforced in their research of the GT-IFQ program where most of those interviewed saw an aging population of fishermen with few younger ones to take their place. Most of those interviewed said that the barriers to entry include "…costs of leasing allocation, high share prices, the inability to purchase shares, the costs of purchasing a boat, reef [fish] permit, vessel monitoring system (VMS) equipment, and recovery fees relative to ex-vessel prices, among others, would prevent younger fishers from entering the fishery" (Griffith et al. 2017: v). While transferability of shares and allocation does offer some flexibility within the market, most innovative markets have low entry barriers, which is not often the case with IFQ programs. This can have disproportionate effects in rural areas where there are fewer economic opportunities for fishermen and fishing may be critical to community identity (Griffith et al. 2017; Langdon 2008).

9.1 Conclusions

A goal shared by most IFQ-type programs is to reduce overcapacity in the fishery. Thus, the concept of new entrants may seem to be in conflict with this goal. However, new entrants does not refer to expanding capacity, but rather to the next generation of fishermen. New entrants are often already participants in the fishery, and may be crew, hired captains, or captains of owner-operated vessels who do not own shares but would buy allocation to cover their landings. Therefore, facilitating access to the program by considering provisions for new entrants would be consistent with the program objectives. For potential new entrants, the access to shares and allocation generally constitutes a major challenge. The Council could consider loan programs (including national programs), redistribution of portions of the commercial quotas, and the establishment of quota banks to ease potential new entrants' access to IFQ shares and allocation.

CHAPTER 10. MONITORING AND ENFORCEMENT

According to Section 303A(c)(1)(H) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), each limited access privilege program (LAPP) must include "an effective system for enforcement, monitoring, and management of the program, including the use of observers or electronic monitoring systems." Wide-spread non-compliance can adversely affect the ability of other catch share program (CSP) attributes to achieve their desired goals and objectives. This section assesses whether the current enforcement provisions and activities, including resources for conducting the latter, are sufficient to ensure a high rate of compliance with program requirements.

10.1 Discussion

Law enforcement is a crucial component of the individual fishing quota (IFQ) programs. Special agents and officers from the National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS) Office of Law Enforcement (OLE) Southeast Division, the U.S. Coast Guard (USCG) and participating Joint Enforcement Agreement (JEA) states enforce the regulated activities mandated under the Gulf of Mexico (Gulf) IFQ programs. State wildlife officers and game wardens routinely contribute to the enforcement of the IFQ programs under the auspices of the Cooperative Enforcement Agreement, by patrolling the waterfront, meeting vessels upon landing, and monitoring offloads.

Commercial vessels harvesting GT-IFQ species are required to have a valid Gulf reef fish permit and a functioning vessel monitoring system (VMS) prior to fishing. VMS units transmit and store information relating to the vessel identification, date, time, latitude/longitude, course and speed, and are able to provide position accuracy to within 33 feet (100 m). VMS units are required to be turned on and properly functioning 24 hours a day, 7 days a week (unless a power down exemption has been approved), even when docked. VMS units provide hourly position transmission and can provide 'real time' position (within 15 minutes) when polled. The VMS protocol contains a requirement that vessels declare their fishing activity and gear type before leaving port (declaration; 'hail out') via the VMS terminal, NMFS website, or a NMFS call service center. The VMS units improve the efficiency of enforcement efforts (e.g., monitor offshore restricted areas, provide enforcement with a way to monitor offshore restricted areas) and the effectiveness and timeliness of at-sea rescue efforts.

Prior to returning to port, all vessels landing commercial GT-IFQ species are required to notify NOAA Fisheries enforcement agents between three hours to twenty-four hours[37] in advance of the time of landing to indicate where and when the landing will occur, the dealer who will be purchasing the fish, and an estimation of the pounds being landed by share category. Before a landing notification is submitted, the vessel account must contain sufficient allocation for the fish onboard. Landing notifications can be made through the VMS unit, the IFQ online website, or

[37] Until 2013, the pre-landing notifications needed to be made between 3 to 12 hours in advance of the time of landing. An administrative rule based on results the Red Snapper IFQ 5-Year review extended this time period to 24 hours.

through the call service center. Each time a landing notification is received, law enforcement officers and dispatch personnel are notified via e-mail. The advance notice allows law enforcement agents to be present when the vessel lands to inspect the catch. GT-IFQ vessel can only land at approved landing locations. Establishing approved landing sites aids in enforcing the landing and offloading aspects of the GT-IFQ program. All landing locations need to be publicly accessible by land and their geographic location must be specifically identifiable. Landing sites must be pre-approved by NOAA OLE to ensure agents can find and access the sites. Landing (arriving at a dock, berth, beach, seawall, or ramp) may occur at any time, provided that a landing notification has been given, but fish may only be offloaded between 6 a.m. and 6 p.m., local time. Offloading is defined as the removal of red snapper from the vessel. A landing transactions report is completed by the GT-IFQ dealer and validated by the fisherman. The landing transaction includes the date, time, and location of transaction; weight and actual ex-vessel value of fish landed and sold; and the identity of shareholder account, vessel, and dealer. All landings data are updated in a real-time basis as the landing transaction is processed.

VMS technicians monitor all IFQ trips. Monitoring begins by confirming that a proper declaration has been made for all IFQ trips. Trip level monitoring consists of tracking the vessel from port to port, assuring the VMS positioning does not stop or have significant gaps in reporting. Vessel landing locations are confirmed to match the location which was reported via their IFQ pre-landing form (hail-in). If the vessel makes an unauthorized landing or lands at a landing location other than the site listed on the IFQ pre-landing, it is forwarded out to OLE officers/agents for follow up. IFQ vessel's tracks are matched with logbook reporting to confirm the accuracy of the declaration as well as reported IFQ catch. In addition, VMS staff work closely with the SE Permit office to confirm that all reef fish permit holders have an active and positioning VMS unit onboard prior to their permit being issued.

OLE Special Agents conduct random monitoring of vessels, assist state wildlife officers and game wardens with violations requiring further investigation and conduct independent investigations, primarily those involving the undocumented landing and sale of IFQ species and the trafficking of illegally landed red snapper and grouper-tilefish entered into interstate commerce. During offshore boarding, the USCG and JEA partners with long range capabilities ensure that vessels landing grouper-tilefish have valid GT-IFQ accounts. During patrol, action was taken by OLE agents to correct problems identified and educate fishermen on program requirements and regulations. In other instances, OLE agents took enforcement action by way of warnings (verbal and written), citations, and follow-up investigation by NOAA's Special Agents. Major violations since implementation of the IFQ programs included the false reporting of species landed and under reporting of total weights landed. Typical violations included landing prior to the three-hour minimum landing notice, landing at a unspecified or unapproved location, insufficient allocation, transporting IFQ species without an approval code, completing a landing transaction without a landing notification, and offloading after approved hours. Typical dealer violations included misreporting IFQ species, failure to provide a current dealer permit and/or IFQ dealer endorsement, and failure to report IFQ species landed.

During patrol there was action taken by OLE agents to correct the problems identified throughout the Gulf through educating fishermen on the use of the technology used to monitor the program (VMS and IFQ notification systems). In other instances OLE agents took

enforcement action by way of warnings (verbal and written), citations, and some of the violations were turned over to NOAA's Special Agents for follow-up investigation.

The number of federal IFQ related cases that have resulted in seizures has decreased since the start of the program, with the greatest number of GT-IFQ seizures occurring in 2011 (Table 10.1.1). It should be noted that these estimates are only based on seizures by federal agents and do not include seizures completed by state law enforcement. As more states change state regulations to match federal regulations there may be a decrease in the number of federal seizures and violations, as they are prosecuted under state regulations. In a paper by Porter, et al. (2013), which covered the first two years of the GT-IFQ program survey respondents believed that the enforcement and compliance of the IFQ programs has increased but that dockside enforcement was inadequate and easy to evade.

Table 10.1.1. Number of enforcement cases resulting in seizure of fish.

Year	IFQ Cases	GT-IFQ Cases	Total Pounds
2010	9	2	3,011
2011	10	7	19,059
2012	6	4	4,893
2013	6	3	4,255
2014	4	3	4,501
Total	**35**	**19**	**35,719**

Catch Share administrative staff regularly audit pre-landing notifications and landing transactions, connecting each notification and landing transaction. Currently, fishermen and dealers are notified via phone call of an outstanding transactions, while in past years they were notified via audit letters. The online system requires dealers submitting a landing transaction to select a landing notification from within the last 96 hours. The majority of notifications and transactions are linked through this process. Occasionally, dealers may be unable to link landings to notifications because it does not appear in the list of available notifications. This may be due to a system delay (e.g., VMS system is delayed in connection to the IFQ system), late reporting of the landing transaction (e.g., past 96 hours from the notification date/time), or because no notification was submitted to the system. In these situations, dealers must select "No Notification Meets Criteria", and Catch Share staff link the notification and transactions after the fact. Likewise, during the daily audit, Catch Share staff may see a notification with no matching landing transaction. In these instances, Catch Share staff reaches out to the dealer listed in the notification, to verify if a landing did occur. When Catch Share staff continues to have difficulty resolving outstanding pre-landing notification, the dealer and vessel are referred to NOAA OLE for further investigation.

In two surveys of GT-IFQ program stakeholders, account holders reported similar levels of satisfaction with enforcement of IFQ program. Program participants (i.e. owners of share and allocation accounts) reported satisfaction at 46% (QuanTech 2015), and dealers/processors reported satisfaction at 47% (Keithly and Wang 2016). About 19% of participants reported dissatisfaction with enforcement (QuanTech 2015) while 20% of dealers/processors were dissatisfied (Keithly and Wang 2016). The remainder of respondents in both surveys were either neutral towards program enforcement or had no opinion. See Appendices B2 and B4 for details of the participant and dealer/processor surveys, respectively.

10.2 Conclusions

When seizures occur in the Gulf IFQ programs, the amount of allocation associated with the seizures cannot be deducted from the account until the case has been settled. Frequently settlement occurs after the year in which the seizure occurred. Since allocation is annual, if the settlement occurs after the year of citation, then the allocation cannot be deducted from the shareholder's account. Therefore, seizures may not be a strong deterrent from violating IFQ regulations. Settlement schedules for penalties may be a more appropriate method to address frequent or smaller violations. In recent years, the Southeast Region summary settlement schedule was updated to allow for a greater penalty in relation to red snapper violations.[38] Discussions with enforcement indicate that this approach improved enforcement of the RS-IFQ program's regulations. Modifying the settlement schedule to also include greater penalties for GT-IFQ species could have a similar effect on enforcement in the GT-IFQ program. Additionally, it might be feasible to have some IFQ specific violations added to the settlement schedule.

[38] http://www.gc.noaa.gov/documents/gces/SE-SS-Fix-it-June2017.pdf

CHAPTER 11. ADMINISTRATION AND COST RECOVERY

According to Section 303A(c)(1)(H) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), each limited access privilege program, (LAPP) must include "an effective system for enforcement, monitoring, and management of the program, including the use of observers or electronic monitoring systems." This section will review if the total administrative costs are being minimized to the extent practicable, which is consistent with National Standard 7. It is likely there will be trade-offs in the various types of administrative costs.

11.1 Cost Recovery

The Magnuson-Stevens Act requires the Secretary of Commerce (Secretary) to adopt regulations implementing a cost recovery program to recover the actual costs of managing, administering, and enforcing the Gulf of Mexico (Gulf) individual fishing quota (IFQ) programs. Monitoring costs are the costs associated with determining how many fish are harvested, when harvest occurs, where harvest occurs, issuing quota, transferring quota, etc. The administrative costs are the costs associated with IFQ personnel, customer service, equipment, travel, call service contracts, and mail outs. The enforcement costs are the costs associated with ensuring the harvesting vessels and fish buyers are in compliance with the existing regulations governing the harvest. The cost recovery fee established for the grouper-tilefish (GT)-IFQ program is currently 3% of the actual ex-vessel value of GT-IFQ species. GT-IFQ allocation holders who complete a landing transaction with a dealer are responsible for payment of the fee. The dealer who receives the GT-IFQ species is responsible for collecting and submitting the fee on a quarterly basis. Monies collected are used for administration of the program, maintenance and upkeep of the online system and software, enforcement of the GT-IFQ program, and scientific research.

Task codes are used to track salaries and benefits, contracts, travel, and equipment, supplies, and materials for the cost recovery expenses, as well as research activities and law enforcement activities directly related to the GT-IFQ program. Additional funding for law enforcement and program administration is provided through the general National Oceanic and Atmospheric Administration (NOAA) catch shares annual funding. Expenses summarized here include only those expenses incurred between January 1, 2010, and December 31, 2014. Expenses for program development by the Council and NOAA Fisheries Service pre-2007 are not included. Additionally, due to pre-existing red snapper (RS)-IFQ program, some expenses (i.e., observers/research, law enforcement) are now jointly associated with one another and cannot be distinguished for tracking against the RS-IFQ versus GT-IFQ. To determine the proportion of expenses associated with the RS-IFQ, the total value reported for each program each year was used to apportion expenses (Table 11.2.1).

In the first five years of the GT-IFQ program, the bulk of the cost recovery expenses were used to fund enforcement and salaries/benefits of staff working on the program, followed by science and research, supplies and materials, contracts, and travel (Figure 11.1.1). During this time period, cost recovery fees were fully funding the program. A total of $3.05 million was spent on

administering and enforcing the program, which represents 2.69% of the total ex-vessel value of IFQ-managed fish reported during the first five years of the program. However, because not all expenses exceeding the 3% cost recovery were tracked, and administrative expenses pre-2010 are not included, expenses likely were greater than those provided here. When setting cost recovery fees the following factors need to be considered: projected ex-vessel value of the catch, costs directly related to the management and enforcement of the program, projected balance from year to year, and expected non-payment of fees. Some expenses, such as hardware and software replacement, only occur every 3-7 years, versus expenses such as labor, enforcement, and supplies which are annual. Monies remaining in the Limited Access System Administration Fund (LASAF) at the end of the fiscal year are rolled over to the next year to allow for the large expenses that occur every 3-7 years.

Table 11.1.1. The proportion of expenses associated with both IFQ programs attributed to each program.

Year	%GT-IFQ	%RS-IFQ
2010	58%	42%
2011	65%	35%
2012	64%	36%
2013	55%	45%
2014	58%	42%

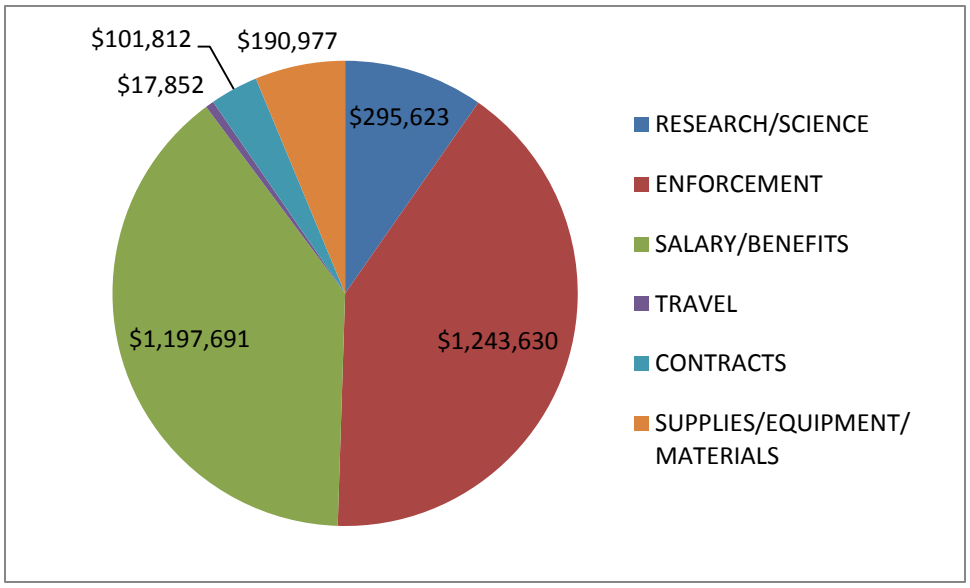

Figure 11.1.1. Aggregated GT-IFQ program expenses, 2010-2014

11.2 Administration

Administration of the IFQ program includes maintaining the online system and database, auditing transactions, and customer support and outreach. Updates are continuously made to the Catch Share system based on input from users, the National Marine Fisheries Service's (NMFS) Southeast Regional Office (SERO) and IT staff, as well as for any regulation requirements. Some of the major changes to the program after implementation include:

- Ex-vessel price definition and related auditing of ex-vessel prices (2011)
- Addition of share and allocation ledgers (2011)
- Citizenship certification (2011)
- Video tutorials (2011)
- Database system transition to SQL Server (2012)
- Landings ledgers for shareholders and dealers (2012)
- Manager comments field in landing notifications to inform enforcement (2012)
- Closing an IFQ account (2012)
- Death of shareholder procedures (2012)
- Mandatory selection of notification for each landing transaction (2012)
- Adding transfer reasons for all share and allocation transfers (2013)
- Require both transferor and transferee to enter the share price (2013)
- Mail survey about share prices (2013)
- Ability to update trip ticket number in landing transactions (2013)
- Updated dealer endorsements to reflect the new Gulf and South Atlantic Dealer permits (2014)

Catch Share support staff also created and maintained several useful documents for participants including: Frequently Asked Questions, Trouble-shooting Guide, Annual Reports, Commercial Quotas and Landings document, IFQ common terms, IFQ fishing guide, IFQ flexibility measures, IFQ proposed Quotas, and IFQ share-allocation calculator. Catch Share support staff also assist customers with questions about the program, creating a new account, and closing an account.

NOAA Fisheries is responsible for maintaining Catch Share programs customer service. Customer service staff are available from 8 a.m. to 4:30 p.m. EST Monday through Friday. Four staff members assist in answering phone calls, auditing and correcting IFQ data, preparing IFQ annual reports, conducting workshops and meetings, and preparing IFQ materials for dissemination to constituents. One to two additional Information Technology staff work full- or part-time to maintain and upgrade the IFQ online data collection system. Additionally, NOAA Fisheries contracts out phone-based IFQ landing notifications to an after-hours call service. The call service typically answers 600-1,000 minutes of phone calls each month.

One aspect of the administrative duties is to provide outreach opportunities for participants in the program. Outreach activities include visiting dealers for face-to-face question and answer meetings, public meetings to address GT-IFQ participants, fishery bulletins to inform participants about changes, and posting messages on the GT-IFQ website (Table 11.2.1). In

2012, Catch Share support staff held 4 public meeting across the Gulf of Mexico (Gulf) in order to address the administrative rule changes being considered.

Table 11.2.1. Number of outreach activities (by type) 2010-14

Type	2010	2011	2012	2013	2014
Dealer Visits	5	7	16	0	11
Important Messages	20	34	42	36	33
Fishery Bulletins	4	7	4	1	4

Account holders consisting of share and allocation owners and dealer/processors (i.e. "dealers") were asked about their attitudes and perceptions regarding the administrative performance of the program (see Appendices B2 and B4 for details of the participant and dealer surveys, respectively). The questions focused on the performance of the IFQ Online System and customer service. In a survey of GT-IFQ program shareholder account owners, QuanTech (2015) reports a majority of the respondents are satisfied with the performance of the IFQ Online System (57%), customer service regarding questions about the IFQ program (58%), and customer service regarding landing transactions by phone (55%). In a survey of program dealers, Keithly and Wang (2016) reports a majority of the respondents are satisfied with the performance of the IFQ Online System (64%) and overall customer service received (84%). Thus, dealer account holders report marginally higher satisfaction levels with using the IFQ Online System to manage transactions while reporting significantly higher levels of satisfaction with customer service received. Differences in perceptions regarding customer service were largely due to participants responding that their satisfaction levels were "neutral" or had "no opinion" in a higher proportion compared to dealers. Levels of dissatisfaction with customer service ranged from 11% for dealers to 16% for participants.

11.3 Conclusions

Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) regulations state that the cost recovery fee must be collected at either the time of landing, filing of a landing report, or sale of such fish during a fishing season or in the last quarter of the calendar year in which the fish is harvested. Under the current system, the fee is collected by the dealer at the time of sale of fish. NMFS then requires the submission of collected fees each quarter. In discussion with participants, NMFS has received feedback suggesting the following changes:

- Monthly collection of cost recovery fees vs quarterly
- Allowance of partial payments of cost recovery fees

NMFS would have to evaluate the cost-benefit ratio to determine if more frequently collection of cost recovery would be beneficial. The allowance of partial payments would have to involve a discussion with Treasury and pay.gov.

Based on the expenses and the cost recovery fee, it is recommended that NMFS review the cost recovery fee to determine if an adjustment is warranted. Factors that should be considered in review the cost recovery fee is the decrease in ex-vessel values since 2014, projected future ex-

vessel values, projected future staffing needs, projected increases in relation to IT needs (e.g., software utilized is nearing end of life, database backup strategy, future development needs, such as mobile platforms), and increases in communication with participants (e.g., newsletters, in-person outreach meetings for shareholders and dealers).

Based on recent discussions with constituents, Catch Share support staff is thinking of extending their outreach activities to include shareholder visits for face-to-face question and answer meetings. This is being considered as an additional way to introduce newer participants to the program, in addition to the new user packet that is sent to each new account holder.

CHAPTER 12. PROGRAM DURATION

Limited access privileges such as individual fishing quota (IFQ) shares are considered by the MSA as a revocable permit. IFQ shares do not constitute a right and therefore do not entitle recipients to compensation should the privilege be revoked. According to Section 303A(f) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), IFQ shares are not issued in perpetuity. For limited access privilege programs established after January 12, 2007, their lifespan is limited to 10 years, though they will be renewed if not revoked, limited, or modified. In effect, limited access privileges are considered to be issued under rolling conditional permanence (Anderson and Holliday, 2007).

In designing the grouper-tilefish (GT)-IFQ program, the Council did not include additional duration provisions and therefore, the privileges granted are currently valid for successive 10-year time intervals. For a predetermined share of the commercial quota for a species included in the GT-IFQ program, e.g., 1% of the gag commercial quota, a fixed commercial quota for that species would grant the shareholder the privilege to harvest the same amount of annual allocation each year. Therefore, given a fixed commercial quota for an IFQ species, a shorter program duration would be expected to result in a smaller potential aggregate harvest from the species considered. Because the value of an asset is equivalent to the net present value of the stream of income expected to be generated from the asset, a shorter program duration would result in a lower asset value. Therefore, the duration of the grouper-tilefish IFQ program, which is equivalent to the duration selected for the red snapper program, would foster greater IFQ share pricees and afford IFQ participants the opportunity to plan in the long term. Compared to programs with a shorter duration, the duration of the grouper-tilefish program, along with the transferability provisions implemented, is conducive to the development of a well-functioning market for IFQ shares. For program with limited duration, incentives to acquire shares through trading would diminish as the end date of the program approaches. In addition, because IFQ programs provide participants a long term stake in the fishery, and thus a vested interest in conservation measures, limited duration would lessen or negate the incentives to support and engage in conservation measures in the long run.

12.1 Conclusions

The duration of the grouper tilefish program, which is not restricted beyond Magnuson-Stevens Act requirements, is consistent with the objectives of the GT–IFQ program because it has fostered longer term planning and conservation. However, to further promote the full utilization of the available quotas, the Gulf of Mexico Fishery Management Council (Council) has recently elected to revoke IFQ shares from non-activated accounts. In Reef Fish Amendment 36A (GMFMC 2017), non-activated accounts are defined as accounts possessing shares but none of the shares or annual allocation associated with the shares has been landed or transferred to another account since 2010. The method for distributing these revoked shares will be determined in a subsequent amendment. Other IFQ programs in the US such as the wreckfish

ITQ program and the Pacific halibut/sablefish include rules specifying the conditions under which shares from inactive accounts would be revoked[39].

[39] For example, see the rules to revoke inactive QS in the wreckfish ITQ program (https://www.federalregister.gov/articles/2012/09/26/2012-23731/fisheries-of-the-caribbean-gulf-of-mexico-and-south-atlantic-snapper-grouper-fishery-off-the) and the Pacific halibut/sablefish IFQ program (https://alaskafisheries.noaa.gov/sites/default/files/finalrules/77fr29556.pdf)

CHAPTER 13. CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the main conclusions of this initial review of the grouper-tilefish individual fishing quota (GT-IFQ) program and discusses the progress made towards achieving the stated goals and objectives of the program. In addition, the section includes recommendations made by the Gulf of Mexico Fishery Management Council (Council), its scientific and statistical committees (Standing and Socioeconomic SSCs) and advisory panel (Ad Hoc Red Snapper and Grouper-Tilefish IFQ Advisory Panel).

13.1 Conclusions

Data Collection and Reporting

- The collection of share and allocation prices has greatly improved since the addition of transfer reasons. However, gaps still exist in the data. Additional measures such as mandatory price reporting and further limiting the range of prices that can be entered may be needed.

- Different data collection programs, which are run for different purposes, have led to duplicative reporting and data discrepancies. Efforts are under way to reduce the data inconsistencies between the IFQ, coastal logbooks, and trip ticket data collection programs.

Participation and Operational Changes

- Stochastic frontier analyses indicate that following the implementation of the GT-IFQ program, fishing capacity and overcapacity have declined. Capacity utilization has increased and the technical efficiency of the fleet has increased for remaining vessels.

- The GT-IFQ program, in conjunction with other regulations, especially the enactment of a bottom longline (BLL) endorsement, has resulted in consolidation and efficiency gains within the BLL and vertical line (VL) sectors, which have seen a reduction in active vessels by 52% and 48%, respectively. However, further consolidation is possible as fishing capacity remains large relative to the available quotas.

Share and Allocation Caps

- Based on Gini coefficient estimates, the distributions of shares as well as landings by share category at the lowest known entity level have changed little if at all since the IFQ programs were implemented.

- Market power analyses concluded that market power does not exist in any of the markets for landings, shares, or annual allocation and that economies of scale are not being exhausted, i.e., average costs of production are not being minimized.

- Existing share and annual allocation caps are not constraining landings. Retaining the current share and annual allocation caps would still prevent participants from exercising market power and would not preclude businesses from achieving economies of scale under current market conditions. Additional flexibility from expanding the size of some of the smaller caps would not create additional risk of market power being exercised, and would provide even more flexibility for the type of consolidation that would improve cost efficiency.

Share, Allocation, and Ex Vessel Prices

- Analyses of share and allocation prices have been hindered by missing or erroneous (e.g., under-reported values such as $0.01 per pound) data. The collection of accurate share and allocation prices continue to be a challenge.

- Although grouper ex-vessel prices increased during the review period, the introduction of the GT-IFQ program does not appear to have an appreciable effect on ex-vessel prices for Gulf groupers.

- The flexibility afforded by the GT-IFQ program has improved the profitability of fishing operations. Fishermen are able to reduce operating costs, thereby improving net revenues

Catch and Sustainability

- The GT-IFQ program has provided year-round fishing opportunities to participating commercial fishermen for all grouper and tilefish species included in the program.

- Gag (GGM) and red grouper (RGM) multi-use shares were not as effective as anticipated. As a result, the program could be streamlined by eliminating GGM and RGM shares and distributing red grouper and gag shares exclusively as red grouper and gag, respectively.

- Multi-use provisions for other shallow-water grouper (SWG) and DWG and overage provisions for all GT-IFQ categories should be maintained as they effectively contributed to reducing discards of GT-IFQ species.

- The GT-IFQ program has successfully met its objectives relative to discard reduction for red grouper. After the implementation of the GT-IFQ, red grouper discards and discard ratios significantly decreased across the Gulf of Mexico (Gulf) and for all gear types. However, due to a significant quota reduction, gag discards and discard ratios increased in 2011 but declined afterwards as the gag quota increased.

Safety at Sea

- The GT-IFQ program has successfully met its objectives relative to improving the safety-at sea of participating commercial fishermen.
- The GT-IFQ has allowed fishermen to select more favorable weather conditions to plan fishing trips and has resulted in significant decreases in the number of fatalities (Marvasti and Dakhlia 2017).

- Safety-at sea improvements were corroborated by which were corroborated by survey responses provided by captains and crewmembers

New Entrants

- Promoting new entrants may seem inconsistent with the program goal of reducing overcapacity. However, new entrants are often participants in the fishery, e.g., crew and hired captains who do not own shares but could buy allocation.

- Fostering access by new entrants would be consistent with the program objectives. Loan programs, share redistributions and quota banks could be considered.

Monitoring and Enforcement

- Seized annual allocation cannot be deducted from the shareholder's account before settlement of the case. Seizures may not be the strongest deterrent from violation of IFQ regulations because of the lengthy delay between the seizure and the adjudication of the citation.

- Updates to the Southeast Region summary settlement schedule to allow for greater penalties in relation to red snapper violations improved the enforcement of the red snapper (RS)-IFQ program. A similar approach could be considered for the GT-IPQ program.

Administration and Cost Recovery

- During the review period, collected cost recovery fees have fully funded the GT-IFQ program (including enforcement activities and salaries and benefits of staff working on the program).

- Changes to the administration of the program, including the provision of outreach material, are enacted on an as needed basis. Several administrative changes have been implemented during the review period, e.g., improvements to the reporting of share and allocation transfer prices.

Program Duration

- GT-IFQ shares are issued for last 10 years, but they will be renewed if not rescinded, limited, or modified. Longer duration is more conducive to longer term planning and conservation

- To promote the full utilization of the available quotas, the Council has revoked IFQ shares from non-activated accounts, i.e., accounts possessing shares but none of the shares or annual allocation associated with the shares has been landed or transferred to another account since 2010.

13.2 Recommendations

TO BE COMPLETED FOLLOWING COUNCIL, SSC, AND AP MEETINGS

13.2.1 Scientific and Statistical Committees Recommendations

13.2.2. Ad Hoc Red Snapper & Grouper-Tilefish IFQ Advisory Panel

13.2.3. Council Recommendations

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APPENDIX A: OVERVIEW OF STUDIES INCLUDED IN THE REVIEW

A1 – Analysis of Technical Efficiency

Title: Individual Fishing Quotas and Technical Efficiency in the Grouper-Tilefish Component of the Gulf of Mexico Reef Fish Fishery
GT-IFQ Report Reference: Ropicki et al (2017)

Purpose of the Study: One of the objectives of the GT-IFQ program is to address issues of overcapacity and derby fishing. One way to assess the achievement of this program objective is to develop an economic model to examine changes in technical efficiency and productivity of the grouper-tilefish (G-T) commercial sector since implementation of the GT-IFQ.

Methodology: Stochastic frontier analysis (SFA) is a parametric approach to analyzing production efficiency. SFA is the preferred methodology when one must account for stochastic forces in production such as the uncertainty of commercial fishing operations. We specify a stochastic distance function (SDF) to estimate the empirical relationship between inputs and outputs (i.e. production efficiency) of commercial G-T fishing vessels. Additionally, we adopt an output-oriented SDF (ODF) to account for the multi-species nature of the reef fish fishery.

Based on the results of a generalized likelihood ratio test, we specify a translog functional form for the ODF. The following conditions are imposed on the ODF: (1) homogeneity of degree one in outputs, and (2) symmetry of the parameters. Output and input variables (y_{ji} and x_{ji}) are normalized by their geometric mean. The stochastic frontier captures the effects of inefficiency in the production process. An error term is added to account for random disturbances.

Following the estimation of the ODF, vessel-level technical efficiency (TE) scores are calculated by averaging trip-level TE scores for each vessel. TE scores are then compared in two different ways to assess the impact of the implementation of the GT-IFQ on fleet performance. First, pre-IFQ TE scores are compared between vessels that left the fishery prior to implementation of the GT-IFQ ("Exit") and vessels that stayed in the fishery ("Stay"). This analysis evaluates potential gains in TE due to less efficient vessels leaving the fishery after implementation of the GT-IFQ. Next, pre- and post-IFQ TE scores are compared for those vessels that stayed in the fishery to examine the effects of regime shift on fleet efficiency. TE scores are bounded between 0 and 1 with a score of 1 indicating that a vessel is producing the maximum amount of outputs given its inputs (i.e. lies on the production frontier).

Data and Model Specification: Data from the Southeast Fisheries Science Center Coastal Logbook Program were used to perform the technical efficiency analysis. The data include trip-level information on landings, fishing effort and vessel characteristics. The data ranged from 2005 to 2014 and included all Gulf of Mexico reef fish trips. Observations with missing data on landings or inputs were removed from the data set.

Models were run for red grouper (RG), gag grouper (GAG), other shallow water groupers (OSWG), deep-water groupers (DWG) and tilefishes (TF) for vessels using bottom longline gear and RG, GAG, and OSWG for vertical line fishers. For all models, only trips by vessels that harvested at least 100 pounds of the IFQ species group being analyzed during the year of the trip were included in the analysis. The empirical models each included four outputs, three inputs, and a set of control variables. The four outputs were specified as trip landings with the species composition varying by model. The three input variables were: crew, number of fishing days, and vessel length. Both the input and output variables were interacted with a monthly time variable allowing for time-varying technical change.

The control variables included varied based on the fishing type (longline or vertical line). The BIOMASS variable was included to account for the potential impacts of stock abundance of commercially important reef fish species. REGION was included to account for differences in production based on fishing grounds. The four closure variables (RS CLOSURE, GROUPER CLOSURE, LONGLINE CLOSURE, and TURTLE CLOSURE) were included to account for differences in production that could have been due to regulatory closures of certain fisheries and fishing grounds. The LONGLINE and TURTLE closures were specific to the longline fishery and, as such, were not included as control variables in the vertical line analysis. Trip-level descriptive statistics for the vertical line and longline analyses are presented in Tables 1 and 2, respectively.

Table 1. Descriptive statistics for the variables used in the SDFs (vertical line fleet)

		MODEL					
		RG		GAG		OSWG	
Variable	Units	Mean	SD	Mean	SD	Mean	SD
y1	lbs	361.20	601.23	136.11	322.72	64.11	195.62
y2	lbs	12.34	91.69	86.71	317.43	147.46	435.60
y3	lbs	171.00	691.18	315.94	994.04	381.73	1,067.98
y4	lbs	107.22	436.84	128.85	456.20	130.85	491.89
Crew	crew	2.34	0.99	2.47	1.08	2.68	1.18
Fishing Days	days	3.89	2.89	3.99	2.89	4.29	2.92
Vessel Length	feet	36.23	7.51	37.16	8.14	39.43	8.59
IFQ	dummy	0.37		0.36	-	0.33	-
Biomass	tons	38.35	0.87	38.38	0.87	38.40	0.87
Weather	dummy	0.01	-	0.01	-	0.01	-
Area:	dummy						
1 (FL Keys)		0.12	-	0.04	-	0.13	-
2 (SW FL)		0.37	-	0.35	-	0.25	-
3 (FL Big Bend)		0.40	-	0.40	-	0.27	-
4 (FL Panhandle - AL-MS)		0.09	-	0.09	-	0.12	-
5 (LA)		0.02	-	0.09	-	0.13	-
6 (SE. TX)		<0.01	-	0.02	-	0.08	-
7 (S. TX)		<0.01	-	<0.01		0.01	-
Season:	dummy						
January		0.08	-	0.08	-	0.08	-
February		0.07	-	0.07	-	0.08	-
March		0.08	-	0.08	-	0.09	-
April		0.10	-	0.10	-	0.09	-
May		0.10	-	0.10	-	0.09	-
June		0.10	-	0.09	-	0.09	-
July		0.10	-	0.10	-	0.10	-
August		0.09	-	0.09	-	0.08	-
September		0.07	-	0.07	-	0.07	-
October		0.07	-	0.08	-	0.07	-
November		0.06	-	0.07	-	0.07	-
December		0.08	-	0.08	-	0.09	-
RS Closure	dummy	0.20	-	0.19	-	0.19	-
Grouper Closure	dummy	0.03	-	0.03	-	0.05	-

Table 2. Descriptive statistics for the variables used in the SDFs (longline fleet)

		MODEL									
		RG		GAG		OSWG		DWG		TF	
Variable	Units	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
y1	Lbs	2,633.50	2,745.75	330.03	631.67	190.38	420.90	908.21	1,784.77	603.78	2,377.40
y2	Lbs	24.77	248.27	404.31	1,315.77	503.50	1,462.90	80.85	1,596.15	189.31	795.18
y3	Lbs	39.30	303.72	81.06	422.85	87.68	408.73	1,860.39	2,588.92	2,064.26	2,693.19
y4	Lbs	756.72	2,328.21	796.70	2,456.72	774.29	2,340.39	269.39	837.49	297.68	858.34
Crew	crew	3.20	0.78	3.25	0.77	3.30	0.86	3.32	0.87	3.36	0.90
Fishing Days	Days	8.87	4.17	9.03	4.16	8.75	4.23	8.79	4.32	8.68	4.35
Vessel Length	Feet	45.80	6.99	46.09	7.11	46.71	7.82	47.00	7.69	47.46	7.90
IFQ	dummy	0.29		0.31		0.29		0.29		0.25	
Biomass	tons	38.18	0.87	38.23	0.88	38.23	0.88	38.24	0.89	38.20	0.86
Weather	dummy	0.03	-	0.03	-	0.03	-	0.03	-	0.03	-
Area:	dummy										
1 (FL Keys)		0.14	-	0.12	-	0.13	-	0.13	-	0.13	-
2 (SW FL)		0.68	-	0.69	-	0.63	-	0.57	-	0.51	-
3 (FL Big Bend)		0.13	-	0.13	-	0.12	-	0.16	-	0.18	-
4 (FL Panhandle - AL-MS)		0.02	-	0.02	-	0.02	-	0.04	-	0.04	-
5 (LA)		0.01	-	0.02	-	0.03	-	0.04	-	0.05	-
6 (SE. TX)		0.00	-	0.01	-	0.01	-	0.01	-	0.02	-
7 (S. TX)		0.02	-	0.03	-	0.05	-	0.06	-	0.07	-
Season:	dummy										
January		0.10	-	0.10	-	0.10	-	0.10	-	0.10	-

February		0.09	-	0.09	-	0.09	-	0.09	-	0.09	-
March		0.09	-	0.09	-	0.09	-	0.10	-	0.10	-
April		0.10	-	0.10	-	0.10	-	0.10	-	0.10	-
May		0.10	-	0.10	-	0.10	-	0.10	-	0.10	-
June		0.08	-	0.08	-	0.08	-	0.08	-	0.08	-
July		0.09	-	0.08	-	0.09	-	0.08	-	0.08	-
August		0.07	-	0.07	-	0.07	-	0.07	-	0.07	-
September		0.08	-	0.08	-	0.08	-	0.07	-	0.07	-
October		0.08	-	0.08	-	0.08	-	0.07	-	0.07	-
November		0.06	-	0.06	-	0.06	-	0.06	-	0.06	-
December		0.06	-	0.06	-	0.06	-	0.06	-	0.06	-
RS Closure	dummy	0.30	-	0.28	-	0.29	-	0.28	-	0.28	-
Grouper Closure	dummy	0.04	-	0.04	-	0.05	-	0.06	-	0.06	-
Longline Closure	dummy	0.05	-	0.06	-	0.05	-	0.06	-	0.05	-
Turtle Closure	dummy	0.01	-	0.01	-	0.01	-	0.01	-	0.01	-

Results:

Stochastic Distance Frontier Estimates

Parameter estimates of the first-order terms have the expected sign for all models demonstrating monotonicity at the geometric mean, that is, non-decreasing in outputs and decreasing in inputs in accordance with economic theory. The statistical significance of the λ estimate for all models indicates that technical inefficiency is present and validates the use of a production frontier rather than a production function. In addition, the fact that the λs are greater than one for all models indicates that skill is more important than random shocks in explaining production variation across vessels. The γ values measure the amount of total variance in landings due to skill and vary across models from a low of 0.662 to a high of 0.867.

By normalizing by the geometric mean and summing the parameter coefficients on the input variables we are able to measure returns to scale. The returns to scale are above one for every model run indicating increasing returns to scale. Increasing returns to scale can be caused by overcapacity in the fishing fleet. The parameter estimates on the fishing area variables indicate that fishing productivity generally varies by fishing area. The parameters for IFQ were all positive indicating that IFQ management led to increases in landings. In addition, the biomass parameter was positive for all SDFs except tilefish (longline) indicating that greater biomass led to increased landings all else equal.

While the grouper closure negatively impacted landings for both the longline and vertical line fleets, the red snapper closure actually had a positive effect on longline vessel landings. The red snapper closures positive effect on longline landings is likely due to the fact that longliners generally do not target red snapper, during the study period longliners accounted for approximately 33% of total landings but only 5% of red snapper landings. The turtle closure negatively impacted longline landings as would be expected but the longline closure had mixed effects. For the shallow water grouper models (RG, GAG, and OSWG), landings were negatively impacted but not statistically significantly so. However, the longline closure positively impacted longliner landings in the deep water grouper and tilefish models. This finding seems reasonable given that fishing for deep water grouper and tilefishes usually occurs in deeper water and targeting of these species may have been increased during the longline closures. The technical inefficiency model results indicate that implementation of the IFQ program led to increased efficiency (the negative coefficient on the parameter value indicates that inefficiency decreased).

In the next subsection we cover the vessel-level TE scores and how they were impacted by IFQ management.

Technical Efficiency Scores

TE scores were estimated for each fishing trip and then averages were calculated at the vessel level. This analysis looks at two facets of how IFQ management changed the fishery. First, we compare pre-IFQ TE scores for those vessels that left the fishery prior to IFQ management to those vessels that continued fishing after IFQ management was implemented. It seems plausible that more technically efficient vessels might place a higher value on quota than their less efficient counterparts and buy them out of a rationalized fishery. In addition, fleet owners might be expected to use only their more efficient vessels when harvesting grouper and tilefish after IFQ implementation given that the race to fish is removed. If that were the case we would expect those vessels that stayed in the fishery to have been the more efficient vessels. Second, we examine how IFQ management effected vessel level efficiency; namely, did fishers harvest more efficiently during the IFQ period when the race to fish was removed.

Table 3 compares the pre-IFQ TE scores of the vessels that stayed in the fishery to those that exited the fishery prior to IFQ management. The vessels that continued fishing after IFQ management were, on average, more technically efficient than the vessels that exited the fishery prior to IFQ implementation. Table 4 evaluates how the TE scores of vessels that remained in the fishery changed following IFQ implementation. On average, vessel TE scores rose following IFQ implementation for the vessels that continued to take part in the fishery. TE scores rose post IFQ implementation across all models, with average increases ranging from 2.37% (OSWG vertical line) to 13.61% (OSWG longline).

Table 3. Pre-IFQ TE Scores (Stayed. Vs. Exited)

	Vertical line fishers						**Difference in Means**
	Stayed			**Exited**			**Stayed TE - Exited TE**
Species Group	**Obs.**	**Mean TE**	**SE**	**Obs.**	**Mean TE**	**SE**	**Pr(|T|>|t|)**
Red Grouper	323	0.487	0.005	491	0.451	0.006	0.000
Gag Grouper	281	0.502	0.006	432	0.448	0.006	0.000
Other Shallow Water Grouper	215	0.507	0.006	421	0.459	0.006	0.000

	Longline fishers						**Difference in Means**
	Stayed			**Exited**			**Stayed TE - Exited TE**
Species Group	**Obs.**	**Mean TE**	**SE**	**Obs.**	**Mean TE**	**SE**	**Pr(|T|>|t|)**
Red Grouper	74	0.511	0.011	105	0.448	0.013	0.001
Gag Grouper	74	0.535	0.010	81	0.472	0.013	0.000
Other Shallow Water Grouper	74	0.507	0.011	103	0.454	0.012	0.002
Deep Water Grouper	73	0.518	0.010	94	0.485	0.012	0.039
Tilefish	73	0.538	0.009	94	0.509	0.011	0.053

Table 4. Vessel level TE Scores (Pre Vs. Post IFQ)

	Vertical line fishers					Difference in Means
		Pre-IFQ		Post-IFQ		Post - Pre IFQ
Species Group	**Obs.**	**Mean TE**	**SE**	**Mean TE**	**SE**	**Pr(|T|>|t|)**
Red Grouper	323	0.487	0.005	0.502	0.006	0.005
Gag Grouper	281	0.502	0.006	0.523	0.006	0.000
Other Shallow Water Grouper	215	0.507	0.006	0.519	0.008	0.093

	Longline fishers					Difference in Means
		Pre-IFQ		Post-IFQ		Post - Pre IFQ
Species Group	**Obs.**	**Mean TE**	**SE**	**Mean TE**	**SE**	**Pr(|T|>|t|)**
Red Grouper	74	0.511	0.011	0.540	0.013	0.025
Gag Grouper	74	0.535	0.010	0.588	0.010	0.000
Other Shallow Water Grouper	74	0.507	0.011	0.576	0.011	0.000
Deep Water Grouper	73	0.518	0.010	0.573	0.011	0.000
Tilefish	73	0.538	0.009	0.590	0.010	0.000

A2 – Analysis of Capacity

Project Title: Individual Fishing Quotas and Capacity in the Grouper-Tilefish Component of the Gulf of Mexico Reef Fish Fishery
GT-IFQ Report Reference: Solis et al (2017)

Purpose of the Study: One of the objectives of the GT-IFQ program is to address issues of overcapacity and derby fishing. One way to assess the achievement of this program objective is to develop an economic model to examine changes in composition, fishing capacity, overcapacity and capacity utilization of the grouper-tilefish commercial sector and the subsequent performance of the fleet since implementation of the GT-IFQ.

Methods: Stochastic frontier analysis (SFA) is a parametric approach to analyzing production efficiency. SFA is the preferred methodology when one must account for stochastic forces in production such as the uncertainty of commercial fishing operations. We specify a stochastic distance function (SDF) to estimate the empirical relationship between inputs and outputs (i.e. production efficiency) of commercial G-T fishing vessels. Additionally, we adopt an output-oriented SDF (ODF) to account for the multi-species nature of the reef fish fishery.

A translog (TL) multi-output production frontier is used to estimate the proposed ODF model. To allow the rate of technical change to be non-constant and non-neutral we interact time, *t*, with the first-order factors for inputs and outputs. From an analytical point of view, a well behaved ODF is homogeneous of degree 1 in outputs and is symmetric in parameters. We impose homogeneity by normalizing the function by an arbitrary output and impose symmetry.

To introduce the concept of stochastic frontier in our model, the distance between each observation is defined as the inefficiency term and a random noise term is also included. The model measures the importance of random shocks in determining variation in output capturing differences in skill or efficiency across vessels. To facilitate the interpretation of the parameters and make them comparable to those from standard production function model, we transformed the left side of the equation to be measured in natural logs.

We also estimate vessel-level technical efficiency (TE). TE scores are bounded between 0 and 1. TE achieves its upper bound when a vessel is producing the maximum feasible output, given the available inputs and stock abundance.

Finally, to estimate capacity measurements at the vessel level, it is necessary to calculate differences in the error terms assuming that the variable inputs are fully utilized. In other words, output levels and the fixed input usage are observed from the fishing activity of the fleet while variable input usage is increased to maximum potential levels.

The capacity TE is the distance from the observed outputs to the maximum attainable production level assuming full utilization of variable inputs and is bounded between zero and one. To obtain a capacity measure for each vessel, the observed outputs have to be multiplied by the inverse of the capacity TE.

Data and Model Specification: To estimate the empirical model we used primary data from the National Marine Fisheries Service (NMFS) Southeast Coastal Fisheries Logbook Program and the Permits Information Management Systems (PIMS) databases. The NMFS logbook data contains detailed trip-level information on landings and fishing effort, and the PIMS dataset includes information on vessel characteristics. The empirical analysis is conducted independently for vessels using vertical lines and bottom longline gears (the two main technologies used in **the** reef-fish fishery) to avoid biases due to heterogeneous production. Aggregate fishery estimates are computed by adding the capacity measurements of the two subgroups of vessels within the fishery.

In this study we bounded our analysis to five years before (2005-2009) and after (2010-2014) the implementation of the GT-IFQ in 2010. Observations with missing or incomplete input and/or output data were also excluded from the analysis resulting in an unbalanced panel data of 83,207 observations on 695 distinct vessels. We aggregated the trip-level data into seasonal vessel-level observations (each year was divided into four equally distributed seasons). The final data set contained 18,869 seasonal vessel-level observations.

Figures 1 and 2 present the evolution of the fleet size and the average vessel-level trip characteristics, respectively. Specifically, Figure 1 shows that during the studied period the fleet contracted approximately 30%. Two distinct shocks in fleet size can be observed in Table 1. The first shock can be explained by the implementation of the Red Snapper IFQ program in 2007, and the second one with the implementation of the Grouper-Tilefish IFQ program in 2010. After the Grouper-Tilefish IFQ program the fleet stabilized at approximately 600 vessels. Figure 2 shows that after implementation of Grouper-Tilefish IFQ fishers began, on average, to take longer but fewer trips. The number of trips and days at sea stabilized after 2012.

Figure 1. Evolution of Feet Size

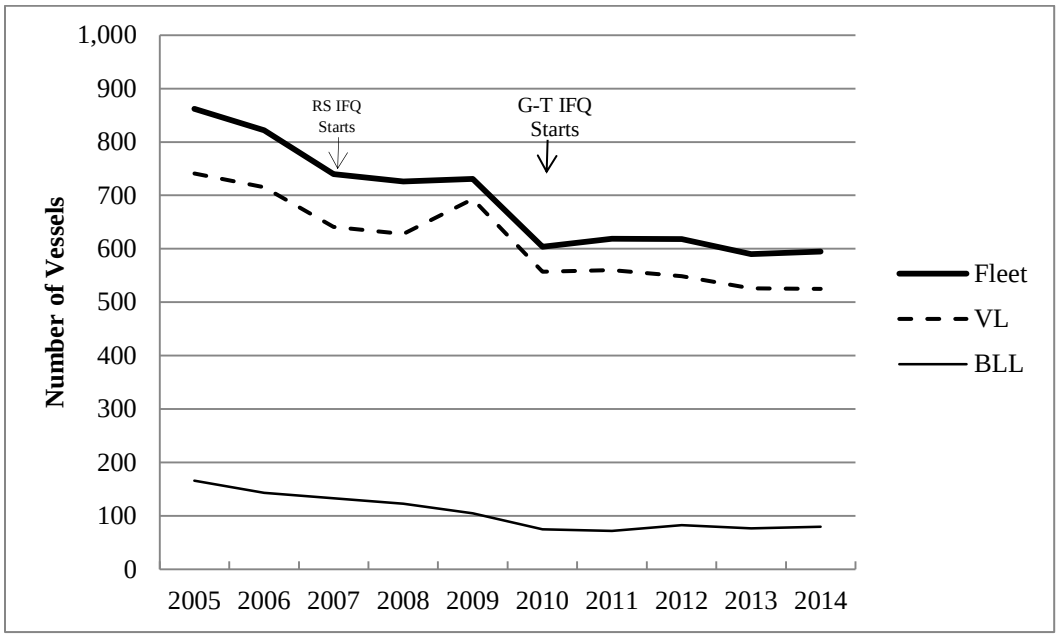
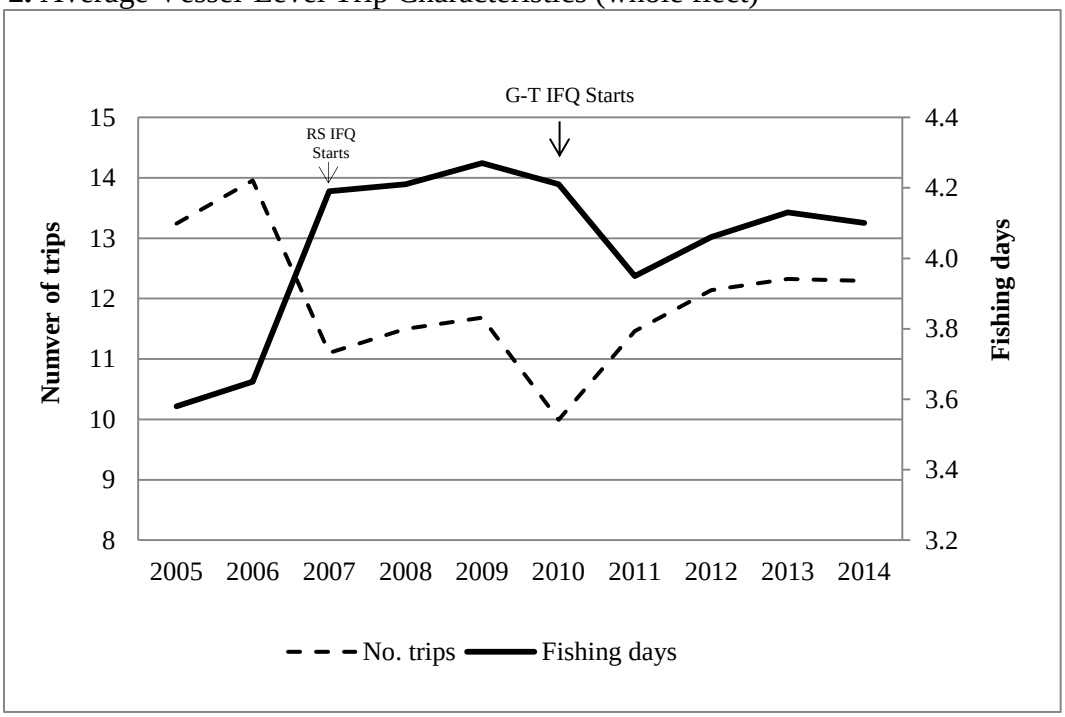


Figure 2. Average Vessel-Level Trip Characteristics (whole fleet)



As indicated, a translog functional form is used to estimate our ODF. The variables included in the model included seven outputs, three conventional inputs, biomass shock for the main species and a set of geographical dummies. The seven outputs were specified as total quarterly landings

of gag grouper, red grouper, other shallow-water groupers (OSWG), deep-water groupers (DWG), tilefishes, red snapper, and other species. Output levels are measured in pounds (gutted weight, g.w.) and gag output levels were used to normalize the OSDF and to impose linear homogeneity in outputs. The conventional inputs included vessel length, number of fishing days, and crew size. Fishing days and crew size were measured as total counts for each season.

The model also controls for changes in stock levels, technical change, and seasonal and regional variability in production. Spawning biomass indexes (stock) were used as proxies of abundance to capture the influence of variations in stock size on catch rates. Specifically, our model included stock levels for gag grouper, red grouper and red snapper. This information was provided by the NMFS. Quarterly dummy variables (Q_1, Q_2 and Q_3; Q_4 is the base quarter) were included to control for seasonal changes in fishing conditions and fishing areas dummies were added to account for productivity differences across the different fishing grounds in the Gulf region (Figure 3). Linear and quadratic time trends were included to account for technical change. Table 1 presents key summary statistics of the variables included in the empirical model.

Figure 3. Studied Area

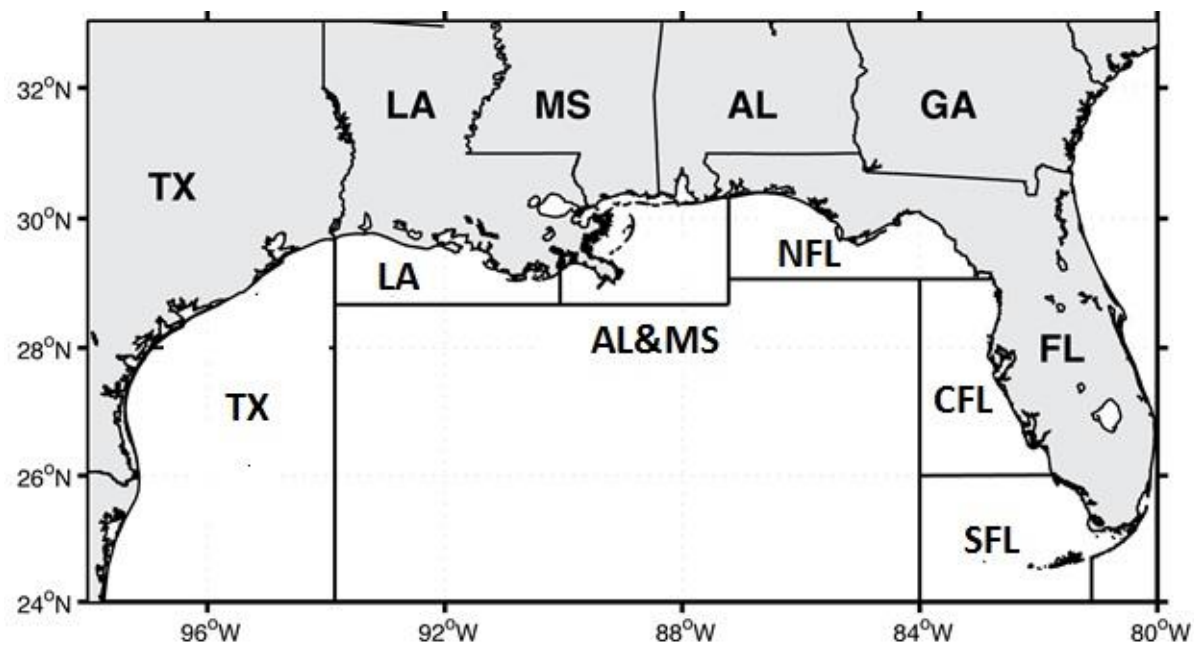


Table 1. Descriptive statistics.

			Vertical Line		Bottom Longline	
Variable	**Unit**	**Parameter**	**Mean**	**S.D.**	**Mean**	**S.D.**
Gag grouper landings	*lbs /trip*	y_1	70.52	236.55	205.13	454.64
Red grouper landings	*lbs/trip*	y_2	226.94	511.07	1971.89	2621.29
OSWG landings	*lbs/trip*	y_3	30.89	128.76	134.04	345.55
DWG landings	*lbs/trip*	y_4	19.81	148.43	642.82	1531.50
Tile landings	*lbs/trip*	y_5	2.99	56.98	345.62	1910.22
Red snapper	*lbs/trip*	y_6	445.49	1236.31	110.33	476.17
Other species landings	*lbs/trip*	y_7	617.35	1158.95	667.22	1126.33
Vessel Length	*feet*	x_1	36.10	9.14	43.63	9.92
Days away	*days*	x_2	3.40	2.85	7.47	4.75
Crew size	*count*	x_3	2.47	1.12	3.09	0.90
Texas (base dummy)	*dummy*	TX	0.07	0.26	0.04	0.20
Louisiana	*dummy*	LA	0.10	0.30	0.13	0.34
Alabama-Mississippi	*dummy*	ALM	0.07	0.25	0.04	0.20
South Florida	*dummy*	SFL	0.21	0.41	0.08	0.28
Center Florida	*dummy*	CFL	0.20	0.40	0.53	0.50
North Florida	*dummy*	NFL	0.35	0.48	0.16	0.37
Stock gag grouper	*Biomass*	$stock_{y1}$	11,113	4,222	10,990	4,424
Stock red grouper	*Biomass*	$stock_{y2}$	33,390	2,516	33,869	2,257
Stock red snapper	*Biomass*	$stock_{y6}$	43,947	13,925	42,735	14,595
N. Observations			***70,776***		***12,431***	

Results:

Model performance results:

- Reject that technical inefficiency does not exist (stochastic frontier model is better than regular production function).
- A log-likelihood ratio test confirms that the technology for the vertical line and bottom longline fleets are different, justifying the estimation of separate OSDF for vessels with alternative fishing gears rather than a combined frontier for the whole sample.
- The results also show that for both fleets, skill (efficiency) is more important than luck in explaining differences in landing levels across vessels.

Some general results from the analysis include:

- The results show that the pre- and post-GT-IFQ 5-year capacity averages declined significantly.

- Fleet capacity decreased between 17% and 34% depending on the capacity measure considered.
- We believe that C^{MAX} is the most sensible measure of fishing capacity because it maintains the current level of TE while allowing for variable input increases to maximum observed levels within the fishery.
- Thus, we use C^{MAX} as the benchmark capacity measure in this study (same used in red snapper review).
- Capacity measures decreased for all G-T species.
- Significant variation in magnitudes among species.
- Gag and OSWG presented the highest decrease with 65% and 63%, respectively.
- Red grouper presented the lowest decrease in capacity with 7%.

Table 2 shows the following results regarding measures of capacity utilization (CU) which indicates the proportion of fleet capacity that is effectively utilized:

- Using the maximum level of input use in the sample, we found a positive effect of the GT-IFQ on CU for both fleets (4% VL, 5.5% BLL).
- Using a 25% and 50% increase in the current input level use shows marginal changes on CU after the GT-IFQ.
- No big changes in CU after the GT-IFQ.

Table 2. Fleet average CU measures.

Period*	**Vertical Line**			**Bottom Longline**		
	$CU^{TE,MAX}$	**$CU^{TE,25}$**	**$CU^{TE,50}$**	**$CU^{TE,MAX}$**	**$CU^{TE,25}$**	**$CU^{TE,50}$**
Entire period	0.568	0.966	0.935	0.459	0.828	0.718
Pre-IFQ	0.558	0.966	0.934	0.450	0.825	0.713
Post-IFQ	0.581	0.967	0.936	0.475	0.834	0.727
% change	***4.0***	***0.1***	***0.2***	***5.5***	***1.2***	***2.1***

* Average CU measures during the time period.

Table 3 shows the following results regarding the measurement of fleet overcapacity (OC) which is the difference between capacity output and a desirable sustainable catch level (i.e. maximum sustainable yield):

- OC decreased significantly (32-69%) for all species except tilefish (increased by 17%).
- OC was still high after the implementation of the GT-IFQ program suggesting that the fleet is substantially larger than necessary to harvest the permissible quota.

Table 3. Fleet Overcapacity by species annually (1,000's lbs. g.w.).

Period*	GAG**	Red Grouper	OSWG	DWG	Tilefish
Whole period	--	1,676	1,150	1,290	1,104
2005-2009	--	1,998	1,754	1,625	1,019
2010-2014	71	1,355	547	956	1,190
% change	***--***	***-32.2***	***-68.8***	***-41.2***	***16.8***

* Annual average capacity measures during the time period.
** Prior to 2009 Gag grouper and Red grouper were part of the OSWG

Finally, Table 4 depicts the following results regarding optimal fleet size:

- Current fleet size could be decreased for all GT-IFQ species categories.
- Significant variation in magnitudes among species.
- 23% of the current fleet could harvest the red grouper quota; but 40% of the current fleet is needed to harvest the gag grouper quota, 28% for the OSWG quota, 62% for the DWG quota, and 45% for the TF quota.
- On average, we estimate that approximately 40% of the current fleet (240 vessels) could harvest the aggregate GT-IFQ quota in 2014.

Table 4. Optimum Fleet size in 2014 (currently 595 vessels)

GT-IFQ Category	GAG	Red Grouper	OSWG	DWG	Tilefish
No. of Vessels	241	136	160	365	270
% of the Fleet	*40.5*	*22.8*	*27.9*	*61.5*	*45.4*

APPENDIX B: COMMUNITY ANALYSIS AND STAKEHOLDER SURVEYS

B1 - Community Analysis

The following Executive Summary is part of a two volume final report describing research conducted from the late fall of 2014 into the summer of 2016 on the socioeconomic impacts of the Grouper Tilefish IFQ on fishing communities (Griffith et al., 2016 Vols. 1&2). Contractors were hired to conduct rapid ethnographic appraisals in communities within four different regions of the Gulf of Mexico (See Figure 4). The project team coordinated work by jointly developing interviewing protocols, check-lists, and other data gathering instruments, as well as conducting research in similar phases. Initial research began with two communities in each region listed in Figure 4, but researchers quickly found that they could not restrict their interviews, observations, and other work solely to those communities. In other words, the grouper-tilefish fleets were spread out over multiple communities in each region.

Figure 4. Grouper-Tilefish IFQ Study Communities

Research began with windshield surveys using marine inventory check-lists of the community's fishing infrastructure, support services, and fleets. With the assistance of shareholders lists, researchers began contacting participants in the IFQ program to interview, including fishermen, dealers, captains, crew, and shareholders who no longer participate directly in the fishery. During the course of fieldwork, in each region, researchers collected background information from census materials and in local bookstores, libraries, newspapers, and other archival venues. A comprehensive literature review about IFQ programs in other parts of the United States and world is included in Volume 1 along with analysis of fishery engagement and reliance and community social vulnerability (Griffith et al., 2016, Vol. 1).

Executive Summary

The Gulf of Mexico Grouper-Tilefish Individual Fishery Quota (IFQ) Program has been in effect since 2010, established by the National Oceanographic and Atmospheric Association (NOAA) National Marine Fisheries Service (NMFS) in cooperation with the Gulf of Mexico Fishery Management Council (GMFMC) to address three principal perceived problems with the fishery: overcapitalization of the fleet, fishing inefficiency, and derby fishing. A limited entry strategy, the Program initially allotted shares in the fishery (percentages of the overall quota of grouper, tilefish species that may be accessed) and distributed annual allocation (pounds of grouper, tilefish species that may be landed) to over 700 individuals with a reef permit and proven history of participation in the fishery with data from their vessel. Those who did not receive shares from this initial allotment could only access the fishery by purchasing shares or leasing allocation from existing shareholders. While shares continue ad infinitum, the annual allocation if not used in the calendar year, does not roll over to the next year. Allocation is determined at the beginning of the year after the Total Allowable Catch (TAC) is set. Shareholders receive shares, their allotted percentage of the TAC for the grouper-tilefish species categories, and allocation for the year.

Put into effect shortly after the Gulf of Mexico Red Snapper IFQ Program was established in 2007, the Grouper-Tilefish IFQ Program has had a variety of real and perceived socioeconomic impacts. The Program has created some anxiety over future management initiatives that may force fishermen used to participating in diverse, multi-species fisheries to specialize. As such, fishery managers and Council members and staff require feedback on how the Program has affected commercial fishing families and communities during its first five years of operation. This report constitutes an evaluation of the Grouper-Tilefish IFQ Program five years after its inception using rapid ethnographic procedures in four regions of the Gulf of Mexico: Southwest-Central Florida, the Florida Panhandle, Louisiana's Bayou Lafouche Corridor, and Texas's Galveston Bay. In each of the regions, multiple commercial fishing families, neighborhoods, organizations, and enterprises comprise the "fishing community," and in no region did researchers find a homogeneous, monolithic fishing community representing the entire region. Instead, the grouper-tilefish fishery like other fisheries of the Gulf generally is a diverse, multi-gear, and multi-species fishery. Participants in the fishery view the fishing community as both an association with a geographical area and an affiliation with people who make some or all of their living from the sea.

The goal of this research was to assess the socioeconomic impacts of the Grouper-Tilefish IFQ Program on the fishing communities in the four regions and, by extension, in the Gulf in general. Specifically, the researchers were tasked with collecting and analyzing data about the Program, compiling a review of relevant literature about catch shares, IFQ, and similar programs, and assessing the program's impacts with social indicators. Research began in the late fall of 2014 and lasted into the summer of 2016.

The research methods included: windshield surveys; direct observations; taking photographs; in-depth and shorter-term interviews with participants in the IFQ program (e.g. commercial fishermen, captains and crew, seafood dealers and processors, fisheries scientists, and others associated with the fishery); background reading and a comprehensive review of the literature; visiting local archives and collections; and reviewing census, landings, and other official data sources. Analysis varied across regional studies, but generally involved a qualitative assessment

of the data collected, with attention to how views of the IFQ program varied among participants based on factors such as the shares allocated to them, history of participation in the fishery, and other factors.

Findings

1. The grouper-tilefish fishery and red snapper fishery are historically interrelated and overlap. Reef fishermen harvested grouper, red snapper, and tilefish in the past. Today, the Grouper-Tilefish and Red Snapper IFQ Programs separate and regulate these fisheries, although many, if not most, commercial reef fish fishermen participate in both programs. While fishermen recognize a general predominance of grouper in the eastern Gulf and red snapper in the western Gulf, the recent influx of red snapper into the eastern Gulf complicates the harvesting and management of these fisheries.

2. In all regions, the initial allotment of shares in the Grouper-Tilefish IFQ Program has become a point of contention among fishermen. Among other aspects of the initial allocation, some individuals objected to: a) NOAA's presumed right to allocate a public natural resource among private citizens; b) perceived problems with how one's history in the fishery was established; and, especially; and c) individuals with no direct participation in the fishery owning and leasing their shares without assuming any of the physical or economic risks of commercial fishing.

3. The program has achieved its goal of addressing overcapitalization of the fleet, reducing the numbers of participants in the fishery and moving toward increased consolidation of fishing effort. While this may have been a desirable outcome of the program, it contradicts the history of Gulf fisheries, which tend to be diverse, multispecies, and multi-gear fisheries. Some fishermen believe that the program rewarded those who practiced less ecologically sound fishing practices, giving shares to those who had specialized in grouper rather than fishing over the full range of Gulf of Mexico fin fish.

4. Those who have to lease allocation to participate in the fishery, including captains and crew who received no shares, must add this expense to the other costs associated with commercial fishing (e.g., vessel maintenance, servicing loans, fuel, ice, bait, tackle). Quite often, the lease expense is passed on to the captains and crew by deducting this from their share of the catch, even in cases where the shareholder either owns the vessel or is the seafood dealer where the captain and crew will sell their catch.

5. Captains and crew often have to pay the 3% recovery fee that is passed on to the government to administer the program. Some captains and crew have little to no idea what this fee pays for, believing that it is an additional unjust tax that has cut into their annual income. In other cases, shareholders and dealers alone pay the recovery fee, sometimes noting the high cost and not fully understanding the purposes of the fee.

6. The impacts of the Grouper-Tilefish IFQ program have not been as pronounced in the western regions (Texas and Louisiana) as in the two Florida regions, in part due to the more recent historical distribution of the stock, with red snapper and red snapper IFQ shareholders being more prevalent in the western Gulf and Grouper-Tilefish species

being more prevalent in the eastern and southern Gulf. The rough boundary between the two regions, according to local ecological knowledge, is Apalachicola Bay. Most fishermen interviewed reported that the red snapper stock, however, has expanded its territory, returning to the eastern Gulf and becoming a nuisance to grouper fishing.

7. The program has altered labor relations in the fishery. Some captains and crew with long histories of participation were not allotted shares in the fishery because the shares went to boat owners with reef permits rather than to fishermen on the vessels. Because the cost of leasing allocation and often the recovery fee are taken out of the captain's and crew's share of the catch value, some fishermen believe the IFQ Program has turned captains and crew into workers similar to sharecroppers, providing all of the labor of fishing for less than 50% of the share of the catch. This is particularly troubling to captains and crew when they have to lease allocation from the vessel owner for whom they are fishing. This has created a disincentive to entering the fishery.

8. The program has changed relations between fishermen and fish dealers in a few ways. On the one hand, fishermen who own enough shares to fish year-round, and who are neither obligated nor reliant on dealers for dock space, ice, fuel, credit, etc. are now free to market their catch in multiple venues. These independent fishermen may market their catch to the highest paying dealer or directly to seafood restaurants or retail markets. On the other hand, captains and crew who rely on shareholders and dealers to lease them allocation and provide dock space, ice, fuel, credit, etc. have fewer options and become even more dependent on dealers.

9. The program allows fishermen flexibility to decide when and how long to fish, and the majority of fishermen recognize this as a benefit of the IFQ Program. Fishermen may "choose their weather" and land fish throughout the year. In other words, fishermen who own shares can now decide to fish their shares all year round instead of during the first few months of the year, as usually occurred prior to the IFQ Program. This has reduced derby fishing and also means that fishermen need not fish in bad weather, when they are ill, or when their boats require maintenance, thus improving safety in the fishery. Other fishermen have stated that derby fishing did not occur in the grouper fishery, only in the red snapper fishery, and that they fish when the fish are out there regardless of the weather.

10. Some boat owners and fishermen reported that the ability to fish throughout the year has also resulted in increased stability of work and higher quality captains and crew in the fishery. Prior to the IFQ, during derby fishing, these participants state that vessel owners were forced to hire as many crew as they could to fish the resource as hard as possible, resulting in having to hire crew who were less high quality and less reliable. With a longer season, they argue, vessel owners can now keep captains and crew employed all year round. Although fewer individuals are hired into the fishery, those that are hired are of higher quality. Conversely, other boat owners, fishermen, and dealers reported difficulty in finding good captains and crew. These participants state that the caliber of captains and crew has declined as a result of the Grouper-Tilefish IFQ Program. This,

they believe, is because there is no future or economic gain for captains and crew who do not hold shares and must lease allocation.

11. The IFQ program has enabled some fishermen to engage in more detailed, year-round planning as to when and where they will fish, including switching from IFQ species to those, such as vermillion snapper, that are not covered by an IFQ. The increased opportunity to plan out their fishing year has allowed them to spend more time with family.

12. Nearly all grouper fishermen on the eastern Gulf Coast reported an invasion of red snapper and having to "fish through the red snapper." Without holding red snapper IFQ program shares or allocation, these fishermen complained about the resulting bycatch, regulatory discards of red snapper. Although reasons for the increase in the red snapper population ranged from red snapper following an oil pipeline from Alabama to Tampa Bay to a year of closure, fishermen reported that red snapper, a voracious feeder, are congregating in, above, and around grouper territories. As such, they have to fish through the snapper to reach the grouper. In the process, red snapper are caught among the grouper, forcing fishermen to secure allocation, and if unable, to discard or "high grade" the red snapper (keep only the best they are allowed to land). [No one in my region mentioned filleting at sea. Since this is not widespread and against the law, I suggest deleting it.] All of those who experienced inordinate bycatch and resulting regulatory discard of red snapper considered this a morally reprehensible waste of the resource.

13. Some fishermen object to the advanced nature of surveillance that has accompanied the IFQ program (i.e. Video Monitoring Systems, which have been advocated by non-governmental organizations), complaining about the cost of the system, but others expressed the belief that the heightened surveillance would result in better landings data and improve the image of commercial fishermen in the eyes of the state. These fishermen saw this as helping them politically, particularly in relation to what they considered poor data collected by recreational fishermen.

14. Those who have few to no shares in the program, as well as some of those who lease all or the majority of their allocation, have had to target other high value species in the Gulf of Mexico. The most commonly mentioned species in the Florida Panhandle was Vermillion Snapper (*Rhomboplites aurorubens*) and the most commonly mentioned species in Southwest-Central Florida was Amberjack (*Seriola dumerili*). [Note: no one mentioned Vermillion Snapper in my region] Others targeted King Mackerel (*Scomberomorus cavalla*). Because many believe that each of these species will eventually be placed under an IFQ management program, part of their incentive for targeting these species is to establish a history of participation so that they will receive future shares in the fishery.

15. The vast majority of those interviewed expressed concern about the future of the fishery. While many fishermen said that the IFQ program had assured the sustainability of grouper-tilefish fisheries, they were unsure about the longevity of commercial fishing.

The majority recognized an aging population of fishermen and a dearth of younger fishers in the fishery. The majority said that the barriers to entry into the fishery, particularly the costs of leasing allocation, high share prices, the inability to purchase shares, the costs of purchasing a boat, reef permit, VMS equipment, and recovery fees relative to ex-vessel prices, among others, would prevent younger fishers from entering the fishery.

Recommendations

In addition to these findings, those interviewed made many recommendations concerning how to improve the Grouper-Tilefish IFQ Program. The research team concurred with some of their recommendations, but were less inclined to agree with others. Those with which the research team concurred are presented below.

1. Steps should be taken to curb the practice among some of passing the recovery fee and leasing costs onto captains and crew. Shareholders are the principal beneficiaries of state oversight of the program, which the recovery fee pays for, and also benefit from the leasing allocation, yet assume little to no risk of catching fish. As such, it is unjust to pass recovery fees and leasing costs onto captains and crew and feeds the idea that the IFQ program has turned captains and crew into sharecroppers.

2. A mechanism should be in place for captains and crew without shares or owned vessel to establish history in the fisheries, so that they may benefit from the allotment of future shares and allocation.

3. Allowing people with no direct physical participation in the fishery to purchase shares in the fishery should be reconsidered. Nearly all IFQ participants interviewed believe that shareholders need to have, in their words, "skin in the game." By this they refer to people who actually assume the risks of searching for, catching, landing, processing, and otherwise handling the catch, or those who have spent lifetimes in these pursuits and now have retired from the fishery.

4. There needs to be some mechanism to bring new fishermen into the fishery, allowing some way for shares to be allotted as they become available. This will address, in part, the issue of the longevity of the fishery, or the fishery's ability to reproduce itself and continue providing high quality fish to the public.

5. The issue of bycatch and regulatory discards of red snapper needs to be addressed in a way that reduces the bycatch, discards of bycatch, and incentives for "high-grading." Before the Grouper-Tilefish and Red Snapper IFQ Programs, much of the bycatch in the past was given away to people in the community who could not afford such high quality protein otherwise.

6. Fisheries managers need to rethink the wisdom of putting every species under an IFQ program. This contradicts both other management measures that focus on ecosystems rather than individual species or species groups (e.g. Marine Protected Areas) and the

realities that many Gulf of Mexico fisheries participate in multiple fisheries over the course of a year.

B2 - GT-IFQ Participants Survey

Survey Title: Survey of Participants in the Gulf of Mexico Grouper-Tilefish Individual Fishing Quota Program (2014)
GT-IFQ Report Reference: QuanTech, Inc. (2015)

Purpose of the Study: QuanTech, Inc. in partnership with SEFSC/SERO conducted an online survey with follow ups using mail and call backs to:

- collect demographic and social information on the participants in the GT-IFQ program,
- elicit attitudes and perceptions about the performance of the GT-IFQ program, paying special attention to crewmember experiences, changes in fishing practices, and relationships with dealers,
- analyze perceptions regarding potential GT-IFQ outcomes, investment and disinvestment decisions, future plans in the grouper-tilefish component of the reef fish fishery, share and allocation transfers and process, and
- compare the attitudes and perceptions relative to the GT-IFQ with those reported in other IFQ program studies.

Methodology: The survey attempted a census of 997 GT-IFQ accounts on record as holding shares or allocation as of January 1, 2014. QuanTech worked with NMFS personnel to develop a multi-mode approach to data collection. Program participants had the option to complete the survey through an online tool linked to their GT-IFQ account, by mail, or by telephone. A pre-notification letter was mailed in March 2014 encouraging participation and listing the online survey web address and QuanTech's toll-free telephone number. The letter invited respondents to participate in the survey online or, if preferred, to request a hard copy of the survey and participate through mail. As participants signed into their GT-IFQ accounts during the survey period they were prompted to complete the survey online.

As of April 24, 2014 there were 824 potential respondents who did not request a hard copy or completed the online survey, and whose pre-notification letter was not returned undeliverable without a forwarding address. A questionnaire package was mailed to each potential respondent by April 28, 2014. Each package contained a cover letter, survey, and business-reply return envelope (no postage necessary). Five business days after mailing the questionnaire packages, we followed up with thank you/reminder post cards. On May 29, 2014, all respondents (those who completed the survey online or by mail) were removed from the sample frame, and a second questionnaire package was mailed to the remaining potential 679 respondents. Online and mail submissions were tracked until July 7, 2014, and respondents were removed from the sample frame once more. QuanTech then called the remaining 548 potential respondents to recruit them to participate in the survey. Follow-up calling was completed by July 10, 2014, resulting in contact with 145 account holders. Of the 145 contacts, 84 (58%) either completed the survey, promised

to do so or requested a new copy of the questionnaire, while 57 (39%) refused the survey. Excluding bad or wrong phone numbers, the contact rate for the telephone follow-up was 37%.

Table 1 shows the number of completed surveys received from the time of data collection implementation through August 20, 2014. Two hundred ninety-one responses to the survey were received. Online submissions from 19 respondents either gave IFQs that were not included in the sample frame or did not provide any identifying information using the online survey tool. A total of at most 25 responses were received subsequent to the telephone follow-up, 32% of the 78 respondents either promised to complete the questionnaire or requested a third copy.

Table 1: Completed GT-IFQ participant surveys.

Completed Online Surveys	Completed Paper Surveys	Total Completed Surveys from All Respondents	Online Surveys from Respondents that Could Not be Matched to the Original List	Total Completed Surveys from Respondents Matched to the Original List
119	172	291	19	272

Table 2 shows the response rate for the survey for all 997 GT-IFQ user accounts. The 272 completed surveys from respondents matched to the sample frame represent 331 GT-IFQ user accounts. 19 respondents could not be matched to the original account list. The completed surveys accounted for 33.2% of the IFQ user accounts. Over half the refusals (56 out of 93) were obtained during follow-up telephone calling.

Table 2: Response rates for the GT-IFQ participant survey.

Survey Status	N	%
Paper Survey Complete	199	*19.96*
Web Survey Complete	132	*13.24*
Deceased	4	*0.40*
Returned Mail No New Address	40	*4.01*
Ineligible	7	*0.70*
No Response	522	*52.36*
Refused	93	*9.33*
All	997	*100.00*

Table 3 shows the response rate for the survey for all 997 IFQ user accounts. The 272 completed surveys from respondents matched to the sample frame represent 331 IFQ user accounts. Of the 19 respondents that could not be matched to the sample frame, all were completed online, eight left the IFQ User ID blank, eight are legitimate IFQ User Accounts, but were not on our list, 1 was

a dealer account, and two were invalid IFQ User ID's. The completed surveys accounted for 33.2% of the IFQ user accounts. Over half the refusals (56 out of 93) were obtained during follow-up telephone calling.

Table 3: The response rates for the survey including the number of IFQ accounts with completed surveys, number of refusals, mail packages returned with no new address, deceased IFQ account holders, ineligible respondents contacted, and non-responses.

Survey Status	N	%
Paper Survey Complete	199	*19.96*
Web Survey Complete	132	*13.24*
Deceased	4	*0.40*
Returned Mail No New Address	40	*4.01*
Ineligible	7	*0.70*
No Response	522	*52.36*
Refused	93	*9.33*
All	997	*100.00*

Survey Instrument: The survey consisted of 40 questions arranged in six sections (see QuanTech, Inc. (2015) for the full survey):

- Background Information
- Attitudes and Perceptions Concerning the GT-IFQ Program
- Socioeconomic Assessment of the GT-IFQ Program
- Transfer of GT-IFQ Allocation or Shares
- Social Well-Being and Demographic Information
- Other Issues (focused on GT-IFQ program operations)

Results: The results in this section include data from respondents who were on the sample frame of 997 IFQ User IDs provided to QuanTech by NMFS. QuanTech received paper surveys representing 199 IFQ User IDs and surveys were submitted online representing 132 IFQ User IDs from the sample frame. There were 81 refusals matched to the sample frame. There were 7 individuals on the sample frame who claimed they never participated in the program despite having an IFQ User ID (i.e. they purchased a vessel and permit but never participated in the fishery). The number of potential respondents on the sample frame who did not return a completed questionnaire or participate online was 666. Tables 4-41 show summary data and statistics for the data collected on the survey from respondents on the sample frame and respondents who were not on the sample frame.

Background Information

In this section of survey, respondents were matched to their GT-IFQ accounts and were allowed to use one survey for multiple accounts if they liked. Respondents on average first became involved in the grouper-tilefish (GT) fishery in 1994-1995 with a median start date of 1998.

Attitudes and Perceptions Concerning the GT-IFQ Program

In this section of the survey, program participants were asked about their views about the GT-IFQ program before and after implementation. A referendum was implemented in 2007 and asked GT fishermen if they supported the implementation of the GT-IFQ sometime in the future. 58% of the respondents to this survey did not vote in that referendum. 38% of respondents to this survey indicated that they supported the GT-IFQ program on the date of implementation (January 1, 2010), while 44% did not support the GT-IFQ at that time and 12% were undecided. Support increased over time as 45% of respondents indicated that they supported the GT-IFQ in 2014, while 40% do not support the program and 15% are undecided. Table 4 depicts the level of satisfaction in 2014 among GT-IFQ participants with the program showing only 39% are satisfied while 48% exhibit some level of dissatisfaction. Thus, there are approximately 6% of participants that support the program but are not satisfied with it five years after implementation.

Table 4: Current satisfaction with the GT-IFQ Program.

Overall, how satisfied are you with the GT-IFQ Program?	N	%
Highly Unsatisfied	89	*33.21*
Unsatisfied	41	*15.30*
Neutral	22	*8.21*
Satisfied	54	*20.15*
Highly Satisfied	51	*19.03*
N/A	11	*4.10*
All	268	*100.00*

Table 5 looks into detail of some of the reasons that participants are either satisfied or dissatisfied with the GT-IFQ. Some interesting points gleaned from Table 5 include:

- 39% of respondents thought that the profitability of their business increased due to increasing ex-vessel prices while only 23% thought an increase in profits was due to decreased operating expenses.
- There was majority agreement that the GT-IFQ provided more flexibility in timing trips (54%), reduced derby-fishing conditions (67%), and decreased crowding on fishing grounds (52%).
- Only 31% and 27% of respondents felt that the IFQ reduced regulatory discards of GT species and incidental catch of non-targeted species, respectively.
- 44% of respondents disagreed that the GT-IFQ reduced the loss of gear.

Table 5: A table showing the number of respondents that indicated their opinion in regards to their opinions of potential outcomes of the G-T IFQ Program.

For each potential GT-IFQ outcome below, please indicate your opinion by checking the appropriate box.	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		No Opinion		All	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Improved the profitability of the grouper-tilefish (G-T) component of my business by increasing ex-vessel prices	59	*22.61*	30	*11.49*	48	*18.39*	51	*19.54*	53	*20.31*	20	*7.66*	261	*100.00*
Improved the profitability of the grouper-tilefish (G-T) component of my business by reducing operating expenses	86	*33.86*	60	*23.62*	32	*12.60*	28	*11.02*	32	*12.60*	16	*6.30*	254	*100.00*
More flexible timing for conducting commercial fishing trips	48	*18.53*	32	*12.36*	27	*10.42*	62	*23.94*	80	*30.89*	10	*3.86*	259	*100.00*
Reduced regulatory discards of G-T species	59	*22.78*	55	*21.24*	46	*17.76*	44	*16.99*	41	*15.83*	14	*5.41*	259	*100.00*
Reduced incidental catch of non-targeted species	66	*25.48*	56	*21.62*	56	*21.62*	35	*13.51*	35	*13.51*	11	*4.25*	259	*100.00*
Reduced the loss of gear	49	*18.85*	66	*25.38*	77	*29.62*	24	*9.23*	24	*9.23*	20	*7.69*	260	*100.00*
Reduced derby-fishing conditions	32	*12.36*	13	*5.02*	28	*10.81*	68	*26.25*	105	*40.54*	13	*5.02*	259	*100.00*
Decreased crowding on fishing grounds	35	*13.41*	38	*14.56*	40	*15.33*	78	*29.89*	57	*21.84*	13	*4.98*	261	*100.00*
Improved safety at sea	42	*16.22*	40	*15.44*	45	*17.37*	48	*18.53*	66	*25.48*	18	*6.95*	259	*100.00*
Increased consolidation in the G-T sector	16	*6.30*	26	*10.24*	67	*26.38*	67	*26.38*	49	*19.29*	29	*11.42*	254	*100.00*
Made it harder for people to enter the G-T sector	22	*8.46*	18	*6.92*	31	*11.92*	73	*28.08*	99	*38.08*	17	*6.54*	260	*100.00*
Improved compliance with regulations associated with G-T species	32	*12.26*	36	*13.79*	56	*21.46*	66	*25.29*	56	*21.46*	15	*5.75*	261	*100.00*

Socioeconomic Assessment of the GT-IFQ Program

This section of the questionnaire primarily examines the effect of the GT-IFQ on the operations of the program participants' commercial fishing business. One question asked if the GT-IFQ resulted in any major purchases of capital. 40 respondents indicated that they had purchased a vessel due to the GT-IFQ. These purchases averaged $139,325 while the median vessel purchased cost $77,500. Likewise, 35 respondents reported making major equipment purchases due to the GT-IFQ. Equipment purchases averaged $39,414 among these operators with the median equipment purchase reported as $25,000. 49 respondents reported purchasing new permits due to the GT-IFQ at an average and median cost of $24,603 and $10,000, respectively, while 76 program participants reported purchasing GT-IFQ shares spending an average of $162,686 with median cost listed as $50,000.

On the other hand, another question asked if the GT-IFQ resulted in any major sales of capital. 36 respondents indicated that they had sold a vessel due to the GT-IFQ. These sales averaged $45,319 while the median vessel sold at $37,500. 10 respondents reported selling equipment due to the GT-IFQ. Equipment sales averaged $5,600 with the median equipment sale reported as $3,250. 29 respondents reported selling permits due to the GT-IFQ at an average and median

amount of $13,448 and $5,000, respectively, while 33 program participants reported selling GT-IFQ shares receiving an average of $59,817 with median revenue listed as $50,000.

This section also examined the effect of the GT-IFQ on labor dynamics. 30% of respondents found it difficult to maintain skilled crew after implementation of GT-IFQ compared to 18% who thought maintaining skilled crew was difficult before the GT-IFQ. Similarly, 31% reported that I was difficult to hire skilled replacement crew after the implementation of GT-IFQ compared to 21% with the same sentiment prior to GT-IFQ. Conversely, the amount of respondents that found it easy to maintain and hire skilled crew fell after GT-IFQ from 30% to 25% and 27% to 20%, respectively. 27% of respondents indicated that they generally hired a captain to fish some or all of their GT-IFQ allocation. Of the 68 respondents that hired captains to fish GT-IFQ allocation, over 80% still paid hired captains a share of total revenues after deductions rather than a share of revenue with no deductions or a flat rate. These expenses included fuel, bait, grocery, payments to crew and other expenses while 69% reported deducting IFQ allocation expenses from revenue before paying the captain. 59% of respondents indicated that they generally employed crew when fishing their GT-IFQ allocation. Of the 145 respondents that hired crew to fish GT-IFQ allocation, over 80% still paid hired crew a share of total revenues after deductions rather than a share of revenue with no deductions or a flat rate. These expenses included fuel, bait, grocery, and other expenses while 63% reported deducting IFQ allocation expenses from revenue before paying the crew. Remuneration payments did not change due to GT-IFQ as the median amount of the distribution of payments to vessel owners, captains and crew remained at 50%, 30% and 25%, respectively.

Transfer of GT-IFQ Allocation or Shares

This section looked at the dynamics of GT-IFQ allocation and share transaction among program participants. Respondents reported a median fair allocation price per pound of $1.10 for DWG, $2.00 for gag/gag-multi, $1.00 for RG, $1.00 for OSWG, and $0.75 for TF. The median fair share price per pound reported was $10.00 for DWG, $12.00 for gag/gag-multi, $7.00 for RG, $7.00 for OSWG, and $5.00 for TF.

65% of respondents said that they had received transferred allocation from another IFQ account. Table 6 looks into detail of some of the reasons that participants received allocation. Some interesting points gleaned from Table 6 include:

- Important reasons for receiving allocation included lack of financial resources to purchase shares (79%), and riskiness of purchasing shares due to stock assessments and sector allocation (86%), uncertainty with duration of GT-IFQ program (85%), future harvesting costs (73%), and ex-vessel prices (62%).
- 51% did not think that it was important to own shares rather than purchase allocation to provide greater flexibility for commercial operations.
- 75% reported that it was important to purchase allocation so that they would not have to discard G-T species.
- 33% felt it was important to buy allocation to sell or give to other fishermen.

Table 6: The number of respondents who indicated, by importance, reasons they received (e.g., leased, gifted) transferred GT-IFQ allocation FROM another IFQ account.

If you received (e.g., leased, gifted) transferred GT-IFQ allocation FROM another IFQ account, how important were the following reasons for doing so?	Not Important		Somewhat Important		Very Important		All	
	#	%	#	%	#	%	#	%
I did not have the financial resources at the time to purchase IFQ shares.	32	*20.51*	33	*21.15*	91	*58.33*	156	*100.00*
I only need (additional) allocation for a relatively short period of time (e.g., a single fishing year).	58	*38.16*	47	*30.92*	47	*30.92*	152	*100.00*
I want to be able to retain grouper-tilefish species which I would have otherwise discarded.	38	*24.84*	21	*13.73*	94	*61.44*	153	*100.00*
Over the long run, I believe that buying allocation on an annual basis will be less expensive than purchasing an equivalent amount of shares.	59	*40.41*	42	*28.77*	45	*30.82*	146	*100.00*
Purchasing annual allocation provides greater flexibility than owning IFQ shares.	75	*50.68*	44	*29.73*	29	*19.59*	148	*100.00*
I consider the buying of additional IFQ shares as too risky due to uncertainty in: future ex-vessel prices	56	*37.84*	37	*25.00*	55	*37.16*	148	*100.00*
I consider the buying of additional IFQ shares as too risky due to uncertainty in: future commercial quotas due to changes in stock assessments or modifications to the commercial/recreational allocation	21	*13.91*	32	*21.19*	98	*64.90*	151	*100.00*
I consider the buying of additional IFQ shares as too risky due to uncertainty in: future harvesting costs	41	*26.97*	36	*23.68*	75	*49.34*	152	*100.00*
I consider the buying of additional IFQ shares as too risky due to uncertainty in: the duration of the GT-IFQ Program	23	*14.94*	27	*17.53*	104	*67.53*	154	*100.00*
I consider the buying of additional IFQ shares as too risky due to uncertainty in: other (please specify)	14	*38.89*	3	*8.33*	19	*52.78*	36	*100.00*
I bought allocation to sell or give to other fishermen.	79	*66.39*	20	*16.81*	20	*16.81*	119	*100.00*
Other	9	*45.00*	1	*5.00*	10	*50.00*	20	*100.00*

Respondents who received allocation were asked to describe the arrangement with the IFQ account seller. There were 113 respondents who indicated they received allocation with no arrangements/restrictions being placed on the allocation received from the IFQ account seller. There were 48 respondents who indicated they received allocation with an arrangement that they sell their catch to a specified dealer. There were 15 respondents who indicated they received allocation with other arrangements.

57% of respondents said that they had transferred allocation to another IFQ account. Table 7 looks into detail of some of the reasons that participants transferred allocation. Some interesting points gleaned from Table 7 include:

- Important reasons for transferring allocation included reducing financial uncertainty (57%), barter for red snapper or other GT-IFQ allocation or shares (56%), and transferring to another of the participant's accounts (49%).
- Insufficient vessel fishing capacity or labor resources was not generally an important reason to transfer allocation, nor was selling their permit or illness.
- 42% responded that vessel repairs prevented them from fishing their allocation.

Table 7: The number of respondents who indicated, by importance, reasons they transferred (e.g., leased, gifted) transferred GT-IFQ allocation TO another IFQ account.

If you transferred (e.g., leased, gifted) GT-IFQ allocation TO another IFQ Account, how important were the following reasons for doing so?	Not Important		Somewhat Important		Very Important		All	
	#	%	#	%	#	%	#	%
I received a higher return from TRANSFERRING allocation than from fishing it.	72	*60.50*	21	*17.65*	26	*21.85*	119	*100.00*
Reduced financial uncertainty.	50	*43.10*	30	*25.86*	36	*31.03*	116	*100.00*
Illness or health issues prevented me from fishing.	79	*67.52*	11	*9.40*	27	*23.08*	117	*100.00*
Vessel repairs prevented me from fishing.	67	*58.26*	18	*15.65*	30	*26.09*	115	*100.00*
My allocation from shares is too small to be worth harvesting.	74	*63.25*	13	*11.11*	30	*25.64*	117	*100.00*
The vessel fishing capacity availability that I have is insufficient to allow for the harvest of my allocation.	95	*85.59*	11	*9.91*	5	*4.50*	111	*100.00*
The amount of labor (captain and crew) that I have is insufficient to allow for the harvest of my allocation.	84	*75.00*	14	*12.50*	14	*12.50*	112	*100.00*
I TRANSFERRED allocation as barter for red snapper or other species IFQ allocation/shares.	51	*44.35*	26	*22.61*	38	*33.04*	115	*100.00*
I no longer have a Gulf of Mexico reef fish permit.	93	*87.74*	3	*2.83*	10	*9.43*	106	*100.00*
I transferred allocation to my other IFQ account(s).	53	*50.96*	11	*10.58*	40	*38.46*	104	*100.00*
Other	16	*72.73*	1	*4.55*	5	*22.73*	22	*100.00*

Respondents who transferred allocation were asked to describe the arrangement with the IFQ account receiving the allocation. There were 106 respondents who indicated they transferred allocation with no arrangements/restrictions being placed on the transferred allocation. There were 19 respondents who indicated they transferred allocation with an arrangement that that the IFQ account to which the transfer was made would deliver the catch to a specified dealer. There were 14 respondents who indicated they transferred allocation with other arrangements.

39% of respondents said that they had purchased GT-IFQ shares. Table 8 looks into detail of some of the reasons that participants purchased shares. Some interesting points gleaned from Table 8 include:

- Reasonable asking prices for the purchased share was important in regards to fishing income (89%) and the future returns from the sale of shares (65%) and annual allocation (63%).
- 91% thought that it was important because additional shares would allow them to fish more efficiently.
- 61% reported that it was important to purchase shares so that they would not have to discard G-T species.
- 70% anticipate increases in total allowable catch after future stock assessments

Table 8: The number of respondents who indicated, by importance, reasons they purchased GT-IFQ shares.

If you purchased GT-IFQ shares, how important were the following reasons for doing so?	Not Important		Somewhat Important		Very Important		All	
	#	%	#	%	#	%	#	%
The asking price for the purchased shares was reasonable compared to the financial return I anticipated from fishing the additional shares.	10	*10.75*	27	*29.03*	56	*60.22*	93	*100.00*
The asking price for the purchased shares was reasonable compared to what I anticipate I will be able to sell the shares.	32	*34.78*	29	*31.52*	31	*33.70*	92	*100.00*
The asking price for the purchased shares was reasonable relative to the return I anticipated from selling the related annual allocation.	34	*37.36*	25	*27.47*	32	*35.16*	91	*100.00*
I believed that the additional shares would allow me to fish at a more efficient level.	9	*9.68*	10	*10.75*	74	*79.57*	93	*100.00*
I needed additional shares because I wanted to retain the grouper-tilefish I land as bycatch.	37	*39.36*	21	*22.34*	36	*38.30*	94	*100.00*
I anticipated that Total Allowable Catch (TAC) will increase after the next stock assessment	27	*29.67*	29	*31.87*	35	*38.46*	91	*100.00*
Other	9	*50.00*	3	*16.67*	6	*33.33*	18	*100.00*

26% of respondents said that they had sold GT-IFQ shares. Table 9 looks into detail of some of the reasons that participants transferred allocation. Some interesting points gleaned from Table 9 include:

- Important reasons for transferring allocation included relatively high selling price (57%).
- Excess shares, expected devaluation and leaving the fishery were generally not important reasons to sell share.

Table 9: The number of respondents who indicated, by importance, reasons they sold GT-IFQ shares.

If you sold GT-IFQ shares, how important were the following reasons for doing so?	Not Important		Somewhat Important		Very Important		All	
	#	%	#	%	#	%	#	%
The selling price was high relative to the expected financial returns I anticipated from fishing the shares.	23	*42.59*	14	*25.93*	17	*31.48*	54	*100.00*
The selling price was higher than what I anticipated receiving for the shares in the future.	29	*55.77*	16	*30.77*	7	*13.46*	52	*100.00*
I had more shares than necessary for an efficient level of production.	35	*68.63*	9	*17.65*	7	*13.73*	51	*100.00*
I anticipated that the value of my shares would decrease after the next stock assessment.	36	*69.23*	7	*13.46*	9	*17.31*	52	*100.00*
I felt uncertain about the duration of the GT-IFQ Program.	28	*54.90*	9	*17.65*	14	*27.45*	51	*100.00*
I wanted to leave the fishery.	36	*70.59*	5	*9.80*	10	*19.61*	51	*100.00*

I TRANSFERRED shares as barter for red snapper or other species IFQ allocation/shares.	27	*51.92*	5	*9.62*	20	*38.46*	52	*100.00*
Other	6	*42.86*	.	.	8	*57.14*	14	*100.00*

There were 225 respondents who indicated if they experienced any changes in their relationship with dealers since the G-T IFQ Program began. Of the 225 respondents, 154 indicated they have not experienced any significant changes while 71 indicated they have experienced significant changes in their relationship with dealers.

The last questions of this section addressed the current market value of vessels, gear and equipment (excluding permits and shares. On average, respondents reported the current market value of these capital assets to be $157,656 with a median figure of $100,000. 27 respondents reported an average increase of $104,000 in current market value of capital with a median increase of $50,000. On the other hand, 38 respondents reported an average decrease of $80,263 in current market value of capital with a median decrease of $35,000.

The last two sections of the survey, Social Well-Being and Demographic Information and Other Issues (i.e. satisfaction with the operation of the GT-IFQ program) are included in the main text of the five-year review report.

B3 - GT-IFQ Captain and Crew Survey

Survey Title: Economic Survey of Gulf of Mexico Captains and Crew Associated with the Gulf of Mexico Grouper-Tilefish Individual Fishing Quota (2016)
GT-IFQ Report Reference: La Riviere (2016)

Purpose of the Study: The GT-IFQ Labor Survey was an in-person survey conducted in the summer and fall of 2016 on captains and crew who at some point in their careers had participated in the grouper-tilefish component of the Gulf of Mexico reef fish fishery. The goal of the survey was to evaluate captain and crew self-reported outcomes and beliefs regarding the GT-IFQ. The IFQ program began on January 1, 2010, thus this survey represents captain and crew experiences after five full years of experience with the IFQ program.

Methodology: The GT-IFQ Labor Survey was implemented in conjunction with the GT-IFQ Dealer Survey (see Appendix B4). Dealers that were interviewed in-person were asked to recommend captains and crew located at or near their physical location to participate in a short survey about labor's attitudes and perceptions toward the GT-IFQ since its implementation. Once the pre-arranged interviews were completed, the field interviewers then canvassed nearby docks based on a random sampling strategy. Once at the docks, the interviewers intercepted as many captains and crew that had any experience working in the Gulf grouper-tilefish fishery as the allotted pre-determined time frame would allow. 153 interviews were completed. The majority of respondents were from Florida although Texas was also represented. A wide range of target species and gear types were represented, and the survey was split with around 60% primarily crew and 40% primarily captain.

Survey Instrument: The survey was intended to be completed within ten to fifteen minutes using a rapid assessment approach and Android tablets to maximize responses, but respondents were free to expound on their views with qualitative answers with no time limit at the end of the survey. At the onset, potential respondents were screened to determine if they had before or after GT-IFQ fished specifically for grouper-tilefish species. The survey asked a series of questions regarding participation before versus after GT-IFQ implementation and subsequently asked if different aspects of the fishery (e.g., level of pay, stability of pay, safety, likelihood of share remuneration, etc...) had increased greatly, increased slightly, not changed, decreased slightly or decreased greatly (see LaRiviere (2016) for the full survey). Also, basic demographic and social information was also collected.

Results: There were four main findings post-IFQ implementation from the survey:

- Work availability, labor choice, and labor mobility were all reported to be significantly lower.
- For captains and crew who stayed active participants, reported income measures were roughly unchanged.
- The strongest result from the survey was a significant increase in reported safety.
- Captains and crew reported similar modest decreases in satisfaction from fishing.

Summary Statistics

One simple way of dividing up survey respondents is by whether subjects fished before or after implementation of the GT-IFQ and, if they did fish, were they captain or crew. Table 1 shows the breakdown of when subjects participated in the grouper-tilefish fishery and how they participated in it. The majority of the respondents are crew although captains are well represented.

Table 1: Composition of Respondents to Survey

	Fished Before Jan 1, 2010		Fished After Jan 1, 2010	
	n	percent	n	percent
Primarily Captain	53	35%	65	42%
Primarily Crew	80	52%	83	54%
Other	1	1%	1	1%
Didn't Fish/Refused	19	12%	4	3%
Total	153	100%	153	100%

Table 1 highlights one important limitation of this survey: it is a single cross section in 2016. Almost all respondents (97%) participated in the survey actively participated in the grouper-tilefish fishery after IFQs had been implemented. 87% of respondents surveyed reported participating before IFQ implementation. Since there is no baseline survey from 2009, all self-reported outcomes regarding how labor mobility, safety, income, opportunity, etc. were impacted by the implementation of IFQs rely on *recalled* pre-2010 outcomes and experiences of the 87% of subjects who participated before 2010. Importantly, that 87% is self-selected: they have stayed in

the fishery throughout the IFQ transition. Other captain and crew did not and their attitudes are not well-represented here. Despite best efforts of surveyors to repeatedly identify and survey captain and crew whom had left the fishery, the exercise proved very challenging.

It's unclear whether captain and crew who stayed in the fishery would have higher or lower opinions of IFQs compared to those who left the fishery. We can compare attitudes of the 19 subjects who only fished post-IFQ implementation to compare their sentiments to the pre-IFQ participants, but we acknowledge this is an imperfect check with a small sample size. Finally, some subjects abstained from answering some questions meaning that total observed answers vary slightly from question to question.

There are some important sociodemographic characteristics to consider. The overwhelming majority of the subjects were white (98%), the vast majority of subjects are from Florida (87%), and on average respondents reported 24 years of experience in commercial fishing. Texas accounts for 10% of subjects with no other state accounting for more than one survey respondent. Third, all but 4 subjects reported speaking English as their primary language at home. Fourth, the age distribution of subjects which is somewhat skewed left averaged 45 with median age 47. We thus conclude that the survey was largely conducted on slightly older English speaking Floridians. Regional, racial and age differences in attitudes, insofar as they exist, will thus not be well-represented in this survey. Income distributions from commercial fishing in 2015 ranged greatly from $0-15K (7%), $15-50K (52%), $50-100K (31%), and over $100K (9%). Due to the sociodemographic similarity of subjects, most of the analysis below reports unconditional t-test to identify differences before or after IFQ implementation.

Labor Mobility

In 2015, 94% of respondents fished for grouper-tilefish species along with red snapper (57%), non-IFQ reef fish (48%), mackerels (18%), dolphin/wahoo (20%) and HMS (27%). The survey also asked which species in the grouper-tilefish fishery subjects targeted both before and after GT-IFQ implementation: Gag, Red Grouper, other shallow water Groupers, Deep Water Groupers and Tilefish. The survey also asked about primary gear type: Longline, Bandit, Rod and Reel, Handline, and Spearfishing. Table 2 reports results for subjects both before and after IFQ implementation. Given differing sample sizes before and after IFQ implementation we report percentages.

Table 2: Labor mobility Pre-IFQ and Post-IFQ

	Gag	Red	Shallow	Deep Water	Tilefish	Don't Know	Average Species
Before Jan 1, 2010	88.8%	94.0%	94.0%	77.6%	69.4%	0.0%	4.28
After Jan 1, 2010	81.8%	83.9%	89.9%	79.2%	63.8%	0.7%	4

	Longline	Bandit	Rod and Reel	Spearfishing	Other
Before Jan 1, 2010	63.4%	27.6%	6.7%	.75%	1.5%
After Jan 1, 2010	59.7%	29.5%	8.7%	0.0%	2.0%

There are some secular trends which should not be attributed to IFQs. For example, of the 130 individuals who fished before and after IFQs, 11% moved from being crew to captain relative to only 2% moving from captain to crew. Attributing this to IFQs would be a mistake since we don't observe background mobility before IFQ implementation. Most remaining subjects stayed within their vessel role of captain or crew (36% and 50% respectively). Similarly, conditional on fishing the number of hours spent working outside the fishery stayed effectively flat for both captain (84%) and crew (82%). However, that is a statement about local economic opportunities on land relative to those at sea.

Self-reported attitudes about labor mobility are the focus of the study. Table 3 describes several attitudes related to labor mobility. One stark finding shown in panel (a) is that over half of captain (58%) and crew (52%) reported that availability of work had decreased either greatly or slightly since IFQ implementation. Only 22% and 19% reported increased availability of work. This is not surprising given that IFQs extend seasons and decrease overcapitalization by eliminating incentives to race to fish. Panel (b) shows that subjects report decreased choices for employment between for captain (46%) and crew (50%). 15% of captains and 17% of crew reported increased choice. This finding is consistent with more stable employment and less turnover across vessels. However, that seems to be a market equilibrium and not the choice of labor. Panel (c) shows that 49% of captains and 43% of crew report decreased ability to switch to another vessel. 11% and 17% report increased ability to switch across vessels. In some labor reports a decreased availability of work. Conditional on working there is less choice and flexibility to move across vessels.

Table 3: Attitudes toward labor mobility

3a: Change in Availability of Work by Vessel Role

Crew Role	Increased Greatly	Increased Slightly	Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Total
Captain	5	9	12	13	25	1	65
	8%	14%	18%	20%	38%	2%	44%
Crew	5	11	23	10	33	1	83
	6%	13%	28%	12%	40%	1%	56%
Other	0	0	0	0	1	0	1
	0%	0%	0%	0%	100%	0%	1%
Total	10	20	35	23	59	2	149
	7%	13%	23%	15%	40%	1%	100%

3b: Change in Choices for employment

Crew Role	Increased Greatly	Increased Slightly	Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Refused	Total
Captain	4	6	21	10	20	3	1	65
	6%	9%	32%	15%	31%	5%	2%	44%
Crew	4	10	26	16	26	1	0	83
	5%	12%	31%	19%	31%	1%	0%	56%
Other	0	0	1	0	0	0	0	1

	0%	0%	100%	0%	0%	0%	0%	1%
Total	8	16	48	26	46	4	1	149
	5%	11%	32%	17%	31%	3%	1%	100%

3c: Change in Ability to switch to another vessel

Crew Role	Increased Greatly	Increased Slightly	Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Refused	Total
Captain	3	4	23	9	23	2	1	65
	5%	6%	35%	14%	35%	3%	2%	44%
Crew	5	9	31	15	21	2	0	83
	6%	11%	37%	18%	25%	2%	0%	56%
Other	0	0	1	0	0	0	0	1
	0%	0%	100%	0%	0%	0%	0%	1%
Total	8	13	55	24	44	4	1	149
	5%	9%	37%	16%	30%	3%	1%	100%

Income

The survey asks respondents several questions relating to income. All but one respondent reported whether their current income was within different ranges. Most responses were between $15,000 and $50,000 and of those most were crew. Captains earn significantly more than crew, with a non-trivial amount earning above $75,000. While some crew earn that much, the overwhelming majority earn less.

The survey asked three scaled response questions on the changes to income after the implementation of the IFQ program. These questions asked about the changes in the overall level of income, stability of income and the 'potential or opportunity' to make a large annual income from fishing. The responses to these questions were highly correlated with each other. Table 4 shows the results.

Across these questions, roughly one third of respondents reported overall level of income, stability of income and potential for large incomes as increased greatly or slightly, one third reported that they stayed the same or decreased slightly and one third reported that they decreased greatly. Captains reported slightly more stable income and also an opportunity to earn higher incomes relative to crew post-IFQs. Importantly, we can't attribute these reported income measures to IFQs directly: to do so we would need to know what background levels of changes to income levels and stability in five normal years.

These three measures of changes to income are relatively consistent within respondents: captain and crew who answered incomes increased, also reported increased stability and incomes ability to earn a large income. Calculating polychoric[40] correlations between the three variables (with "Don't know" responses omitted) shows very consistent individual level answers.

[40] A standard measure of correlation between ordinal variables.

Table 4: IFQs and Self-Reported Income Measures

Subtable 4a: Change in average annual income

Crew Role (Q8)	Increased Greatly	Increased Slightly	Q20 Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Total
Captain	14 22%	15 23%	10 15%	6 9%	18 28%	2 3%	65 44%
Crew	12 14%	21 25%	16 19%	9 11%	23 28%	2 2%	83 56%
Total	26 17%	36 12%	27 22%	15 12%	41 34%	4 2%	149 100%

Subtable 4b: Change in stability of annual income

Crew Role (Q8)	Increased Greatly	Increased Slightly	Q20_2 Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Total
Captain	13 20%	15 23%	11 17%	4 6%	21 32%	1 2%	65 44%
Crew	4 5%	19 23%	22 27%	12 14%	25 30%	1 1%	83 56%
Total	17 11%	34 23%	34 23%	16 11%	46 31%	2 1%	149 100%

Subtable 4c: Change in potential or opportunity for large annual income from fishing

Crew Role (Q8)	Increased Greatly	Increased Slightly	Q20_3 Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Total
Captain	12 18%	12 18%	11 17%	7 11%	22 34%	1 2%	65 44%
Crew	9 11%	12 14%	24 29%	6 7%	30 36%	2 2%	83 44%
Total	21 14%	24 16%	36 24%	13 9%	52 35%	3 2%	149 44%

Given that survey participants also reported their own incomes, we can correlate answers to how IFQ implementation impacted incomes with income levels. The correlation between changes in income levels and reported annual income is 0.5; higher incomes were more likely to report increased in average income. This is consistent with small efficiency gains to IFQ implementations: higher earners reported earning greater incomes. This is also consistent with some hypothesized results of a catch share systems as lower skilled captain and crew might exit the fishery. This is a tenuous result (.5 correlation) so forming policy from it is not appropriate. Rather, further research is merited.

Another important industry characteristic driving fishing income is share of revenue. Captain and crew are almost always paid as a percentage of revenue. The survey asked how the share of revenue changed since IFQ implementation. Understanding how IFQs impacted revenue shares help to understand the dispersion of incomes before and after IFQs. Table 5 shows results.

Changes in share of revenue tracks the general pattern observed in the other income questions though the pattern is slightly less consistent: roughly one third repost shares increasing, 15-20% reported no change in shares and roughly 45% report decreases in share; the polychoric correlation between the income level question and the revenue share question is 0.71. On average, then, shares decreased although for many fishermen they increased. It unclear whether IFQs caused this decrease directly, whether it was caused by general labor market conditions (e.g., fewer GGT jobs thereby bidding down wages), or some other change. Changes in shares post-IFQ could thus be responsible for differences in reported income measures before and after IFQs rather than changes in vessel level revenue.

Table 5: Change in share of revenue

Crew Role (Q8)	Increased Greatly	Increased Slightly	Q15 Stayed the Same	Decreased Slightly	Decreased Greatly	Don't Know	Total
Captain	9	15	10	8	21	2	65
	14%	23%	15%	12%	32%	3%	44%
Crew	12	17	16	9	27	2	83
	14%	20%	19%	11%	33%	2%	44%
Total	21	32	27	17	48	4	149
	14%	21%	18%	11%	32%	3%	100%

Safety and Personal Satisfaction

The survey asked respondents directly about changes in perceived safety and personal satisfaction with fishing. Both questions asked whether captain and crew thought that safety had increase greatly, slightly, stayed the same, decreased slightly or decreased greatly.

For safety, more than 90% of respondents think safety has stayed the same or increased and nearly 40% of respondents believe safety has increased greatly. As with many other questions there is little difference between captains and crew. This is the starkest finding in the survey: less than 10% of respondents reported decreases in safety. There is a positive but relatively weak correlation (0.4) between safety responses and income level responses.

The final question relating to working conditions asks respondents to report changes in personal satisfaction. About one third of respondents report slight or great increases in satisfaction and roughly 45% report slight or greatly decreased satisfaction with fishing. These responses are positively correlated (0.64) with changes in income levels. The implication is income changes might contribute to decreased satisfaction but there is no evidence that income changes fully explain changes in personal satisfaction. Decreases in industry level employment, the changing nature of employment and other factors likely contribute as well.

B4 - GT-IFQ Dealer Survey

Survey Title: Gulf of Mexico Grouper-Tilefish Dealer Survey (2016)
GT-IFQ Report Reference: Keithly Jr. and Wang (2016)

Purpose of the Study: QuanTech, Inc. in partnership with SEFSC/SERO conducted an in-person survey with an option to complete a hard copy survey through the mail to:

- collect background information on Gulf of Mexico grouper-tilefish dealers and processors (based on those holding the appropriate license for buying and selling product),
- elicit their attitudes and perceptions about the performance of the GT-IFQ program, paying special attention to sources and costs of product, changes in sales practices, and relationships with fishermen, and
- analyze perceptions regarding potential GT-IFQ outcomes, investment and disinvestment decisions, future plans in the grouper-tilefish component of the reef fish fishery, and share and allocation decisions.

Methodology: The Gulf of Mexico Grouper-Tilefish Dealer Survey was conducted in person and by mail with dealers and processors that operate in the Gulf of Mexico GT-IFQ program. Any business that sold or processed grouper-tilefish products were targeted. We collected 62 interviews, 25 in person and 37 by mail. Responding businesses were responsible for approximately 87% of grouper-tilefish landings in the Gulf of Mexico in 2015. We attempted to

survey all 215 dealers that were active in the GT-IFQ program in 2015 based on information provided by the NMFS SERO. Table 1 depicts response rates for the survey. The raw response rate, which represents completed surveys as a percentage of all dealers was 28.8%. The response rate accounting for ineligible businesses and returned mail was 37.7%.

Table 1. Response rates for the Gulf of Mexico Grouper-Tilefish Dealer Survey

Survey Status	N	%
In-Person Survey Complete	25	*11.6*
Mail Survey Complete[41]	37	*17.2*
Returned Mail No New Address	13	*6.0*
Claimed Ineligible	10	*4.7*
No Response	117	*54.4*
Refused	13	*6.0*
All	215	*100*

Survey Instrument: The survey consisted of 25 questions arranged in five sections (see Keithly Jr. and Wang (2016) for the full survey):

- Background Information
- Pre- and Post-GT-IFQ Operations
- Pre- and Post-GT-IFQ Infrastructure and Equipment
- GT-IFQ Share in Business Operations
- Opinions Regarding the GT-IFQ Program (operations)

Results:

Section 1: Background Information

In general, this section of the questionnaire elicited information pertaining to business operations and opinions regarding the grouper/tilefish Individual Fishing Quota program (GT-IFQ) established in 2010.

Year of current ownership: Of the 61 respondents, 58 answered the question "What year did this business at this address start handling seafood under the current ownership?" (i.e., Question 1).[42] On average, businesses came under current ownership in 1995 with a range from 1940 to 2015. Seventeen of the 58 firms, or about 30%, came under present ownership since the beginning of the GT-IFQ program (i.e., 2010) with another 14 firms, or about 25%, coming under current ownership during the 2000-2009 period. Almost 40% of the respondents (22 firms) indicated that operations under current ownership were initiated prior to 1995.

Primary activity of the business: Interviewees were also queried as to what they considered to be the PRIMARY activity of the business (Question 2). Choices from which they could select

[41] One mail response received after survey cut-off date
[42] Presumably, three of the establishments did not know the answer to this question.

included: (a) commercial fishing (operating commercial fishing vessels to harvest seafood), (b) dealer/distributor activities (buying and reselling seafood), (c) processor activities (transforming seafood into new products and reselling the products), (d) retailer activities (transforming seafood into new products and reselling the products, and (e) "Other". Of the 61 respondents, 15, or 25%, considered commercial fishing to be their primary activity. Twenty-eight, or about 45%, considered their primary activity to be that of dealing/distributing seafood. Six of the respondents (10%) considered their primary activity to be that of processing while another six respondents (10%) considered themselves to be primarily retailers. Only one firm responded "other" as being its primary activity. Finally, while interviewees were asked to select only one primary activity, five selected more than one activity (not totally unexpected given the complexity and vertical integration nature of the industry).

Opinion regarding the GT-IFQ program prior to its implementation (2009) and post-implementation (2014): Interviewees were queried as to their opinion of the GT-IFQ program prior to its implementation (Question 3) and post-implementation (Question 4) in both cases, they were asked to select either: (a) strongly opposed, (b) opposed, (c) neutral, (d) supported, (e) strongly supported, and (f) no opinion.

As indicated by the information in Table 1.1, opinions regarding the GT-IFQ program varied strongly among respondents. Prior to its implementation, almost 40% of the respondents indicated opposition to the program (either 'strongly opposed' or 'opposed') while 30% voiced support (either 'strongly supported' or 'supported') for the program. Finally, 30% of the respondents stated they were either 'neutral' or had 'no opinion' regarding the program prior it its implementation.[43]

Table 1.1. Opinions on GT-IFQ Program at the Time of Implementation (January 2010) and 2014

	Pre-IFQ		Post-IFQ	
	Number	Percent	Number	Percent
Strongly Opposed	11	18	15	25
Opposed	12	20	8	13
Neutral	9	15	7	11
Supported	11	18	14	23
Strongly Supported	9	15	16	26
No Opinion	9	15	1	2
TOTAL	61	100	61	100

Approximately five years after implementation of the GT-IFQ program (i.e., in 2014 when the survey was conducted), almost 40% of the respondents continued to voice opposition to the program (i.e., either 'strongly opposed' or 'opposed') while support for the program (i.e., either 'support' or 'strongly support') increased to almost 50%. Much of this increase may reflect a change among those who expressed 'no opinion' of the program prior to its implementation; potentially because they were not involved in the fishery prior to the GT-IFQ implementation.

[43] Of those expressing 'no opinion' of the program prior to its implementation, more than one-half (5 out of the 9) indicated that they had entered the business before implementation of the GT-IFQ program in 2010 (Question 1).

To investigate this issue in some greater detail, those operations expressing 'no opinion' either prior to implementation of the GT-IFQ program or after its implementation were deleted from consideration leaving 52 observations (Table 1.2). Based on this smaller sample, approximately 20% of the respondents were 'strongly opposed' to the GT-IFQ program at the time of its implementation with the percentage increasing only marginally (from 21% to 23% approximately five years later). The proportion 'opposed' to the program, by comparison, fell from 23% to 15%. Those expressing 'strong support' for the program increased from 17% to 29% while those expressing 'support' for the program equaled 21% both at the implementation of the program and approximately five years after the program was implemented.

Table 1.2. Opinions on GT-IFQ Program at the Time of Implementation (January 2010) and 2014

	Pre-IFQ		Post-IFQ	
	Number	Percent	Number	Percent
Strongly Opposed	11	21	12	23
Opposed	12	23	8	15
Neutral	9	17	6	12
Supported	11	21	11	21
Strongly Supported	9	17	15	29
TOTAL	52	100	52	100

Among those respondents considering their operation to be primarily that of commercial fishing (15 in total), almost one-half of them indicated that they were opposed to the program (either 'strongly opposed' or 'opposed') prior to its implementation compared to one-third of them who expressed support (either 'supported' or 'strongly supported') for the program. At the time the survey was conducted in 2016, the proportion among this type of operation who expressed support for the GT-IFQ program had increased to two-thirds (i.e., 10 out of 15) while those expressing opposition had fallen to a third. Only one respondent considering his operation to be primarily that of commercial fishing had 'no opinion' with respect to the program prior to its implementation and none of them had 'no opinion' at the time the survey was conducted in 2016.

Among those respondents considering their operation to be primarily that of a dealer/distributor, nine of the twenty-eight (or about a third of the total) were expressed opposition to the program prior to its implementation while 11 of the 28 (about 40%) expressed support for the program. In 2016, more than one-half of the dealers/distributors (15 of 28) voiced support for the GT-IFQ program while ten of the twenty-eight dealers/distributors expressed opposition to the program. A large number of dealers/distributors (5 of the 28) expressed 'no opinion' with respect to the GT-IFQ program prior to its implementation in 2010 and this number fell to zero in 2016.

Arrangements with fishermen: In order to examine whether the GT-IFQ program resulted in any significant changes in arrangements with fishermen, the following question was asked to survey participants: "Have your arrangements with fishermen from whom you purchased grouper/tilefish changed significantly as a result of the GT-IFQ program?" (Question 5). Out of the 54 applicable responses (seven respondents indicated that this question was not applicable to them; presumably because they were not operating prior to implementation of the GT-IFQ program), 25 (46%) indicated 'yes' while the remaining 29 indicated 'no'. Those that answered in the affirmative were then asked "What were the primary changes in your arrangements with

fishermen from whom you purchased grouper/tilefish?" (Question 5.a) Reasons cited are numerous and varying to such an extent that no generalizations can be made. As such, they are given verbatim in the Appendix to this Section of the report.

Section 2: Pre- and Post-GT-IFQ Operations

Gross sales of grouper/tilefish: To ascertain whether implementation of the GT-IFQ program culminated in significant changes in in grouper/tilefish sales, interviewees were queried as to their pre-GT-IFQ grouper/tilefish sales as well as to their post-GT-IFQ grouper/tilefish sales (Question 6). Given that much of the study emphasis is to compare pre-and-post IFQ activities, only those firms that reported grouper/tilefish sales in both periods were considered for analysis. This procedure resulted in only 25 observations being used in the analysis[44] with the mean grouper/tilefish sales pre-IFQ equaling $1.01 million per firm compared to $1.24 million per firm post-IFQ; representing an increase of approximately 22% inflation between the two periods (based on the standard Consumer Price Index) was approximately 10% suggesting that the inflation-adjusted difference is only about 12% which would, undoubtedly, be within any margin of error (statistical or other).[45]

Providing only means tends to obfuscate some of the important aspects associated with the data. As such, the analysis is also presented on a discrete basis and related to the primary activity of the business (i.e., Question 2). This analysis is presented in Table 2.1. As indicated, those respondents who consider their business to be primarily commercial fishing (7 in total) tend to exhibit smaller grouper/tilefish sales do those respondents considering themselves to be primarily processors. Overall, one of the seven commercial fishing businesses appears to have expanded into the >$1 million range while two of the 13 dealer/distributors appear to have moved to the >$1 million category (i.e., from 4 to 6).

Table 2.1. Number of Firms (by Type) and Reported Grouper/tilefish Sales (pre-and-post GT-IFQ)

Grouper/tilefish sales	Commercial		Dealer/Dist.		Processor		Retailer	
	Pre-IFQ	Post-IFQ	Pre-IFQ	Post-IFQ	Pre-IFQ	Post-IFQ	Pre-IFQ	Post-IFQ
< $100,000	3	3	5	3	0	0	1	1
$100,000 - $1 million	4	3	4	4	0	0	1	1
> $1 million	0	1	4	6	3	3	0	0
Total	7	7	13	13	3	3	2	2

Overall, about 62% of these firms were of the opinion that the GT-IFQ program contributed to the change in grouper tilefish sales pre-and-post GT-IFQ implementation (Question 6.a) with a wide range of explanations. These explanations are too varied to discuss here but are presented in the Appendix to this section.

Survey participants were also queried as to their respective gross sales of other finfish and shellfish species pre-and-post GT-IFQ (Question 7). Based on 20 firms who provided relevant information

[44] In total, 19 observations were deleted due to missing BOTH pre-and-post IFQ values. Another 14 were deleted due to missing pre-IFQ values. Three observations were deleted due to missing post-IFQ values,

[45] Estimates based on those reporting positive sales for either period are provided in the Appendix to this section of the report (i.e., Section 2).

for both periods, pre GT-IFQ sales averaged $375 thousand per responding firm versus $515,000 post GT-IFQ. Caution in using these numbers is warranted, however, given that (a) the sample is relatively small and (b) a few firms with apparently very large sales skews the averages for both periods.

Supply Sources: There are a number of alternative sources which can be used by grouper/tilefish dealers/processors to secure product for further value-added activities or for final sale and these sources may have changed as a result of the GT-IFQ program. To examine this issue, interviewees were asked the question "What percentage (%) of the grouper/tilefish purchased or obtained pre – and post GT-IFQ by this seafood business, by weight, came from the following sources?" (Question 8) with available sources including (a) U.S. based fishermen who operate vessels owned by this business, (b) U.S. based fishermen who operate vessels not owned by this business, (c) U.S. based seafood dealers/distributors/processors, (d) outside the U.S., and (e) other.

Relevant information related to pre-and-post GT-IFQ sources of grouper/tilefish (Question 8 on survey) can be calculated in a number of ways. One method is by including only those firms that reported their respective sources in both periods (though not necessarily of the same sources). This information is presented in Table 2.2. In total, 33 establishments reported sources in both periods of analysis (for which data appear to be valid).[46] Of these 33 firms, 13, or 39% of the total, reported that U.S. based fishermen who operate vessels owned by their respective businesses represented a source of their grouper/tilefish supply prior to implementation of the IFQ program and this source represented about one-half of the total grouper/tilefish purchased or obtained by this group. By comparison, 14 firms also reported this supply source post-IFQ and this source represented 60% of their product procured from the various sources. Similarly, 28 firms, or 85% of the total, reported procurement from 'U.S. based fishermen who operate vessels not owned by this business' and this supply source represented almost two-thirds (65.7%) of the product purchased or obtained by these 28 firms. The number of firms reporting procurement from 'U.S. based fishermen who operate vessels not owned by this business' post GT-IFQ period also equaled 27 and this supply source represented about 54% of the product purchased or secured by these 27 establishments. While only 8 of the respondents (24% of the total) indicated that 'outside the United States' represented a supply source prior to implementation of the GT-IFQ (7 in 2014), this supply source represented a significant portion of the supply purchased or obtained by this group of firms.

Table 2.2. Estimated Unweighted Sources of Grouper/Tilefish Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Source	Number	Pre-IFQ (2009)	Std. Dev	Number	Post-IFQ (2014)	Std. Dev
U.S. based fishermen who operate vessels owned by this business	13	54.5%	35.7	14	60.2 %	39.6
U.S. based fishermen who operate vessels not owned by this business	28	65.7%	29.8	27	53.6%	38.0

[46] Overall, 12 observations were deleted because they provided no information was provided for either the pre GT-IFQ period or the post GT-IFQ period. Another 10 were deleted because no pre GT-IFQ information was provided while three were deleted because, while pre GT-IFQ information was provided, post GT-IFQ information was not provided. Three other firms were deleted due to information that did not appear to be valid (i.e., numbers did not sum to 100%). Relevant information on more complete samples (i.e., those reporting in either period) can be found in Appendix to this section.

U.S. based seafood dealers/distributors or processors	18	23.8%	21.9	18	32.8%	31.1
Outside the United States	8	38.8%	29.0	7	54.0%	26.1
Other	0	NA	NA	1	50%	.

Based on the same group of firms used to generate the information in Table 2.2, one can also evaluate the weighted supply sources. The estimated weighted supply by source are presented in Table 2.3. As indicated, while the source 'U.S. based fishermen who operate vessels not owned by this business' dominates purchases (or procurement by other means) of grouper/tilefish, its share fell considerably between 2009 (i.e., pre GT-IFQ) and 2014 (i.e., post GT-IFQ).[47] By comparison, sources including 'U.S. based fishermen who operate vessels owned by this business' and 'U.S. based seafood dealers/distributors or processors' increased between the pre GT-IFQ and the post GT-IFQ (though the increases would not be statistically significant).

Table 2.3. Estimated Weighted Sources of Grouper/Tilefish Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Source	Number	Pre-IFQ (2009)	Number	Post-IFQ (2014)
U.S. based fishermen who operate vessels owned by this business	13	21.9%	14	25.5%
U.S. based fishermen who operate vessels not owned by this business	28	55.8%	27	43.9%
U.S. based seafood dealers/distributors or processors	18	13.0%	18	17.6%
Outside the United States	8	9.4%	7	11.5%
Other	0	NA	1	1.5%

Of the 33 firms included in the 'sources of supply' analysis, 12 establishments, or about 36% of the total, secured their grouper/tilefish supplies from only one source, both pre-and-post GT-IFQ. Twelve (about 36%) secured their respective grouper/tilefish supplies from two sources in 2009 compared to 11 in 2014. Seven of the 33 establishments reported that they procured their grouper/tilefish supplies from three sources prior to implementation of the GT-IFQ program compared to 9 in 2014. Finally, only two firms reported that four or more supply sources were utilized prior to implementation of the GT-IFQ program and only one firm reported using four or more supply sources post GT-IFQ.

When queried as to whether the GT-IFQ program contributed to the change in grouper/tilefish sources (Question 8.a), 13 of the 33 respondents replied affirmatively while 15 indicated that the program did not result in a change in supply sources. The remaining five firms had no opinion or indicated that the question was not applicable to their respective operations.

Employment: To examine whether implementation of the GT-IFQ program resulted in any significant changes in employment among dealers, survey participants were asked the following

[47] While the share fell by a relatively large amount, it is safe to say that there is no statistical difference between the two estimates.

question: "Approximately how many people were employed at this seafood business pre –and post GT-IFQ (excluding captains and crew on vessels)?" (Question 9). Thirty-seven firms reported both pre-and-post employment information and these 37 observations were used to generate the estimates provided in Table 2.4.[48] The number of employees, as indicated, is, in general, relatively small with 33 of the 37 firms (about 90%) reporting less than 50 employees pre GT-IFQ compared to 31 firms (84%) post GT-IFQ (Table 2.4).[49] The number of full-time employees, based on these 37 firms, averaged 13 prior to implementation of the GT-IFQ program compared to 19 post GT-IFQ program (i.e., 2014). The number of part-time employees averaged only three in both periods.

Table 2.4. Estimated Number of Employees (by range) Pre-IFQ (2009) and Post-IFQ (2014)

Number (range)	Pre-GT-IFQ (2009)	Post-GT-IFQ (2014)
1-10	23	21
11-50	10	10
>50	4	6

Thirteen of the 37 establishments (40%) used to generate the information in Table 2.4 were of the opinion that implementation of the GT-IFQ program contributed to a change in employment while about 45% of the firms were of the opinion that it did not result in a change in employment activities.

Prices of Grouper/Tilefish Bought and Sold: To examine whether the GT-IFQ program resulted in changes in the markup (i.e., the difference between the sales price and the price of the raw product), survey participants were asked to report the raw costs (finished weight) for the different grouper/tilefish species and the sales prices for both pre-and-post GT-IFQ (i.e., 2009 and 2014) (Question 10). For purposes of analysis, only those who reported the cost (or the sales price) for both periods were included in the analysis. As indicated in Table 2.5, for example, 27 establishments reported the raw cost of gag grouper in both 2009 and 2014 while 24 firms reported the sales price of this species for both periods. Similarly, 28 firms reported the raw cost (finished weight) for red grouper in both periods while 25 firms reported the sales price for this species in both periods.[50]

As indicated by the information in Table 2.5, gag grouper, red grouper, and scamp appear to be the species most frequently handled, subject to the sample that is being used for analysis. The raw fish cost (finished weight) for gag grouper in 2009 among the 27 firms averaged $4.39 per pound while the sales price averaged $6.78 per pound. By 2014, the gag grouper raw fish cost (finished weight) had increased to $5.75 per pound while the sales price had increased to $8.53 per pound. The estimated markup for this species between 2009 and 2014 increased from $2.39 per pound to $2.78 per pound.

Overall, the raw fish cost (finished weight), sales price, and markups between 2009 and 2014 were observed in all seven species considered. Increases in the markup ranged from a low of $0.04 per pound (blue tilefish) to $0.61 (red grouper). Expressed on a percentage basis, the estimated

[48] A total of 9 observations were deleted because neither pre-or-post IFQ employment estimates were provided. Another 12 observations were deleted due to the fact that employment estimates prior to implementation of the GT-IFQ program were not provided.

[49] While not shown, the larger firms (in terms of employees) generally identified themselves as processors.

[50] Analysis including all firms providing positive prices for either period is presented in the Appendix to this section.

markup for each species is as follows: gag grouper, 16.3%; red grouper, 28.5%, black grouper, 3%; scamp 16.1%; yellowedge grouper, 8.0%; golden tilefish, 5.4%; and blueline tilefish, 5.9%.

Whether the increased markups are related in any manner to the GT-IFQ program are a matter of speculation. Inflation from 2009 to 2014 equaled about 10% (based on the Consumer Price Index) which would suggest that increases in the markup for four of the seven species did not even equal that of inflation.

Table 2.5. Raw Fish Cost ($/Lb.), Sales Price ($/Lb.), and Estimated Markup ($/Lb.) Pre-and-Post GT-IFQ (unconverted)

Species	Number (raw fish)	Raw fish cost in 2009	Raw fish cost in 2014	Number (sales price)	Sales price in 2009	Sales price in 2014	Markup (2009)	Markup (2014)
Gag grouper	27	$4.39	$5.75	24	$6.78	$8.53	$2.39	$2.78
Red grouper	28	$3.64	$4.81	25	$5.78	$7.56	$2.14	$2.75
Black grouper	17	$4.03	$5.10	14	$5.63	$6.75	$1.60	$1.65
Scamp	28	$4.46	$5.66	26	$6.69	$8.25	$2.23	$2.59
Yellowedge grouper	16	$4.70	$5.67	15	$6.57	$7.69	$1.87	$2.02
Golden tilefish	13	$3.05	$3.78	12	$4.69	$5.51	$1.64	$1.73
Blueline tilefish	7	$1.44	$2.20	6	$2.12	$2.92	$0.68	$0.72

One problem with estimating appropriate markups for seafood products relates to the fact that the raw product can be purchased (secured) many different forms; including fillets which are then resold. Changes in the product form changes both the weight and the cost of the raw product (or sales price). In an attempt to adjust for this issue, all raw costs in excess of $10 per pound and sales prices in excess of $10 per pound were converted by taking multiplying the respective cost or price by 0.40 (i.e., changing from a fillet price to a whole/gutted price per pound). Estimated raw fish costs, sales prices, and markups based on this conversion of some observations resulted in the information presented in Table 2.6. As indicated the raw fish cost for many of the species were reduced by some amount and the sales prices for all species fell by a larger amount.[51] The converted raw fish costs for most species increased by about $0.80 to $1.00 between 2009 and 2014. The estimated markups on a converted basis are as follows: gag grouper, 27.1%; red grouper, -3.6%; black grouper 3.5%; scamp, 30.1%; yellowedge grouper, 9.1%; golden tilefish, 4.9%; and blueline tilefish, 5.9%. As was the case when considering the unconverted prices, there is little evidence that markups increased as a result of the GT-IFQ program.

[51] Note that the raw fish cost for some species did not change at all (e.g., golden tilefish). This is because there were no reported raw fish costs in excess of $10 per pound. The sales price, as one would expect, fell by a much higher percentage than the raw cost because a large portion of the product sold (versus being bought) was on a filet basis.

Participants were also queried as to their opinion as to whether the GT-IFQ program contributed to changes in the raw fish cost (Question 10.a). Thirty of the 53 individuals responding to this question answered in the affirmative while 7 answered 'no'.[52] Of those who had an opinion one way or another (i.e., 'yes' or 'no'), almost three-quarters (30 of 41) were of the opinion that the GT-IFQ program did contribute to a change in costs. A near similar proportion expressed the same belief with respect to the sales price (Question 10.c). The full list of comments concerning reasons for the increase in raw fish costs and sales prices are provided in the appendix to this section with the one prevailing comment being that the cost of allocation/share is added to cost or price of the fish.

Table 2.6. Raw Fish Cost ($/Lb.), Sales Price ($/Lb.), and Estimated Markup ($/Lb.) Pre-and-Post GT-IFQ (converted)

Species	Number (raw fish)	Raw fish cost in 2009	Raw fish cost in 2014	Number (sales price)	Sales price in 2009	Sales price in 2014	Markup (2009)	Markup (2014)
Gag grouper	27	$4.10	$5.10	24	$5.10	$6.32	$0.96	$1.22
Red grouper	28	$3.38	$4.24	25	$4.50	$5.58	$1.12	$1.08
Black grouper	17	$4.03	$5.10	14	$4.89	$5.99	$0.86	$0.89
Scamp	28	$4.16	$5.03	26	$5.04	$6.18	$0.88	$1.15
Yellowedge grouper	16	$4.21	$5.14	15	$5.20	$6.22	$0.99	$1.08
Golden tilefish	13	$3.05	$3.78	12	$3.86	$4.63	$0.81	$0.85
Blueline tilefish	7	$1.44	$2.20	6	$2.12	$2.92	$0.68	$0.72

Sales by Product Form: Relevant information related to pre-and-post GT-IFQ sales by product form (Question 11 on survey) can be calculated in a number of ways. One method is by including only those firms that reported sales in both periods (though not necessarily of the same product forms).[53] [54] In total, 31 establishments reported sales by product form in both periods of analysis (for which data appear to be valid). Of these 31 firms, 30 reported selling fresh whole (or gutted) product prior to implementation of the IFQ program and sales of this product contributed more

[52] Included in this 53 were four who checked more than one box, 1 who indicated that it was not applicable to his operation, and 6 who had 'no opinion'.

[53] These estimates are based only on those respondents who indicated activities in both periods. In other words, if an establishment provided information on sales by product form Post-GT-IFQ but not Pre-GT-IFQ (or vice versa), information from this establishment was not included in the analysis. In total, 14 observations were deleted due to non-reporting in both periods. Another 10 observations were deleted due to non-reporting in the pre-IFQ period while 2 observations were deleted because of no post-IFQ reporting. Finally, 4 observations were deleted due to significant errors in the data (i.e., the sum across product types was less than or greater than 100%).

[54] Additional information for the full sample (regardless of whether they reported information in both periods) is presented in the appendix to this section. In general, changes in estimates appear to be relatively minor.

than two-thirds of the total grouper/tilefish sales among this group Table 2.7). By comparison, 30 firms also reported sales of fresh whole (or gutted) product in the post-IFQ period with sales of this product among these 30 establishments representing 65% of their total sales. Similarly, 16 firms reported sales of fresh fillets in the pre-IFQ period and sales of this product among these 16 firms averaged 59% of their total grouper/tilefish sales. The number of firms reporting sales of fresh grouper/tilefish fillets in the post GT-IFQ period also equaled 16 and sales of this product by these 16 firms represented about 63% of their total grouper/tilefish sales.

Table 2.7. Estimated Unweighted Sales by Product Form Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Product Form	Number	Pre-IFQ (2009)	Std. Dev	Number	Post-IFQ (2014)	Std. Dev
Fresh whole or gutted	30	67.6%	39.1	30	65.0%	40.3
Frozen whole or gutted	1	5.0%	.	1	3.0%	.
Fresh fillets	16	59.3%	32.2	16	63.3%	29.7
Frozen fillets	7	9.8%	5.4	7	9.7%	9.4
Other	2	24.0%	22.6	2	32.0%	33.9

Evaluating the 31 firms that reported sales by product form in both periods of analysis (i.e., 2009 and 2014) suggests that 17, or one-half of the total, reported sales of only one product. Another 9 firms (or about one-third) reported sales of two products. Only 4 firms reported sales in three of the categories while the remaining 2 firms reported sales in either 4 categories or all five categories.

Based on the same 31 establishments used to generate the same information presented in Table 2.7, one can also evaluate the weighted sales by product form. The estimated weighted sales by product form are presented in Table 2.8.

Table 2.8. Estimated Weighted Sales by Product Form Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Product Form	Number	Pre-IFQ (2009)	Number	Post IFQ (2014)
Fresh whole or gutted	30	62.5%	30	62.9%
Frozen whole or gutted	1	0.2%	1	0.1%
Fresh fillets	16	30.6%	16	32.7%
Frozen fillets	7	2.2%	7	2.2%
Other	2	1.6%	2	2.1%

In general, two features are highlighted by the information presented in Tables 2.7 and 2.8. The first feature is that sales are dominated by fresh product (either fresh whole or fresh fillet) with the weighted average indicating that more than 90% of the product is sold fresh (either whole or fillet). The second feature is that there appears to be little change in the preparation by product form pre-and-post implementation of the GT-IFQ program.

Sales to Alternative Outlets: Information related to grouper/tilefish sales to alternative outlets is presented in Tables 2.9 and 2.10. The information in these two tables are calculated in a manner

analogous to those associated with "Sales by Product Form" (i.e., Tables 2.7 and 2.8). A total of 32 establishments provided information on outlet sales in both the pre-and-post IFQ periods. Of these 32 establishments, 24 sold product to restaurants prior to the implementation of the GT-IFQ and sales to this outlet accounted for one-half of their total sales. While the number of firms reporting the sale of grouper/tilefish to restaurants decreased marginally after the IFQ (to 23) sales remained at one-half among these firms. Nineteen of the 31 firms reported the sale of grouper/tilefish to wholesalers pre-IFQ with the number marginally declining to 18 post GT-IFQ. The percentage, however, remained consistent at about 45%. Sales to other dealers/processors were also common with 18 of the 32 establishments reporting such sales both pre-and-post GT-IFQ. Finally, more than third of the 32 firms reported sales directly to consumers both pre-and-post the GT-IFQ and sales to consumers among this group of firms represented a 'surprisingly' large percentage (about 21%) of their sales to the alternative outlets.

Table 2.9. Estimated Unweighted Grouper/Tilefish Sales to Alternative Outlets Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Outlet	Number	Pre-IFQ (2009)	Std. Dev	Number	Post-IFQ (2014)	Std. Dev
Other dealers/proc.	18	32.1%	33.0	18	32.9%	32.6
Wholesalers	19	45.6%	28.1	18	44.4%	30.4
Retailers	12	18.8%	15.4	14	21.4%	16.2
Restaurants	24	49.9%	31.0	23	49.5%	30.8
Consumers	13	21.2%	24.0	14	21.7%	26.8
Other outlets	1	10.0%	.	1	20.0%	.

The weighted sales among these 32 firms to the alternative outlets, presented in Table 2.10, indicates that more that the sales to restaurants represent the largest proportion of sales (39% prior to the implementation of the GT-IFQ program and 37% post GT-IFQ program) followed by sales to wholesalers (27% in 2009 and 25% in 2014) and other dealers/processors (20% in 2009 and 21% in 2014). While a large percentage of the firms reported sales directly to consumers, the weighted proportion of these sales was less than 10% in both periods.

Table 2.10. Estimated Weighted Grouper/Tilefish Sales to Alternative Outlets Pre-and-Post GT-IFQ (i.e., 2009 and 2014)

Outlet	Number	Pre IFQ (2009)	Number	Post-IFQ (2014)
Other dealers/proc.	18	20.1%	18	20.6%
Wholesalers	19	27.1%	18	25.0%
Retailers	12	7.0%	14	9.4%
Restaurants	24	37.4%	23	35.6%
Consumers	13	8.0%	14	8.8%
Other outlets	1	0.3%	1	0.6%

In total, 11 of the 32 firms used in the analysis of 'sales to alternative outlets' reported that they sold to three different outlets. This was the situation both pre-and-post GT-IFQ. Ten reported sales to two outlets prior to the GT-IFQ compared to 11 post GT-IFQ. Five reported sales to four outlets both before and after the implementation of the GT-IFQ while 2 reported sales to five

outlets (both before and after the GT-IFQ). Finally, four of the 32 firms reported sales to only one outlet in 2009 compared to 3 in 2014.

Overall, analysis of outlet sales pre-and-post implementation of the GT-IFQ program suggests little change in outlet sales.

Section 3: Pre – and Post GT-IFQ Infrastructure and Equipment

Vessels: The question "Has this business, or you personally, ever owned any vessels used in the harvesting of grouper/tilefish in the Gulf of Mexico?" (question 13), was answered by 54 of the 61 respondents. Thirty-five of the 54 (65%) responded affirmatively to this question. Of those that responded affirmatively, about 45% (16 of 35) also indicated that implementation of the GT-IFQ program led to no changes in the number or size of vessels owned (Question 13.a). One-third of those that responded affirmatively to the question "Has this business, or you personally, ever owned any vessels used in the harvesting of grouper/tilefish in the Gulf of Mexico?" indicated that the program allowed them to decrease the number or size of vessels. About 20% (8) reported that that they had increased the number or size of vessels as a result of the implementation of the GT-IFQ program. With respect to future plans among this group (i.e., those reporting affirmatively to Question 13 (Has this business, or you personally, ever owned any vessels used in the harvesting of grouper/tilefish in the Gulf of Mexico), approximately 60% indicated that they had no future plans to either increase or decrease the number or size of vessels owned over the next five years. By comparison, about 15% indicated that they did plan to increase the number or size of vessels owned over the next five years while slightly less than 10% indicated a desire to decrease the number/size of vessels over the next five years (Question 13.b).

Among those establishments who considered commercial fishing to be their primary activity (i.e., Question 2) and answered affirmatively to Question 13 (i.e., "Has this business, or you personally, ever owned any vessels used in the harvesting of grouper/tilefish in the Gulf of Mexico?"), one-half indicated that implementation of the GT-IFQ program did not result them increasing the number or size of vessels since its implementation (i.e., Question 13.a) while 70% of this group indicated that they had no future plans (in the next five years) to increase their respective number (size) of vessels as a result of the GT-IFQ program.

Other Major Investments/Disinvestments: In addition to soliciting information on changes in vessels (size of vessels) associated with implementation of the GT-IFQ program, the question "Excluding vessels and GT-IFQ shares, have you made MAJOR INVESTMENTS or DISINVESTMENTS in your seafood business that you attribute to the implementation of the GT-IFQ program?" was also asked of interviewees (Question 14). Fifty-four of the 61 survey respondents completed this question and 18 of the 54, or one-third of the total, responded 'yes' while 36, or two-thirds of the total, responded 'no'. Investments commonly cited were purchasing additional quota (cited by five individuals). [55] Purchasing quota or the leasing of allocation was cited by an additional three individuals. Long-term infrastructure improvements (e.g., trucks, freezers, purchasing on water facility to offload boats) was cited relatively infrequently.

[55] The question specifically stated 'excluding vessels and ITQ shares' but some appear to have neglected to consider this qualification to the question. Also, some mentioned the purchasing of quota while other mentioned the purchasing of shares.

Current Market Value: The question "Excluding real estate, vessels, and any GT-IFQ shares owned by the business, what would you estimate as the CURRENT MARKET VALUE of this seafood business?" was also queried from the survey participants. Thirty-seven individuals completed this question with approximately one-half (19) reporting the current market value to be less than $1 million and another 13 (about 35%) reporting a value of between $1 million and $7million. Five individuals (15%) indicated a value in excess of $7 million.

While only 37 individuals responded to the question regarding current market value, 52 provided an opinion regarding whether or not implementation of the GT-IFQ program resulted in a change in the current market value of the seafood business. Of the 52 respondents, 65% (i.e., 34 individuals) were of the opinion that implementation of the GT-IFQ program resulted in no change in the current value of their respective businesses. By comparison 14 individuals, or about one-quarter of the total, were of the opinion that implementation of the GT-IFQ program resulted in an increase in the current market value of their respective businesses while 4 individuals (about 8%) opined that the current market value of their respective businesses declined as a result of the GT-IFQ program. Among those respondents who considered the

Among those who considered commercial fishing to be the primary activity of the business (Question 2), 10 of 14 (about 70%) were of the opinion that implementation of the GT-IFQ program resulted in no change in the current market value of their respective seafood businesses while the remaining four were of the opinion that the GT-IFQ program resulted in an increase in the current market value of their business. Among 23 firms who considered their primary activity to be that of a dealer/distributor, 12, or slightly more than one-half, were of the opinion that implementation of the GT-IFQ program had no impact on the current market value of their respective businesses. Seven of the 23, however, were of the belief that implementation of the GT-IFQ program increased the current market value of their business while 4 (17%) suggested that implementation of the GT-IFQ program culminated in a loss in the current market value of their respective businesses. Based on small samples, 80% of both processors (4 out of 5) and retailers (4 out of 5) were of the opinion that implementation of the GT-IFQ program had no impact on the current market value of their businesses while the other 20% among both groups opined that implementation of the program increased the current market value of their businesses.

Section 4: GT-IFQ Share in Business Operations

Acquiring GT-IFQ shares: This section of the report attempts to establish the importance of IFQ shares in business operations and how these shares are used. To do so, it is first important to establish the prevalence of these businesses holding GT-IFQ shares. As such, interviewees were first asked the question "Do you or your business currently hold any GT-IFQ shares?" (Question 17). Fifty-five individuals answered this question with 29 (53%) indicating that they did currently hold GT-IFQ shares and 26 (47%) responding that they did not.

Those responding affirmatively to currently holding GT-IFQ shares were then asked the proportion of their 2014 post-GT-IFQ gross sales of grouper and tilefish was represented by GT shares that they held (Question 17.a). Twenty-five of the 29 firms answered this question with 9 of the 25 (36%) reporting that the proportion of their 2014 gross grouper/tilefish gross sales represented by GT shares that they held was less than or equal to 10%. Another five firms (20%) reported the proportion from 11% to 25%. Seven firms (28%) indicated a proportion approximating or equaling 100%.

All were queried as to whether "…you or your business plan to acquire shares in the future?" (Question 18). Fifty-four firms responded to this question. Of these 54 responses, 17 (31%) replied 'yes' while 21 replied 'no'. The remaining 30% (16) were undecided. Those responding affirmatively to the question "Do you or your business plan to acquire shares in the future?" were then queried as to primary reasons (Question 18.a). A list of reasons from which to select included: (a) Increased GT-IFQ shares would allow me to expand my dealer/processor operations, (b) I would like to increase and/or change the product mix of GT-IFQ species that I am currently allowed to harvest with my existing GT-IFQ shares, and (c) 'Other'.[56] Fourteen of the 17 indicated that a primary reason for acquiring additional shares would be to allow expansion of their dealer/processor operations. Seven of the 17 (41%) indicated that a primary reason for acquiring additional shares would be to increase and/or change the product mix of GT-IFQ species. Four of the 17 stated 'other' with reasons provided including it being a good investment, the preference of owning shares to buying allocation, the need to generate income to cover operating costs.

Interviewees replying 'no' to question 18 (i.e., Do you or your business plan to acquire shares in the future?) were queried as to primary reasons for not acquiring additional GT-IFQ shares (Question 18.b). Reasons provided on the questionnaire included: (a) The cost of acquiring GT-IFQ shares is high relative to any expected benefits I might receive from additional GT-IFQ shares, (b) My business is currently at an 'optimal' size and therefore I need no additional grouper/tilefish product, (c) I can buy all the raw product I need at a reasonable price from local fishermen or other sources, (d) Buying GT-IFQ allocation better suits my business, and (e) "Other". Nine of the 21 (100%) who replied 'no' to question 18 indicated the relative high cost as being a primary reason for answering in the negative. One of the 21 indicated that 'my business is currently at an 'optimal size' and therefor I do not need additional grouper/tilefish product' as a primary reason for not acquiring additional shares in the future. Four of the 21 who indicated that they were not interested in acquiring additional share gave as a primary reason "I can buy all the raw product I need at a reasonable price from local fishermen or other sources" while "Buying GT-IFQ allocation better suits my business" was cited by one of the 21. Seven of the 21 cited "Other" reasons including: (a) the investment would never give a sufficient return, (b) the business was for sale and, as such the owner did not wish to make any additional investments, (c) leasing allocation is preferable, and (d) have excessive shares that could satisfy an additional boat without purchasing more.

IFQ allocation to vessels: To ascertain the use of the GT-IFQ shares, survey participants were asked the question "Do you provide allocation to vessels not owned by you or your business?" (Question 19) This question was answered by 55 participants with 31 (56%) replying affirmatively with the remaining 24 responding in the negative.[57] Only 2 of the 31, or less than 10%, indicated that such an arrangement (i.e., providing GT allocation to vessels not owned by you or your business) called for the fishermen given allocation to sell his/her catch (associated with the GT-

[56] The interviewees were allowed to select more than one option in this section. Hence, the number of reasons given exceeds the relevant number that answered either 'yes' or 'no' to question 18.

[57] While only 29 firms responded affirmatively to the question "Do you or your business currently hold any GT-IFQ shares? (i.e., Question 17), 31 firms answered affirmatively to the question "Do you provide GT allocation to vessels not owned by you or your business?" The reason why the second question received more affirmative responses than the first question is a matter of speculation. It may be that the firm purchased allocation to give to fishermen.

IFQ allocation) to the business with no payment for the GT-IFQ allocation being required.[58] Twenty-one of the 31 (68%), however, indicated that the arrangement called for the fishermen given allocation to sell their catch to the firm with payment for GT-IFQ allocation subtracted from payment for the catch. Eight of the 31 (26%) checked the box "Fishermen must pay 'up front' for the GT-IFQ allocation provided but are not required to sell their catch to my business." Finally, three of the 31 (10%) listed "Other arrangements" which included trading allocation for red snapper, gathering allocation to distribute to anyone that needs it and are willing to help restore stability in the industry, and fishermen given allocation sell part of their catch to the firm in return for being given the allocation. [59]

Survey participants were also asked the question "Of the GT-IFQ allocation you held on an annual basis, what percentage on average was: (a) used for vessels owned by you or your business, (b) provided to fishermen who own their vessels with the stipulation that they sell their catch to your business, (c) provided to fishermen with no requirement regarding sales (d) sold (leased), and (e) "other" (Question 20). Summary statistics related to this question and based on 41 firms responding to this question are provided in Table 4.1.[60] As indicated, almost 40% of the allocation was used by vessels owned by the business with much of the remaining use being attached to vessels being required to sell their respective catches to the business providing the allocation.

Table 4.1. Use of GT-IFQ Allocation

Purpose	Percent	St. Dev.
Used by vessels owned by this business	38.3%	40.2
Provided to fishermen who own their own vessels with the stipulation that they sell their catch to business	42.1%	43.4
Provided to fishermen with no requirements on sales	8.4%	22.9
Sold (leased)	4.3%	16.2
Other	6.8%	22.8

Section 5: Opinions Regarding the IFQ Program

In general, survey participants appear to be supportive of the GT-IFQ program. With respect to the question "How satisfied are you with the IFQ Online System for managing and completing the landing transactions (i.e., Question 21), about two-thirds of the 56 respondents indicated that they were either 'Satisfied' or 'Highly Satisfied' (Table 5.1). By comparison, less than 10% reported being 'Unsatisfied' or 'Highly Unsatisfied.' One-quarter of the respondents reported being 'Neutral.' Suggested improvements in the System are provided in the Appendix to Section 5.

Table 5.1. Satisfaction with the IFQ Online System

	Number	Percent
Highly Unsatisfied	2	3.6%
Unsatisfied	3	5.4%

[58] See question 19.a for a detailed description of options.

[59] Note that the summation of percentages exceed 100% because the establishments were permitted to select more than one category.

[60] Nineteen observations that had no information to this question were deleted as well as one observation in which the sum across alternatives did not sum to 100. The 41 establishments that answered this question brings up the issue of how is allocation was acquired given that significantly fewer firms reported holding share (Question 17).

Neutral	14	25.0%
Satisfied	22	39.3%
Highly Satisfied	14	25.0%
No Opinion	1	1.8%

Respondents were also, in general, satisfied with customer service when contacting NOAA Fisheries Service regarding questions about the IFQ program. Specifically, almost 85% of the respondents indicated that they were either 'Satisfied' or 'Highly Satisfied' with customer service compared to only 10% who were 'Highly Unsatisfied' or 'Unsatisfied' (Table 5.2). Suggested improvements in the IFQ customer service are provided in the Appendix to Section 5.

Table 5.2. Satisfaction with Customer Service Received

	Number	Percent
Highly Unsatisfied	3	5.4%
Unsatisfied	3	5.4%
Neutral	2	3.6%
Satisfied	22	39.3%
Highly Satisfied	25	44.6%
No Opinion	1	1.8%

Interviewees were also queried regarding their satisfaction with respect to enforcement of the IFQ program Question 23). Responses to this question, based on 55 observations, are presented in Table 5.3. Overall, about 20% of the respondents indicated that they were either 'Unsatisfied' or 'Highly Unsatisfied' with the program compared to slightly less than 50% responding that they were either 'Satisfied' or 'Highly Satisfied' with the program.

Table 5.3. Satisfaction with Customer Service Received

	Number	Percent
Highly Unsatisfied	5	9.0%
Unsatisfied	6	10.9%
Neutral	13	23.6%
Satisfied	15	27.3%
Highly Satisfied	11	20.0%
No Opinion	5	9.1%

Southeast Fisheries Science Center Economic Analyses

The SEFSC conducted several analyses to explore the economic performance of the GT-IFQ program. These studies reviewed the empirical evidence to examine whether the anticipated impacts of the program met the objectives of the program and matched with the experience of

other catch share programs. These analyses drew from several sources including… The analysis examined ….

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.

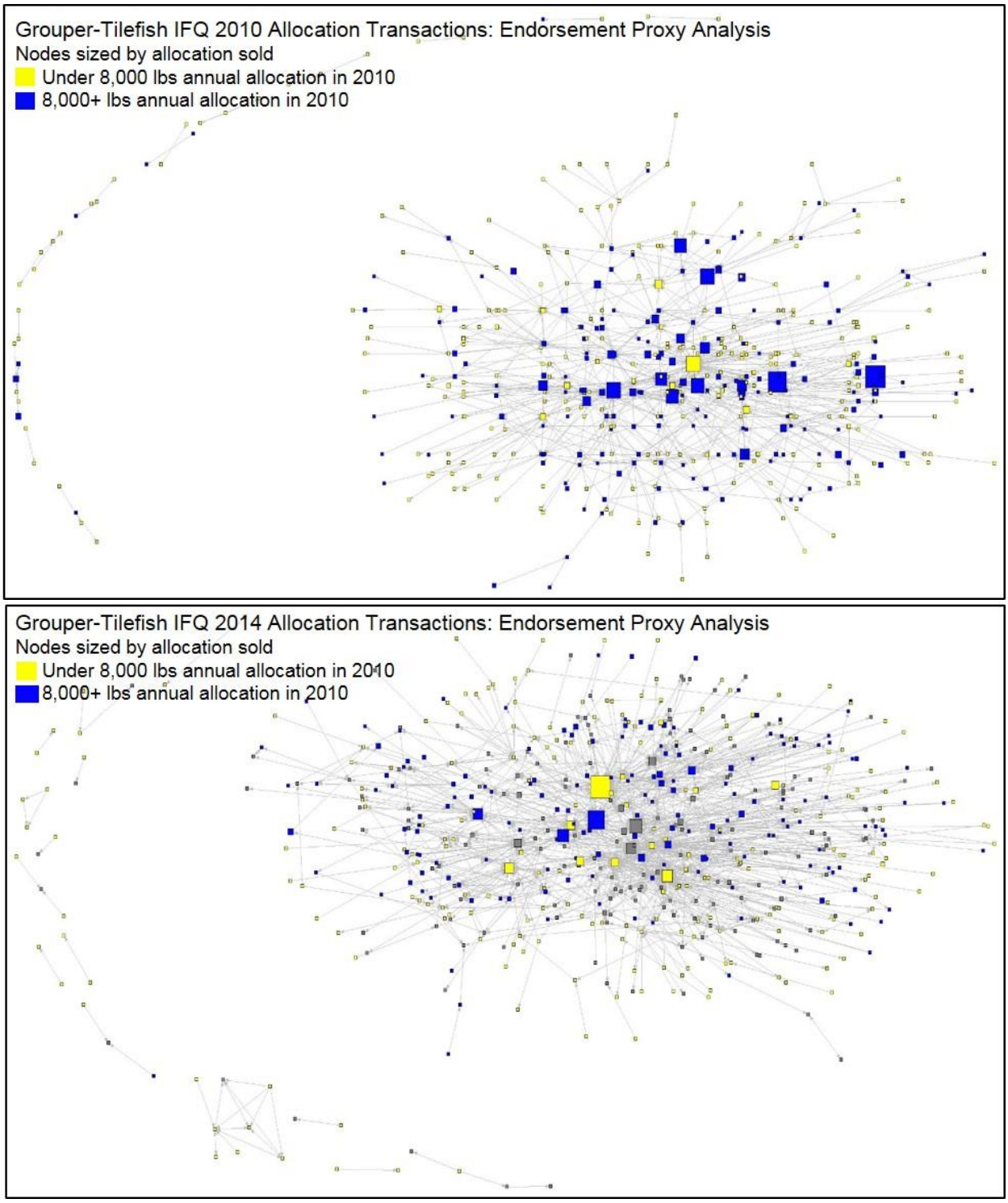
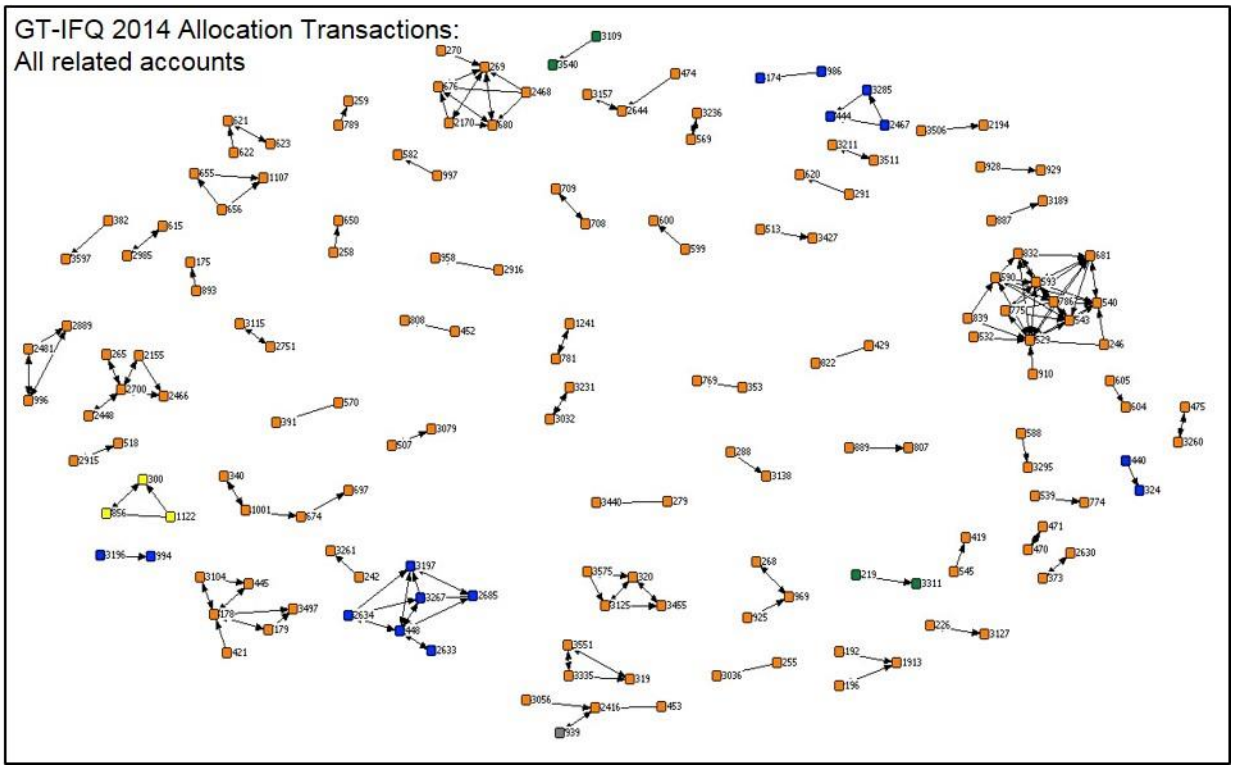


Figure 1. 2010 and 2014 Grouper-Tilefish IFQ allocation transaction networks with endorsement proxy data. Nodes are colored by cumulative allocation in 2010 (yellow = less than 8,000 lbs of cumulative allocation, blue = at least 8,000 lbs of cumulative allocation). Nodes are sized by pounds of allocation 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.



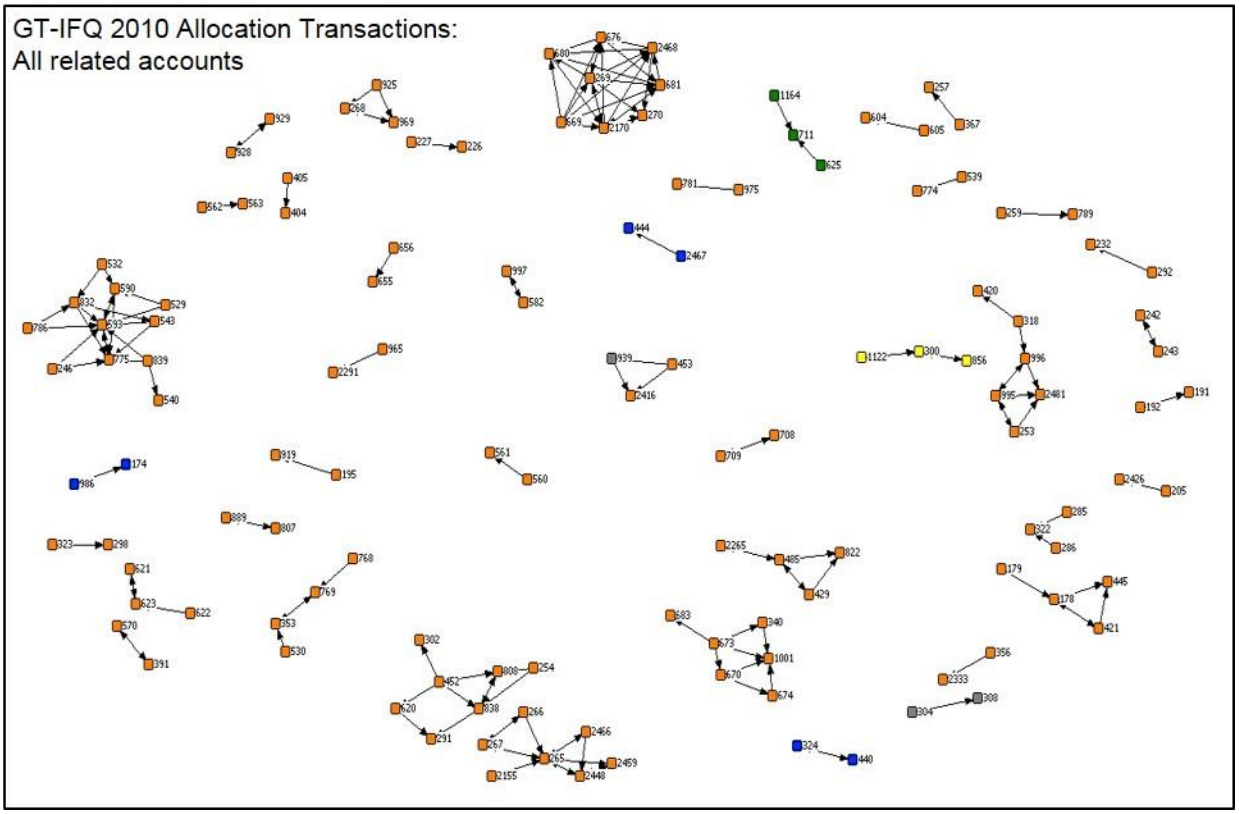


Figure 2. 2010 and 2014 Grouper-Tilefish IFQ related accounts networks. Nodes are colored by state (Florida = orange; Alabama = gray; Mississippi = yellow; Louisiana = green; Texas = blue).

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.

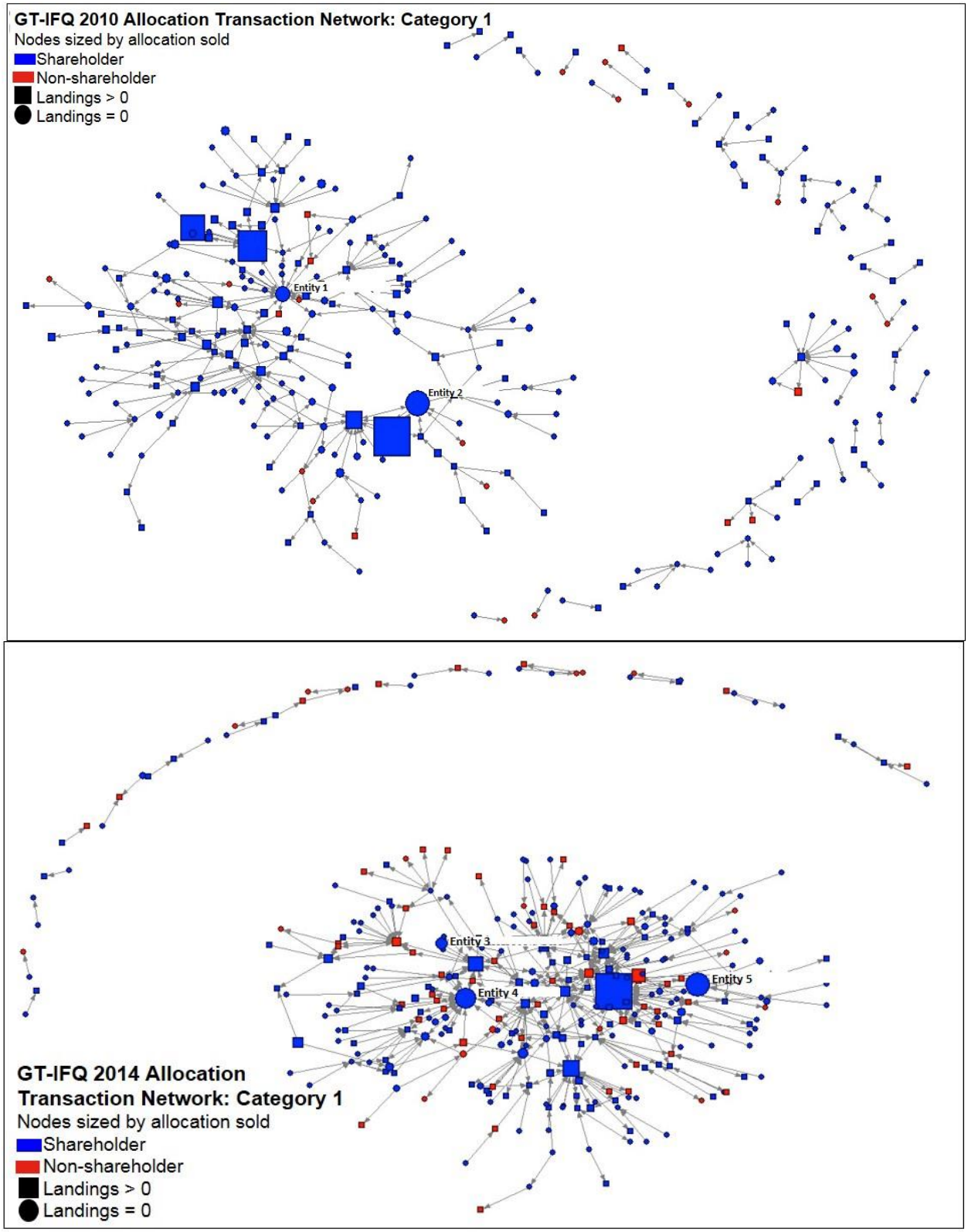


Figure 3. 2010 and 2014 Grouper-Tilefish IFQ Category 1 allocation transaction networks. Nodes are colored by shareholder status (blue = shareholder, red=non-shareholder), shaped by

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.

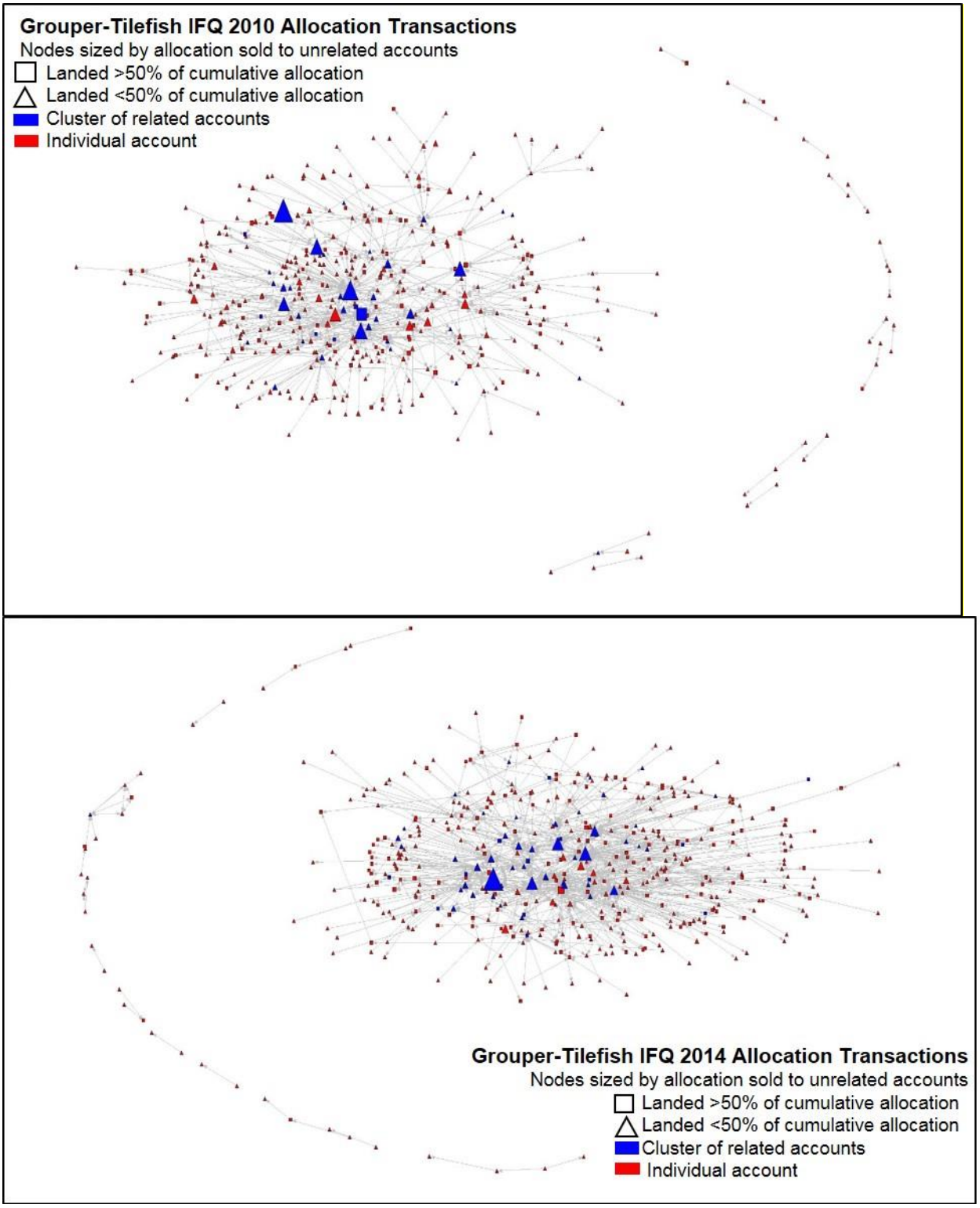


Figure 4. 2010 and 2014 Grouper-Tilefish allocation transaction network with related account clusters. Nodes are colored by related account status (blue = related account cluster, red=individual IFQ accounts), shaped by reported landings (squares = landed at least 50% of

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.

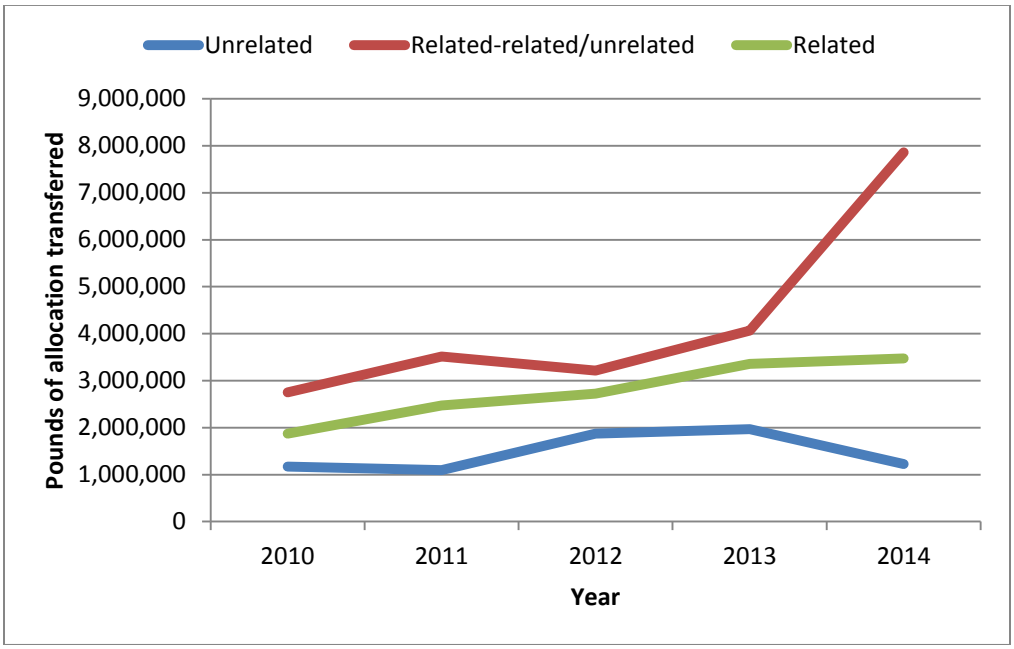


Figure 5. Pounds of allocation transactions by year among unrelated, related and unrelated, and related accounts.