Golden Tilefish

Individual Fishing Quota Program

5-Year Review

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Prepared by the Mid-Atlantic Fishery Management Council
in cooperation with
the National Marine Fisheries Service (NMFS)

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Abbreviations

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
AGEPRO	Age Structured Projection Model
AM	Accountability Measure
AP	Advisory Panel
APSD	Analysis and Program Support Division
ASAP	Age Structured Assessment Program
ASPIC	A Stock Production Model Incorporating Covariates
B_{MSY}	Biomass Based Reference Point (Biomass at which MSY can be taken)
SSB_{MSY}	Spawning Stock Biomass Based Reference Point
CFR	Code of Federal Regulations
CSP	Catch Share Program
CPH	Confirmation of Permit History
CPUE	Catch Per Unit Effort
e.g.	For Example
et al.	And Others
EFH	Essential Fish Habitat
F	Fishing Mortality
FMP	Fishery Management Plan
FMAT	Fishery Management Action Team
F_{MSY}	Overfishing Based Reference Point
F_{MULT}	Fishing Mortality Multiplier (fully recruited fishing mortality rate)
FR	Federal Register
FPR	Fishery Performance Report
FY	Fishing Year
GARFO	Greater Atlantic Regional Fisheries Office (formerly Northeast Regional Office or NERO)
GTF	Golden Tilefish
HAPC	Habitat Area of Particular Concern
HHI	Herfindahl-Hirschman Index
IFQ	Individual Fishing Quota
i.e.	That Is
ITQ	Individual Transferable Quota
IVR	Interactive Voice Response
MAFMC	Mid-Atlantic Fishery Management Council
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	Maximum Sustainable Yield
mt	Metric Ton (1 metric ton = 2,204.6226 pounds)
MTA	Montauk Tilefish Association
NEFOP	Northeast Fisheries Observer Program,
NEFSC	Northeast Fisheries Science Center
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	Optimal Yield
PSE	Proportional Standard Error
r	Intrinsic Rate of Increase
RFA	Regulatory Flexibility Act
S/T	NMFS Office of Science and Technology
SARC	Stock Assessment Review Committee
SAW	Stock Assessment Workshop
SSB	Stock Spawning Biomass
SSC	Scientific and Statistical Committee
TAL	Total Allowable Landings
TFP	Total Factor Productivity
VTR	Vessel Trip Report
U.S.	United States
WWII	World War II

Executive Summary

This report was developed to provide the first comprehensive review of the progress of the Golden Tilefish Individual Fishing Quota Program towards achieving the stated goals of reducing overcapacity and eliminating the problems associated with derby fishing. In addition, the review proposes modifications to the program in order to better achieve the overall goals and objectives of the Tilefish Fishery Management Plan. The Magnuson-Stevens Act stipulates that a formal and detailed review is required 5 years after the implementation of the program and, thereafter, no less than once every 7 years. A Fishery Management Action Team that included staff from the Mid-Atlantic Fishery Management Council, the Northeast Fisheries Science Center, and the Greater Atlantic Regional Fisheries Office was formed to conduct this review. The program review was organized into six main outcomes or impacts: socioeconomic outcomes, biological outcomes, social impacts, community impacts, safety at sea, and program enforcement. The review also addresses recent administrative changes to the program, and summarizes future research needs and recommended changes to the program. In general terms, it was found that overcapacity has been reduced since the program was implemented, and it appears that derby-style fishing has subsided and that ex-vessel prices have improved under the Individual Fishing Quota system.

1.0 Introduction

The purpose of this review is to evaluate the progress made in meeting the goals of the golden tilefish (GTF) Individual Fishing Quota (IFQ) program. Catch share programs (CSPs) must undergo periodic reviews (see Section 2.0, Summary of Legal Requirements for Program Review, for additional details). The following elements are typically addressed in these reviews:

1) Purpose and need of the review (discuss legal/policy requirements)
2) Goals and objectives of the program and the Magnuson-Stevens Fishery Conservation and Management Act (MSA)
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
4) Description of biological, ecological/environmental, economic, social, and administrative environments before and since the program's implementation
5) Analysis of the program's biological, ecological/environmental, economic, social, and administrative effects
6) 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) Recommendations regarding potential changes to the program's structure, including the potential need for additional data collection and/or research

The 5-year review is organized in sections as follows:

- Summary of Legal Requirements for Program Review
- Program Goals and Objectives
- History and Development of the Program
- Program Performance and Review
- Research Needs
- Recommended Program Changes
- Summary and Conclusions of This Review
- References

Discussed in this document are the following topics that are integral to this review:

A) Goals and objectives
B) Allocations
C) Eligibility
D) Transferability
E) Annual Catch Limits (ACLs)
F) Accumulation limits/caps
G) Cost recovery
H) Data collection/reporting, monitoring, and enforcement

I) Duration
J) New entrants

2.0 Summary of Legal Requirements for Program Review

The 2007 reauthorization of the MSA included new requirements related to the monitoring and review of limited access privilege programs, which includes fisheries managed under IFQs. The term "limited access privilege" is defined as a Federal permit to harvest a quantity of fish representing a portion of the total allowable catch of the fishery. MSA requires that periodic formal and detailed reviews be conducted to assess whether the program is meeting management goals. Section 303A(c)(1)(G) of the MSA states the following requirements for limited access privilege programs:

> *MSA 303A(c) Requirements for Limited Access Privilege Programs*
> *(1) IN GENERAL*
> *(G) 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 those 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 [FMP] (but no less frequently than once every 7 years);*

Tilefish regulations under 50 CFR §648.294(i) state that:

> *(i) Periodic review of the IFQ program. A formal review of the IFQ program must be conducted by the MAFMC within 5 years of the effective date of the final regulations. Thereafter, it shall be incorporated into every scheduled MAFMC review of the FMP (i.e., future amendments or frameworks), but no less frequently than every 7 years.*

This review followed an early draft of Guidance for Conducting Reviews of Catch Share Programs developed by the NMFS (unpublished draft version) as well as reviews previously conducted of other limited access programs.[1]

[1] Red Snapper Individual Fishing Quota Program 5-year Review (2013); available at: http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/documents/red-snapper-5-year-review.pdf and Limited Access General Category (LAGC) IFQ Fishery Performance Evaluation (LAGC IFQ REPORT, 2012); available at: http://archive.nefmc.org/scallops/cte_mtg_docs/130917-18/7%20LAGC%20IFQ%20Report%20Draft%20(2).pdf. Final Guidance for Conducting Review of Catch Share Programs were published in April 2017 (http://www.nmfs.noaa.gov/op/pds/documents/01/121/01-121-01.pdf). The guidance provided in final guideline document does not significantly differ from the guidance provided under the unpublished draft document.

3.0 Program Goals and Objectives

The overall goal of the Tilefish FMP is to rebuild golden tilefish so that the optimum yield can be obtained from this resource. To meet the overall goal, the following objectives were adopted:

1. Prevent overfishing and rebuild the resource to the biomass that would support MSY [Maximum Sustainable Yield]
2. Prevent overcapitalization and limit new entrants
3. Identify and describe essential tilefish habitat
4. Collect necessary data to develop, monitor, and assess biological, economic, and social impacts of management measures designed to prevent overfishing and to reduce bycatch of tilefish in all fisheries

Amendment 1 did not change the overall goals and objective of the FMP. Amendment 1 continued the existing management measures to prevent overfishing and rebuild the resource. The goal of the Tilefish FMP is in accord with the general purpose of the IFQ management system: to reduce overcapacity and latent fishing effort in the commercial fishery, and to eliminate, to the extent possible, the problems associated with derby-style fishing, in order to assist the Council in achieving optimal yield (OY). The IFQ system was initiated to reduce discards and waste for sectors experiencing early closures in the commercial fishery. Vessel operators would not have to go to sea during unsafe winter weather conditions in order to compete with someone else for a share of the quota. The IFQ system was implemented to provide vessel operators more flexibility in deciding when, where, and how to fish. The program would allow vessel operators to determine the best time at which to harvest quota share, given weather conditions and price at the dock.

4.0 History and Development of the Program

4.1 Pre-GTF-IFQ Stock Status and Management History

4.1.1 Path to Developing Initial Management Regime

Golden tilefish fishing has occurred in the mid-Atlantic and southern New England coasts since the early 1900s. Longline gear has been used traditionally for the directed tilefish fishery but tilefish has also been landed as bycatch in otter trawl fisheries (MAFMC 2001). The initial fishery was a longline fishery and within the first 10 months of 1916, 10 million pounds, the largest amount of tilefish ever landed in a year, was caught (Turner 1986).

In the following years, up through World War II (WWII), when landings were recorded, they fluctuated between one and four million pounds. After WWII, a mixed trawl fishery developed in New England and accounted for most of the landings through the mid-1960s. The directed longline fishery that developed in the mid-Atlantic in the early 1970s has accounted for nearly all of the landings since then. The tilefish fishery has been cyclical, and for the period from 1950–1980, landings ranged from 66,000 pounds (in 1967 and 1968) to 8.7 million pounds (in 1979).

Landings fluctuated over the next three decades, with an overall downward trend since the late 1960s/late 1970s peak (MAFMC 2001).

The directed longline tilefish fishery developed in the 1970s in central New Jersey; however, by the late 1970s and early 1980s a significant amount of landings was also coming from eastern New York. The Council became interested in management of tilefish in 1981 and began funding part of the dissertation work of a graduate student (Turner) on tilefish at Rutgers. That dissertation, "Population Dynamics of And, Impact of Fishing on Tilefish, *Lopholatilus Chamaeleonticepts*, in the Middle Atlantic – Southern New England Region During the 1970's and Early 1980's," (Turner 1986) still is considered important work on this species in this area. This study is important because it provided the needed information on the stock and the fishery during the initial development of the directed longline tilefish fishery (MAFMC 2001).

In 1982 and 1983, while Turner was conducting his research, Council staff began drafting a management plan. An industry advisory panel (AP) was created. There was significant scientific interest in the Council's efforts and the Scientific and Statistical Committee (SSC) met numerous times to review and discuss the science with the Rutgers researchers and the advisors from industry. Industry and staff were working on management measures and industry had nearly agreed to a catch share (i.e., Individual Transferable Quota or ITQ) approach based on historical landings. When Turner finally completed the population analysis, however, and industry representatives realized they had to significantly reduce landings in order to get to the MSY level, industry withdrew its support. At that point, the Council reprioritized its efforts and concentrated on a striped bass Fishery Management Plan (FMP) (MAFMC 2001).

The Council made several additional attempts to address the development of a management system for golden tilefish but it was not until the NMFS declared golden tilefish overfished based on a 1999 stock assessment that the Council started the development of a management plan for tilefish. The Council did this in order to comply with the amended Magnuson-Stevens Act, which requires the rebuilding of all overfished resources under Council jurisdiction (MAFMC 2001). The Council implemented a fast-track approach to develop the Tilefish FMP in a time period encompassing slightly over one year, and the FMP was implemented in November 1, 2001.

Some stakeholders wanted the FMP to establish an IFQ program; however, at that time there was a Congressional moratorium in place that prohibited implementation of new IFQ programs (Kitts et al. 2007). The FMP established or implemented the following:

- Management and administrative measures to ensure effective management of the tilefish resource
- Total allowable landings (TAL) as the primary control on fishing mortality
- Limited entry program and a tiered commercial quota allocation of the TAL

Three fishing categories, an incidental, a part-time, and a full-time with two different tiers or subcategories), were established for division of the quota under the tilefish limited access

program.[2] Under the FMP, the "target" estimate of landings for the incidental category (5% of the TAL) is first deducted from the overall TAL, and then the remainder of the TAL is divided among the full-time Tier 1 category, which receives 66%; the full-time Tier 2 category, which receives 15%; and, the part-time category, which receives 19%. While the original FMP allocated the TAL amongst the various fishing categories, it did not indicate how it should be divided between vessel owners within each category. Trip limits were only imposed in the incidental non-directed permit category (open access) to achieve a "target" or soft quota.

Other elements of the original FMP included the following:

- Stock rebuilding strategy
- Permits and reporting requirements for commercial vessels, operators, and dealers
- Prohibition on the use of gear other than longline gear by limited-access tilefish vessels (later amended see discussion below)
- Framework adjustment process

4.1.2 Brief Description of the Management System Performance

The FMP implemented a constant harvest strategy of 1.995 million pounds (with annual quota reductions for previous overages of the quota) based on stock projections to rebuild the stock to B_{MSY} in a 10-year time period with the 50% probability. The original FMP limited coast-wide tilefish landings to the overall TAL every year since the FMP proved to be effective with the sole exception in 2003, when the overall quota had been exceeded by 16% after the permit categories were vacated by a Federal Court Order resulting from the *Hadaja v. Evans* lawsuit[3] (Table 1). In 2010, the overall TAL was exceeded by approximately 2,000 pounds, or 0.1%.

The constant harvest strategy and limited entry program implemented under the FMP appeared to have had a positive impact on the tilefish stock. The 2005 and 2009 stock assessment indicated that the tilefish stock was increasing (NEFSC 2005, 2009). However, while overall landings were constrained by the TAL, derby-style fishing developed as some fishermen competed to catch as much fish as possible before their category annual limit was reached.

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[2] The following landings qualification criteria was used to assess entry into the limited access program: *Full-time Tier 1 category*: at least 250,000 pounds/year for any three years between 1993-1998, at least 1 pound of which was landed prior to June 15, 1993; *Full-time Tier 2 category*: at least 30,000 pounds/year for any three years between 1993-1998, at least 1 pound of which was landed prior to June 15, 1993; *Part-time category*: at least 10,000 pounds in any one year between 1988-1993 and at least 10,000 pounds in any one year between 1994-1998 or 28,000 pounds in one year between 1984-1993, at least 1 pound of which was landed prior to June 15, 1993. For a detailed description on the evolution and rationale underlying the limited access permit categories see Appendix B of Amendment 1 to the FMP (MAFMC 2009).

[3] As a result of the decision of the *Hadaja v. Evans* lawsuit, the permitting and reporting requirements for the FMP were postponed for close to a year (May 15, 2003 through May 31, 2004). During that time period, it was not mandatory for permitted tilefish vessels to report their landings. This decision vacated the regulations that implemented sub-quotas for the various limited access categories out of order. Therefore, landings in excess of the originally established tilefish quota occurred during this time period.

In fact, the full-time Tier 2 category closed early from 2005–2009 and the part-time category had early closures from 2004–2009 (Table 2). The full-time Tier 1 category behaved differently. The Tier 1 tilefish vessels had formed the Montauk Tilefish Association (MTA), a registered non-profit organization with the objective to provide an organizational structure for making collective decisions for its members. The MTA also provided members protections under the Fishermen's Collective Marketing Act (Kitts et al. 2007, Rountree et al. 2008). Further, this association worked to create and foster a fisheries management regime that is efficient and encourages resource stewardship at the local level. Other important outcomes from this collaboration include fresher fish for the market, more constant supply of fish to the market, and prevention of a derby fishery that can promote fishing in unsafe conditions (Kitts et al. 2007).

Table 1. Summary of Management Measures and Landings for the FY 2002–2016. [a]

Fishing Year	ABC (million pounds) [b]	TAL (million pounds) [c]	Commercial quota (million pounds) [d]	Commercial landings (million pounds) [d]	Incidental trip limit (pounds)	Recreational possession limit
2002	NA	1.995	1.995	1.935	300	NA
2003	NA	1.995	1.995	2.318 [e]	300	NA
2004	NA	1.995	1.995	2.622 [e]	300	NA
2005	NA	1.995	1.995	1.497	133	NA
2006	NA	1.995	1.995	1.897	300	NA
2007	NA	1.995	1.995	1.766	300	NA
2008	NA	1.995	1.995	1.672	300	NA
2009	NA	1.995	1.995	1.887	300	NA
2010	NA	1.995	1.995	1.997	300	8[e]
2011	NA	1.995	1.995	1.946	300	8[e]
2012	NA	1.995	1.995	1.874	500	8[e]
2013	2.013	1.995	1.995	1.841	500	8[e]
2014	2.013	1.995	1.995	1.830	500	8[e]
2015	1.766	1.755	1.755	1.346	500	8[e]

[a] Fishing Year (FY) 2002 (November 1, 2001 – October 31, 2002). [b] Acceptable biological catch (ABC) were first implemented for golden tilefish in FY2013. [c] IFQ and incidental fisheries combined TAL. [d] Includes both IFQ fishery and incidental fishery. [e] Lawsuit period (see text above and footnote 2). [f] Eight fish per angler per trip. NA = not applicable.

Table 2. Golden Tilefish Pre-IFQ Permit Category Quota Monitoring FY 2003–2009.

Fishing Year	Permit category					
	Full-time Tier 1		Full-time Tier 2		Part-time	
	Closure	Date	Closure	Date	Closure	Date
2003	No	NA	No	NA	No	NA
2004	No	NA	No	NA	Yes	9/25/2004
2005	No	NA	Yes	~ 6/2005	Yes	~3/2005
2006	No	NA	Yes	8/2/2006	Yes	3/27/2006
2007	No	NA	Yes	7/7/2007	Yes	12/29/2006
2008	No	NA	Yes	5/8/2008	Yes	~3/2008
2009	No	NA	Yes	6/6/2009	Yes	8/21/2009

NA = Not applicable. ~ = approximately.

4.2 GTF-IFQ Development, Design, and Structure

4.2.1 Path to Developing IFQ Regime

As documented in Section 4.1.1 (Path to Developing Initial Management Regime), the Tilefish FMP implemented a limited entry program and a tiered commercial quota allocation of the TAL. The original FMP did not address how the quota was to be distributed among vessels within each of the three fishing categories. Industry members and managers were concerned about the early closures in the full-time Tier 2 and part-time categories that had occurred in the fishery and the development of a derby-style fishing. Derby fishing was exacerbated due to the November 1 start of the fishing season that in some instances forced smaller-sized vessels to go to sea during unsafe winter weather conditions in order to compete for a share of the quota. The development of derby-style fishing practices was unique to the full-time Tier 2 and the part-time categories.

Full-time Tier 1 did not experience derby-style fishing or early closures because individuals in this fishing category developed an agreement to further allocate the overall Tier 1 allocation to vessels within that category. Full-time Tier 1 stakeholders indicated that their "cooperative understanding" allowed them to spread landings throughout the year to maximize their performance. More specifically, under this "cooperative understanding," full-time Tier 1 participants decide at the vessel level when to fish, how much to fish, and when to land the fish harvested in order to maximize ex-vessel price (by avoiding market gluts and spreading landings throughout the year). The Council indicated that the implementation of an IFQ program could possibly mitigate the effects of the early closures that were occurring in other fishing categories, and maximize fishery performance.

Furthermore, full-time Tier 1 stakeholders indicated that they were also interested in exploring the possibility of implementing an IFQ program that would further stabilize the fishery and

formalize their cooperative agreement (MAFMC 2009).[4] The cooperative actions of the full-time Tier 1 stakeholders helped them manage their business operations more effectively and laid the foundation for implementing the IFQ program.

4.2.1.1 Allocation Formula for IFQ Program

Amendment 1 to the Tilefish FMP created an IFQ program that took effect on November 1, 2009 (74 FR 42580; September 24, 2009). The implementation of the IFQ system allowed for the distribution of the overall TAL among the full-time and part-time vessel categories that were permitted to participate in the fishery. The Council evaluated 18 alternatives with several different time periods of landings (e.g., calendar year 1988–1998; 2001–2005; best five years from 1997–2005) and allocation schemes (e.g., allocations to qualifying vessels in each permit category can be based on the percentages associated with landings for each of these time periods, or based on dividing the overall quota for each permit category equally among all vessels in each category) for IFQ program development.

However, regardless of the time period used for allocation purposes, vessels qualifying for IFQ allocation in the full-time Tier 1 would receive a group allocation equal to 66% of the adjusted TAL, full-time Tier 2 vessels would receive 15% of the adjusted TAL, and part-time vessels 19% of the adjusted TAL.[5] The incidental permit category would continue to share 5% of the overall initial TAL, regardless of the number and combination of limited entry permit categories chosen to be included in the IFQ program. The Council chose to use average landings for the 2001–2005 period in order to allocate IFQ shares to full-time Tier 1 and 2 vessels. For part-time vessels, an equal allocation for vessels that landed tilefish during the 2001–2005 period was used to allocate IFQ shares. The preferred alternative selected by the Council to implement the IFQ allocation system allowed the flexibility of an IFQ system to be established for any combination of limited entry permit categories, time periods, and/or allocation schemes (MAFMC 2009).

4.2.1.2 Brief Description of the Management System Structure

In this section, key elements of the IFQ management program will be summarized and briefly discussed. Some of these elements will be discussed further in subsequent sections of the document. The following elements present a snapshot of the nature of harvest privilege under the Golden Tilefish IFQ system.

[4] For a summary of Amendment 1 to the Tilefish FMP approved measures see: Amendment 1 to the Tilefish FMP Approved Measures, see: https://www.greateratlantic.fisheries.noaa.gov/nero/nr/nrdoc/09/09tileamend1phlattach.pdf. For a summary of the IFQ fishery and management system; see Catch Share Spotlight No. 13. Mid-Atlantic Golden Tilefish Individual Fishing Quota (IFQ) Program, available online at: http://www.nmfs.noaa.gov/sfa/management/catch_shares/about/documents/mid_atlantic_tilefish_ifq_2009.pdf.

[5] The overall allocation values for each fishing category implemented in the original FMP.

4.2.1.2.1 Eligibility

In order to qualify for a tilefish IFQ allocation, a person or entity had to own a vessel with fishing history, had a valid tilefish Limited Access permit for the 2005 permit year, and reported average landings of tilefish from 2001–2005 that accounted for at least 0.5%[6] of the average landings in its fishing category during that time frame. An individual could also qualify to receive IFQ share allocation if they held a valid Confirmation of Permit History (CPH) for the above criteria.[7]

4.2.1.2.2 Initial Allocation Process

Numerous documents offer guidance on initial allocations within catch share programs (Anderson and Holliday 2007, NOAA Catch Share Policy 2010, Morrison and Scott 2014). Each of these documents identifies three parts of the process:

1. Determining eligibility
2. Calculating allocations (whether group or individual)
3. Creating accumulation limits

For the first year of the IFQ program, the tilefish TAL was allocated to persons or entities holding IFQ allocation permits as follows:

- 3% for research-set aside projects, if any[8]
- 5% for incidental catch
- 15% was temporarily reserved to resolve any potential appeals[9]
- 77% (the remaining portion of the TAL) to IFQ allocation permit holders

The IFQ allocation is determined by calculating the percentage of the vessel's average landings (within each limited access category) during the qualification period. The allocation granted each IFQ shareholder was derived by multiplying their IFQ share times the annual tilefish IFQ overall quota.

The FMP initially defined an IFQ share as the percentage of the commercial quota of tilefish proportioned to each eligible person based on specified landings data. An IFQ allocation was

[6] See footnote number 11.
[7] A CPH is required when a vessel that has been issued a limited access permit has sunk, been destroyed, or been sold to another person without its permit history and a new vessel has not been purchased. For a complete definition of CPH see 50 CFR §648.4 at: http://www.ecfr.gov/cgi-bin/text-idx?SID=1224ee2b57f9c524c0ca22fcc7d87b42&mc=true&node=pt50.12.648&rgn=div5.
[8] No research set-aside projects were conducted, and as such, this reserve was reallocated to the fishery.
[9] Two appeals were filed following the initial allocation, but they were denied because the eligibility requirements were not met. After the appeals process had ended, the entire reserved/set aside was reallocated to the IFQ fishery.

defined as the actual poundage of tilefish, measured in both whole (live) and gutted (landed) weight, that each IFQ shareholder may land during a given fishing year.

The implementation of the IFQ system under Amendment 1 allowed for all four vessels that were participating in the full-time Tier 1 category limited access system to qualify for IFQ allocation. The percent of full-time Tier 2 limited access vessels that received IFQ allocation was 40% (2 out of 4 vessels plus a confirmation of permit history).[10] Lastly, the number of part-time limited access vessels that received IFQ allocation was 32% (7 out of 22 vessels).[11,12]

4.2.1.2.3 IFQ Overages

A person would not be permitted to land any tilefish in excess of the shareholder's current allocation. If a shareholder lands more than is allowed under the shareholder's allocation, such overage would be deducted from the next year's allocation associated with the shareholder's IFQ share. If a shareholder leases any of the annual allocation, and then lands more tilefish than is allowed under the shareholder's allocation, such overage would be deducted from the next year's allocation associated with the shareholder's IFQ share.

4.2.1.2.4 Highgrading

The FMP prohibits the practice of highgrading or discarding under the IFQ program.[13] Highgrading and discarding are further discussed in Sections 5.3.4 (Discards) and 5.9 (Overall Fishery Discards).

4.2.1.2.5 IFQ Share Accumulation

No person or entity may own, or hold an interest in, more than 49% of the tilefish IFQ TAL at any time. IFQ share accumulation is further discussed in Section 5.2.1.1 (Participation Consolidation) and 5.2.5 (Quota and Allocation Markets).

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[10] One of these entities was not active in the tilefish fishery during the 2001 through 2005 period but had a Confirmation of Permit History.

[11] While the Council provided neither a minimum allocation nor minimum landings requirements for initial eligibility, it required a 0.5% minimum IFQ share allocation/share distribution (i.e., each tilefish limited access vessel would require a minimum 0.5% group share allocation/share distribution in order to qualify for IFQ). This minimum share allocation/distribution was mainly intended to ensure that the lowest allocation would be at least a practical minimum amount with which to participate in the fishery. If the eligibility criterion had been relaxed, the number of qualifying part-time vessels for IFQ shares would have been reduced by 50% (11 out of 22 vessels) instead of 32% (7 out of 22 vessels).

[12] Additional information regarding vessels that qualified and did not qualify for IFQ allocations is presented in Section 5.4 (Social and Community Impacts).

[13] Discarding is only allowed if fishing pursuant to the incidental catch limit, or under a Letter of Authorization trip limit if one is issued by the Greater Atlantic Regional Administrator.

4.2.1.2.6 IFQ Transferability

IFQ allocations (shares) are fully transferable among persons or entities that are permanent U.S. citizens or permanent resident aliens, or corporations eligible to own a U.S. Coast Guard documented vessel, as long as they meet the requirements under the Magnuson-Stevens Act. Transferability can be temporary (lease) or permanent (sale). However, sub-leasing within a given year is not allowed (that is, an IFQ allocation cannot be leased more than once during a fishing year) as this would require additional management steps that may be administratively prohibited.

For IFQ transferability purposes, a receipt showing account balance and time of transfer must be filed. In order for an individual to transfer any portion of an individual allocation either permanently (sale) or temporarily (lease), an IFQ Transfer Form must be submitted to NMFS.[14] IFQ transferability is further discussed in Section 5.2.1.1 (Participation Consolidation) and Section 5.2.5 (Quota and Allocation Markets).

4.2.1.2.7 Duration

IFQ privileges would be assigned for the duration of the IFQ program. The IFQ program would remain in effect until it is modified or terminated through the normal Council process.[15]

4.2.1.2.8 Adjustments in Commercial Quota and Allocation

The Council periodically reviews and adjusts the commercial quota for tilefish in response to new data and information, which include benchmark or updated tilefish stock assessments. As the quota is adjusted, shareholders' IFQ allocations would be proportionately adjusted based on the IFQ share each shareholder has at the time of the adjustment.

[14] Transfer forms can be found at: https://www.greateratlantic.fisheries.noaa.gov/aps/forms.html.

[15] In the U.S., IFQ programs constitute a limited privilege to harvest a public resource only, and should never be considered private property. Therefore, IFQs are privileges that can be revocable and are not permanent in nature. An IFQ system may last as long as the program meets its stated objectives. However, the Council reserves the right to cancel the program if needed. Section 303A(b) of the Magnuson-Stevens Act specifies the following regarding IFQs: 1) Shall be considered permits; 2) may be revoked, limited, or modified at any time in accordance with this Act, including revocation if the system is found to have jeopardized the sustainability of the stock or the safety of fishermen; 3) shall not confer any right of compensation to the holder of such limited access privilege, quota share, or other such limited access system authorization if it is revoked, limited, or modified; 4) shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested by the holder; and 5) shall be considered a grant of permission to the holder of the limited access privilege or quota share to engage in activities permitted by such limited access privilege or quota share. The Act also requires that Regional Fishery Management Councils ensure that any new IFQ program "establishes procedures and requirements for the review and revision of the terms of any such program (including any revisions that may be necessary once a national policy with respect to individual fishing quota programs is implemented), and, if appropriate, for the renewal, reallocation, or reissuance of individual fishing quotas."

4.2.1.2.9 IFQ Program Review

In accordance with the MSA, the IFQ program will undergo a formal review within 5/7 years of implementation. Subsequent program reviews will coincide with the MAFMC's regular FMP review. Should an interest in modifying the IFQ program emerge, a framework adjustment process established by the FMP would allow managers to make adjustments through a streamlined public review process (MAFMC 2009).

4.2.1.2.10 Landings Reporting

Under current regulations, vessels fishing under a Tilefish IFQ Allocation permit have to submit a tilefish catch report by using the interactive voice response (IVR) phone line system within 48 hours after returning to port and offloading. In addition, vessel trip reports (VTRs) must be maintained on board the vessel and submitted to NMFS for all fishing trips undertaken with Commercial/Incidental permits, regardless of species retained.

4.2.1.2.11 Corrections and Modifications to the IFQ Program

In 2013, the Northeast Regional Office (NERO), now known as Greater Atlantic Regional Fisheries Office (GARFO) made some corrections, clarifications, and modifications to the regulations implementing the IFQ program. These changes were intended to make regulations easier to understand. These changes are further discussed in Section 5.10.1 (Changes to the GTF-IFQ Program). Additional information can be found at: https://www.greateratlantic.fisheries.noaa.gov/nr/2013/August/13tilefishamendcorfrphl.pdf and https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/tilefish/.

5.0 Program Performance and Review

This review will compare and analyze the fishery before and after the program's implementation. The baseline period of three years from FY 2007–2009 will be used when providing comparisons and metrics.

We are looking at six main general areas to be reviewed/analyzed for this IFQ program; socioeconomic outcomes, biological outcomes, social impacts, community impacts, safety at sea, and enforcement (see discussion below). Like reviews of regulatory actions conducted under Executive Order 13563[16] and Section 610 of the Regulatory Flexibility Act (RFA),[17] a 5 to 7 year review of a CSP is a retrospective evaluation of an established program. Thus, rather than analyzing the program's expected effects, the task in a 5 to 7 year 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 (i.e., an ex-post analysis).

[16] http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/eo13563.pdf.
[17] http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/rfa_revised_through_2010_jobs_act.pdf.

5.1 Overview of Available Information for Program Review

There have been many studies completed that are relevant to this review, as well as reviews currently underway and interim reports related to such reviews for various CSPs. We will mention those studies in this introduction, but will be describing them in more detail later in the review.

In addition, valuable information is obtained from industry advisors, both through personal conversations and in the preparation of annual fishery performance reports (FPRs), which can be found at: http://www.mafmc.org/fishery-performance-reports/.

As another point of information, MAFMC initiated development of a stakeholder-driven vision for the future of their managed fisheries.[18] The public provided extensive input, identifying both challenges and opportunities for the Council and its managed fisheries. Some of these comments shed some light on issues very relevant to tilefish and the development of the IFQ program.

5.1.1 Northeast Fisheries Science Center Economic Analyses

One of the most relevant reports is entitled, "The Economic Performance of U.S. Catch Share Programs." This report describes economic and social conditions, and analyzes economic and social effects, using the NMFS Office of Science and Technology's (S/T) economic and social performance indicators.[19] Brinson and Thunberg (2013) demonstrate how many of the economic indicators in the report can be used to evaluate CSP performance. This review makes use of these standardized performance indicators developed at the national level, as well as additional indicators at our regional level. These catch share indicators were further updated in a later publication (Brinson and Thunberg 2016).

In an additional report, also relevant to this review, Walden et al. (2014) subsequently demonstrated how to measure multi-factor productivity changes in CSPs.

There have been no studies pertaining to attitudes and perception conducted in the Northeast on catch shares, but one was done in the Gulf region. Louisiana State University's Center for Natural Resources and Policy conducted a mail survey to elicit attitudes and perceptions about the performance of the Red Snapper IFQ program, paying special attention to crewmember experiences, changes in fishing practices, and relationships with dealers, (Alsharif and Miller 2012). The study found that participants with large shareholdings tended to be very satisfied with the IFQ program, whereas those with small shareholdings were the least satisfied with the program. The study indicated that the industry believed that the IFQ program had reduced derby-fishing conditions. Additionally, medium and large shareholders, as well as western Gulf shareholders, agreed that the Red Snapper IFQ program had decreased crowding on fishing grounds.

[18] For additional details on the Visioning and Strategic Project (including Stakeholder Input Report; survey, and comment letters), please visit: http://www.mafmc.org/strategic-plan.

[19] http://www.st.nmfs.noaa.gov/economics/fisheries/commercial/catch-share-program/indicators-definition/.

5.1.2 Data Sources

Dealer reporting is the primary method for ensuring accurate catch accounting by IFQ participants. Dealers must report all purchases of golden tilefish, including the pounds of tilefish purchased and the name, permit number, and trip identification number of the seller. The identification information on the dealer reports facilitates trip-by-trip accounting in order to ensure accurate reporting of landings' weight and value. The dealer data are used to construct the prices needed to compute the value of landed product.

In addition to detailed landed product reports from dealers, vessel operators must also keep paper or electronic logbook records of each trip. These records contain the hail (estimated) weight of their catch, gear type and quantity employed, fishing depth, location and effort, and port of landing. The majority of the VTR data are generated by vessel operators who fill out paper logbook forms by hand. These forms are archived electronically. VTR quantities are hail weights while dealer data should be more accurately measured. The mandatory VTR and dealer data collection processes began in 1994; the Tilefish FMP mandated federal reporting in 2001; prior to this time, the VTR records may not have been a census and many of the VTR records do not distinguish between golden tilefish and unclassified tilefish, or blueline tilefish, simply reporting them as "tilefish."

The IVR requirements were first implemented when the FMP was initiated in 2001 as a way to track quota landings in the fishery in a timely fashion. The IVR is a self-reporting system, within 48-hours of docking and unloading the catch. The IVR system allowed NMFS to track landings throughout the year and to provide an accurate annual report of landings and their value to each IFQ permit holder. However, with the implementation of electronic dealer reporting in 2004 and improved VTR reporting processing by the agency, the information provided by vessel operators using the IVR system has become redundant. Furthermore, IVR landings have not been reconciled since 2008. Currently, GARFO uses landings reported in the dealer system as the primary tool to track landings in the fishery. Framework 2 to the Tilefish FMP considers eliminating the IVR reporting requirements (see Section 7.3, Issues to be Addressed Under Framework 2 to the Tilefish FMP, for additional details).

5.1.3 SAW/SARC Stock Assessments

Golden tilefish was first assessed at SARC 16 (Stock Assessment Review Committee 16) in 1992 (NEFSC 1993). The SARC accepted a non-equilibrium surplus production model (ASPIC; A Stock Production Model Incorporating Covariates). The ASPIC model estimated biomass-based fishing mortality (F) in 1992 to be three times higher than F_{MSY}, and the 1992 total stock biomass to be about 40% of B_{MSY}. The intrinsic rate of increase (r) was estimated at 0.22.

The SSC reviewed an updated tilefish assessment in 1999. Total biomass in 1998 was estimated to be 6.473 million pounds (2,936 mt),[20] which was 35% of B_{MSY} = 18.625 million pounds (8,448 mt). Fishing mortality was estimated to be 0.45 in 1998, which was about 2-times higher

[20] 1 metric ton = 2,204.6226 pounds.

than F_{MSY} = 0.22. The intrinsic rate of increase (r) was estimated to be 0.45. These results were used in the development of the Tilefish FMP (MAFMC 2001). The MAFMC implemented the Tilefish FMP in November of 2001. Rebuilding of the tilefish stock to B_{MSY} was based on a ten-year constant harvest quota of 1.995 million pounds (905 mt).

SARC 41 reviewed a benchmark tilefish assessment in 2005. The surplus production model indicated that the tilefish stock biomass in 2005 had improved since the assessment in 1999. Total biomass in 2005 was estimated to be 72% of B_{MSY} and fishing mortality in 2004 was estimated to be 87% of F_{MSY}. Biological reference points did not change greatly from the 1999 assessment. B_{MSY} was estimated to be 20.688 million pounds (9,384 mt) and F_{MSY} was estimated to be 0.21. The SARC concluded that the projections were too uncertain to form the basis for evaluating likely biomass recovery schedules relative to B_{MSY}. The TAL and reference points were not changed based on the SARC 41 assessment.

Stock status from SARC 48 (NEFSC 2009) was also based on the ASPIC surplus production model, which was the basis of the stock assessment for the last three assessments. The model is calibrated with catch per unit effort (CPUE) series, as there are no fishery-independent sources of information on trends in population abundance. While the Working Group expressed concern about the lack of fit of the model to the VTR CPUE index at the end of the time series, they agreed to accept the estimates of current fishing mortality and biomass and associated reference points. The instability of model results in the scenario projections was also a source of concern. It was noted that the bootstrap uncertainty estimates do not capture the true uncertainty in the assessment. The ASPIC model indicated that the stock was rebuilt. However, the working group acknowledged that there was high uncertainty on whether the stock was truly rebuilt.

The golden tilefish stock was last assessed at SARC 58 in 2014 (NEFSC 2014) with a terminal year of 2012. The golden tilefish stock was not overfished and overfishing was not occurring in 2012 relative to the SARC 58 accepted biological reference points. The stock was declared rebuilt in 2014 by NMFS based on SARC 58 results which indicated that the stock spawning biomass (SSB) was at 101% of the accepted SSB_{MSY}. A new model, ASAP (Age Structured Assessment Program), was used in this assessment to incorporate newly available length and age data. The ASAP model integrates more realistic life history information on size and growth into a single model framework and better characterizes the population dynamics of the tilefish stock. This ASAP model was used to estimate ABCs and OFLs from 2015–2017 through Age Structured Projection Model (AGEPRO) projections.

The Northeast Fisheries Science Center (NEFSC) has performed data updates each year since 2012. The MAFMC SSC considers information from the data updates in March of each year for possible changes to the ABCs and OFLs for the next fishing year, which starts on November 1st. These data update reports provide updated commercial landings, longline fishery CPUE, and landings size distributions. To date, quotas have never been changed as a result of data updates.

The last model update was done by the NEFSC in February of 2017 (with a terminal year of 2016 data). The SSC reviewed this updated model in March for estimation of the 2018–2020 ABCs and OFLs. The 2017 update report concluded that the decrease in landings in 2015 appear

to be a combination of lower catch rates and some inactive vessels. Industry members have also reported that winter weather conditions and dogfish and skate interactions affected landings in recent years. Changes in the CPUE can be generally explained by the evidence of strong incoming year classes that track through the landings size composition over time. CPUE in 2015 continues to decline as the strong 1999 year class entered the large and extra-large market category. However, this is similar to historic patterns of year class effects on CPUE. The catch distribution of fish landed is wide and encompasses all market categories. Large fish remain an important component of the catch. A new recent large year class was estimated in 2013 (2.85 million fish; see Section 5.3.2, Spawning Stock Biomass, for additional details) in the 2017 updated ASAP model. However, this year class has just started to enter the directed longline fishery in the terminal year (2016), and therefore there is high uncertainty regarding the exact strength of this year class.

5.1.4 Cost Recovery Report(s)

The Section 304(d)(2)(A) of the MSA requires NOAA's NMFS to collect fees to recover the "actual cost directly related to the management, data collection, and enforcement" of IFQ programs. The law stipulates that the fee be paid by the IFQ allocation shareholder, based on the ex-vessel value of golden tilefish landed under the program. Ex-vessel value is calculated as the price paid to the vessel per pound multiplied by the total weight landed. Fishing regulations stipulate that the fee may be up to, but cannot exceed, 3 percent of the total ex-vessel value of golden tilefish harvested under the IFQ program.

While the golden tilefish fishing year extends from November 1 – October 31, the cost recovery fee is based on expenses and landings made during each calendar year. The last Annual Report of the Golden Tilefish Individual Fishing Quota Cost Recovery Program was for calendar year 2016 (January 1, 2016 through December 31, 2016). The 2016 report was the seventh year of the golden tilefish recovery program.[21]

GARFO has determined the recoverable costs associated with management, enforcement, and data collection in the golden tilefish IFQ program to include only the incremental (or attributable) costs of the IFQ program. That is, costs that would have been incurred in the administration of the golden tilefish fishery if an IFQ program did not exist are not included. Furthermore, costs associated with the initial development of the IFQ program are not included in recoverable costs.

Personnel costs are calculated by multiplying staff hours spend on tasks directly related to the IFQ program by the hourly salary rates for that personnel. Salary rates include the government's share of the benefits on a prorated basis. Lastly, contract expenses are calculated as the cost of contract employees prorated for the percentage of time the contact employee spent on tasks directly related to the IFQ program.

[21] Golden tilefish IFQ cost recovery program reports are available at: https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/tilefish/.

Recoverable expenses may primarily consist of time spent by personnel for the following divisions of GARFO and the NEFSC:

GARFO[22]
Analysis and Program Support Division
Sustainable Fisheries Division
Information Resource Management
Operations and Budget Division
Stake Holder Engagement Division
Office of Law Enforcement
NOAA General Counsel

NEFSC
Population Dynamics Branch
Social Science Branch

The recoverable costs associated with each specific division mentioned above depends on the amount of work directly related to the IFQ program and may change from year to year. In addition to personnel costs (including all benefits), recoverable costs may include: travel, printing and postage, contracts, supplies, equipment, and other items. As indicated before, the amount of work and associated recoverable costs vary by specific division from year to year. Since the implementation of the cost recovery program, there have not been recoverable expenses associated with the golden tilefish IFQ program for the Stake Holder Engagement Division, the Office of Law Enforcement, or NOAA General Counsel. While for other divisions like the Analysis and Program Support Division, Sustainable Fisheries Division, Information Resource Management, and Operations and Budget Division, recoverable expenses were determined for every year.

Total recoverable costs fluctuate from year to year as some tasks may be needed to be conducted every year, and some tasks may require more time and effort in some years. For example, the golden tilefish recoverable costs for 2016 were higher than previous years (Table 3). Recoverable costs for work conducted by the NEFSC was incurred for the first time in 2016, as staff from both the Social Sciences Branch and Population Dynamics Branch contributed significant work to the ongoing review of the golden tilefish IFQ program.

Due to potential variations in the recoverable costs from year to year, GARFO recently included a section in the annual cost recovery reports that describes potential anticipated changes to recoverable costs from the current year to the following year. This was intended to help industry better prepare to meet cost recoverable requirements.

[22] For specific tasks conducted by each division as it relates to the work associated with the golden tilefish cost recovery IFQ program see: https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/tilefish/.

Table 3. Golden tilefish recoverable costs, fishery values, and fee percentage by year, 2010–2016.

Fee Year	Recoverable Costs	Total Fishery Value	Fee Percentage
2010	$21,438	$5,054,073	0.424%
2011	$21,353	$5,566,543	0.3835%
2012	$14,242	$5,372,291	0.2650%
2013	$35,966	$5,787,335	0.6214%
2014	$14,662	$5,501,343	0.2665%
2015	$20,744	$5,075,467	0.4087%
2016	$56,166	$4,180,838	1.3434%

Source: 2016 Annual Report of the Golden Tilefish Individual Fishing Quota Cost Recovery Program. Available at: https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/tilefish/.

5.1.5 Social Papers

Social changes have accompanied the economic and environmental changes in the fishery. The collaborative management that has characterized the tilefish fishery has been the subject of previous work (Kitts et al. 2007, Rountree at al. 2008).

A recent publication (Clay and Colburn, in press), "The Human Dimensions of Catch Share programs in the Northeast," covers the social dimensions of U.S. catch share programs and is a quasi-partner to The Economic Performance of U.S. Catch Share Programs report (see Section 5.1.1, Northeast Fisheries Science Center Economic Analyses, for additional details). It is similar to the economic catch share report showing tables and figures with a modest amount of explanatory text.

The analytical approach (including the social indicator methodology) used for this report identifies the communities involved in these programs from the baseline pre-implementation to 2013. The difference between how this was done in the past and this report is that Clay and Colburn (in press) calculated the catch share program specific engagement scores at the community level in addition to the more traditional approach that identifies communities based on the amount of value and/or pounds alone.

Vessel owner and cost surveys conducted by the Social Sciences Branch of the NEFSC provide both social and economic information of a general nature. The participation of tilefish owners in this survey was too limited to be more specific.

5.1.6 Groundfish Catch Report

Murphy et al. (2015) provides an evaluation of the economic and social performance of active limited access Northeast groundfish vessels for FY 2013 (May 2013 – April 2014). FY 2013 saw a continuation of the mostly negative trends seen for the limited access groundfish fleet in FY 2012 compared with the landings and revenues seen in the fishery from FY 2010–2011. A revised version of this report covering 2007–2015 is scheduled to be published before the end of 2017.

Although this report deals with groundfish vessels, it provides a comparison to that of the tilefish fishery and points to relevant issues that apply to fisheries outside of their major target and/or gear type.

5.2 Economic Outcomes

A guiding principle of the National Oceanic and Atmospheric Administration (NOAA) Catch Share Policy is to track the performance of programs in order to monitor whether they are achieving their goals and objectives. Brinson and Thunberg (2013, 2016) developed performance metrics to assess the overall economic performance of U.S. catch share programs.
The performance measure categories are:

- Financial viability
- Distributional outcomes
- Stewardship,
- Governance
- Well-being

There are multiple indicators within each category. The Northeast indicators are part of a NMFS-wide process of developing social and economic indicators for all U.S. fisheries. This report includes a subset of indicators that are sufficiently developed for reporting. These cover aspects of financial viability (landings, revenue, number of vessels and effort, and average vessel performance) and distributional outcomes (employment and fleet diversity). Nominal revenues are based on landings and ex-vessel (first sale) prices and—together with fishing effort, operating costs, and quantities of fishing inputs—provide an indication of vessel performance. Fleet diversity is measured by vessel size and vessel revenue categories, and by distribution of nominal revenue among individual vessels and vessel affiliations. Over time, additional indicators will be available for reporting as the NEFSC Social Sciences Branch's research and the National Performance Measures Program continue to develop.

As part of its visioning process, the MAFMC received stakeholder input on all 12 of its managed species, including golden tilefish. A common theme from the commercial industry was for those who have access to sufficient quota, the GTF-IFQ system has helped stabilize the fishery.

The 16 commercial participants who completed the golden tilefish visioning survey made several observations. Input was given on golden tilefish in 36% of commercial meetings and 40% of the recreational meetings. For those who own sufficient quota in the GTF-IFQ system, it has been easier to run a fishing business. Businesses can work together to plan out trips to minimize effort and maximize/stabilize ex-vessel prices. Those without significant quota in the IFQ system, especially those early participants in the fishery, are frustrated and feel that quota shares were based on arbitrary qualification dates that benefited certain fishing businesses.

The visioning survey also revealed concern that an increase in recreational fishing of golden tilefish could impact the health of the stock. Specifically, increased recreational fishing effort has

been directed towards golden tilefish as seasons for other key recreational species have been shortened. Because tilefish is a slow growth species with a relatively high bag limit, some anglers are worried that the increased recreational effort could affect the health of the stock. See Section 5.6, Recreational Fishery, for additional information regarding the recreational fishery.

Additional analyses of economic factors including overcapitalization, consolidation, productivity, quota, allocation markets, and market stability is found in the following sections.

5.2.1 Reduce Overcapitalization

The first reduction in the number of participants in the directed fishery occurred when the original FMP was first implemented in 2001 (see Section 4.1). As previously indicated, the original FMP implemented a limited entry program that established a tiered system based on participation in the fishery. The FMP identified that 4 full-time Tier 1 vessels, 4 full-time Tier 2 vessels, and 42 part-time vessels were eligible for the limited entry program (MAFMC 2001).[23,24]

When the IFQ system was implemented under Amendment 1, the Council evaluated multiple alternatives to develop the IFQ system (see Section 4.2) and chose to use more current landings (2001–2005) for allocation purposes (i.e., vessels that had recently been active in the fishery). Amendment 1 to the FMP identified 13 vessels to be eligible for the IFQ system (4 full-time Tier 1, 2 full-time Tier 2, and 7 part-time vessels).

Thus, the initial implementation of the limited access system under the original FMP and the IFQ system under Amendment 1 resulted in a reduction in capacity or a decrease in the number of vessels allowed to participate in the golden tilefish directed fishery. It is important to note that vessels that qualified for full-Tier 1 and Tier 2 categories when the FMP was first developed had more than enough capacity to harvest the quota level implemented under the constant harvest strategy (1.995 million pounds) and stock rebuilding scheme originally implemented by the Council. In fact, in 1997, three full-time Tier 1 vessels landed between 706 and 811 thousand pounds of tilefish (MAFMC 2009).

Limited access privilege programs (e.g., IFQ systems) provide incentives to reduce overcapacity and to improve product quality (Anderson and Holliday 2007). IFQ programs are anticipated to generate incentives that balance the harvesting capacity of fishing fleets with the productivity of the resource and market conditions. It is expected that after IFQ program implementation, excess capital and labor employed in the fishery would be reduced.

Although it is expected that an IFQ program would reduce overcapacity in the fishery, there are factors that can limit the speed of such transformation. Examples of these activities include, but are not limited to, adopted transferability rules, employment opportunities in other fisheries or

[23] However, after the initial appeals process ended, five vessels were determined to be eligible for full-time Tier 2 status.

[24] Vessel activity indicated that the number of present participants at the time the FMP was developed consisted of 215 vessels that had landed tilefish in 1998.

economic sectors, the initial amount of allocated quota, capital availability and flexibility, credit availability, and skipper and crew experience.

In general, the existence of excessive harvesting capacity signals the presence of unwarranted investment, which can affect the profitability of the fleet and, as such, are economically undesirable. Excessive harvest can also affect the sustainability of the stock; however, in the golden tilefish fishery, the ACL is closely monitored and enforced; as such, this is not a major concern in this fishery.

In the following sections, recent trends in the fishery and participation, fleet and effort consolidation are presented to assess changes in the fishery. Trends in the fishery post-IFQ implementation are compared against the baseline period.[25]

5.2.1.1 Participation Consolidation

We first look at changes in the number of entities holding shares over time in order to gain insight into the economic performance of the IFQ program. Under IFQ programs, vessel operators are anticipated to adjust their fishing operations to improve profitability. More efficient fishing operations (more profitable) are expected to value shares higher than less efficient vessel operators and shares would be expected to move toward the more efficient producers.

Table 4 shows the Golden Tilefish IFQ shareholdings since the program was implemented.[26] The quota share holding presented in this table were categorized into three hypothetical quota categories (small, medium, large) to better conceptualize changes within those shareholding size categories. During the first year of IFQ program implementation (2010), 13 IFQ accounts were initially established. The bulk of the initial accounts with small shareholdings (<5%) were previously part-time vessels (7 out of 8; 87.5%) with one full-time Tier 2 vessel (1 out of 8; 12.5%) also qualifying as a small shareholder; cumulative, these 8 small shareholdings accounts received 19.8% of the Golden Tilefish IFQ. Two of the initial accounts with medium (5% – 19.99%) shareholdings were previously full-time Tier 1 vessels (2 out of 3; 66.6%), the remainder (1 out of 3; 33.3%) was a part-time vessel; cumulative, these 3 medium shareholdings accounts received 37.9% of the Golden Tilefish IFQ. All the initial accounts with large shareholdings (≥20%) were previously full-time vessels (2 vessels); cumulative, these 2 large shareholdings accounts received 42.3% of the Golden Tilefish IFQ.

Since the implementation of the IFQ system, five accounts have sold all their shares.[27] Two small accounts sold all their shares in 2011 and one small account in 2012 (these accounts were previously part-time vessels). A large account also sold all its shares in 2013 (this account was previously a full-time Tier 1 vessel). A medium account also sold all its shares in 2015 (this account was previously a full-time Tier 1 vessel). The sales of these accounts resulted in the

[25] The baseline period represents the average for the three years prior to the IFQ implementation (2007–2009 period).
[26] A more detailed analysis is presented in section 5.2.5 (Quota and Allocation Markets).
[27] A total of 30% of the initial allocations was permanently sold (Table 4).

first-time acquisition of IFQ shares by four new entities and the expansion of IFQ share allocation of existing accounts.

In all, the number of accounts have remained relatively stable for the 2010–2015 period. An increase in the cumulative allocation percentage for large shareholdings accounts has occurred during the 2010–2015 period, while that for medium shareholdings accounts has decreased. The cumulative allocation for small shareholdings accounts has remained relatively stable during the same period. As indicated before, in general, the harvest privileges will flow to the more efficient operators and economic benefits can be obtained when the market further rationalizes the fishery (Anderson and Holliday 2007).

The Golden Tilefish IFQ system specified a cap on accumulation of quota shares of 49% of the total quota shares. Concentration of shares in the hands of one or a few entities can create market power problems, where the quota owners control market price for either their fished goods or for quota in the fishery. The purpose of excessive quota share caps is to prevent individual shareholders from controlling production or control market price for either their fished goods or for quota in the fishery, as well as achieving management objectives of the FMP. The Magnuson-Stevens Act requires FMPs to guarantee that shareholders in IFQ program do not acquire an excessive share of the quota. In developing the IFQ system for golden tilefish, the Council reviewed several potential accumulation limits. The Council specifically considered factors such as potential market power and competition (from other fisheries), historical fishing practices, and efficiency of fishing operations (MAFMC 2009). The Council did not believe that a 49% IFQ share cap would allow harvesters to control the market price for tilefish due to the large number of substitutes for tilefish available in the market place. The Golden Tilefish IFQ cap accumulation could potentially result in a minimum number of 3 entities to be able to participate in the fishery. The number of entities in 2015 was four times higher than the minimum allowed under the established cap accumulation.

While five accounts have sold all their shares since the implementation of the IFQ system, the percent allocation held by fishermen on a state-by-state basis has not changed, and the total number of allocations has remained almost identical. This indicates that the allocations that were permanently sold were acquired by individuals (new participants or existing participants) within the states where the allocations were sold. Across all years since IFQ implementation, most IFQ shares were held by fishermen in New York (80%), followed by New Jersey (17%; Table 5).

Table 4. Golden tilefish IFQ allocation accounts.

IFQ Allocations		2010	2011	2012	2013	2014	2015
Small (<5%)	# accounts	8	8	7	7	8	8
	Cumulative allocation %	19.8	19.8	19.9	19.9	21.4	21.4
	Average per account	2.5	2.5	2.8	2.8	2.7	2.7
Medium (5% – 19.99%)	# accounts	3	3	3	3	2	2
	Cumulative allocation %	37.9	37.9	37.9	32.4	25.2	25.2
	Average per account	12.6	12.6	12.6	11.8	12.6	12.6
Large (≥20%)	# accounts	2	2	2	2	2	2
	Cumulative allocation %	42.3	42.3	42.3	47.8	53.3	53.3
	Average per account	21.1	21.1	21.1	23.9	26.7	26.7
Changes in Allocations		Initial Allocation					
Increase			0	1	2	1	0
No change			11	11	9	10	11
Decrease			0	0	0	1	0
Permanently Sold*			2 (5.4%)	1 (0.8%)	1 (12.7%)	0	1 (11.0%)
New**			2	0	1	0	1

Note: Data not available for the 2007–2009 period (baseline period). *Values in parentheses represent the percentage of quota shares permanently sold from the previous year. **A new entrant for this table was determined by identifying new allocation numbers that were generated as a result of the permanent transfer.

Table 5. Share holdings by state of residence.

Year	% allocation*			Number of allocations*		
	NY	NJ	MA	NY	NJ	MA
2010	80.2	17.1	2.7	5	7	1
2011	80.2	17.1	2.7	5	7	1
2012	80.2	17.1	2.7	5	6	1
2013	80.2	17.1	2.7	5	6	1
2014	80.2	17.1	2.7	5	6	1
2015	80.2	17.1	2.7	4	7	1

*At the start of the fishing year.

As previously indicated, a major concern associated with the implementation of an IFQ system is the potential for concentration of quota ownership and market power. In time, the implementation of an IFQ system is expected to impel less efficient operators to sell their shares, causing the rest of the participants to control a larger share of the quota. While transferability of harvesting privilege can provide potential advantages to IFQ systems, it could also lead to a rise in market power (e.g., monopoly [a single seller] or monopsony [a single buyer]) or lead to undesired changes in the structure of the fishing community (Anderson and Holliday 2007).

The Gini coefficient (a measure of inequality)[28] and the Herfindahl-Hirschman Index (HHI; an indicator of the amount of competition in the market place)[29] were developed in order to assess concentration and market power impacts of the IFQ system. The Gini coefficient shows a downward trend (e.g., meaning less inequality) during the first two years of program implementation (when compared with the baseline period) but then has steadily increased to pre-IFQ or baseline period levels. According to the Gini coefficient estimates, the revenue distribution among participating vessels in 2015 was relatively similar to that during the baseline period (pre-IFQ; See Table 6 in Section 5.2.1.2, Fleet and Effort Consolidation).

The HHI value approaches zero when a specific market comprises a large number of similar firms, and reaches 10,000 when a market is controlled by a single firm. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. The HHI values indicate a slight upward trend in concentration since the IFQ program was implemented when compared with the baseline period (see Table 6 in Section 5.2.1.2, Fleet and Effort Consolidation). The increase in the HHI value between the base line period (FY 2007–2009) and FY 2010 may be due to the decrease in the number of vessels that participated in the fishery in FY 2010 when compared with the base line period (pre-IFQ period). The upward trend in the HHI values in FY 2012–2013 is due to the increase in the cumulative allocation percentage for large allocation holders (Tables 4 and 6). Markets in which the HHI is between 1,500 and 2,500 points are typically considered to be moderately concentrated and markets in which the HHI is in excess of 2,500 points are considered to be highly concentrated.

5.2.1.2 Fleet and Effort Consolidation

In this section, several performance measures are presented to characterize recent trends in fleet and effort consolidation. The annual IFQ quota for golden tilefish averaged 1.86 million pounds during the FY 2007–2009 baseline period, and was approximately 1.90 and 1.70 million pounds, respectively, for FY 2010–2014 and FY 2015. Quota utilization (amount of the quota landed) averaged approximately 97% during the FY 2010–2014 period, slightly above the 94% quota utilization during the baseline period. In 2015, 80% of the IFQ quota was harvested by the fleet (Table 6 and Figure 1). The NEFSC 2016 data update report indicated that the decrease in landings in FY 2015 appear to be a combination of lower catch rates and some inactive vessels (Nitschke 2016). In addition, industry members have reported that winter weather conditions and dogfish and skate interactions have affected landings in recent years.

[28] The Gini coefficient was used to measure changes in the distribution of the use of quota in terms of catch share revenue among active vessels. A Gini coefficient of zero indicates that the catch share revenues are the same for all active vessels; a value of one indicates that catch share revenues are highly concentrated on a single or a small number of vessels. A decreasing Gini coefficient indicates increasing evenness or equality in catch share program revenues. Conversely, an increasing Gini coefficient indicates decreasing evenness or increasing inequality catch share program revenues among participants. The absolute value of the Gini coefficient is not the principal measure of interest here, it is the general trend across years.

[29] The HHI is equal to the sum of the squared market shares of the participants in the market. Thus, if there are three firms with shares of 50%, 30%, and 20%, the HHI is equal to 3800 ($3800 = 50^2 + 30^2 + 20^2 = 2500 + 900 + 400 = 3800$).

Prior to IFQ program implementation, there were about 31 vessels in the limited access fishery that were eligible to participate in the IFQ system. Nevertheless, due to inactivity in the fishery during the years chosen for IFQ share allocation (2001–2005 landings activity), only 13 of the 31 eligible entities were issued a quota allocation. The number of entities holding quota shares since the IFQ program was implemented have ranged from 12 to 13 (2010 to 2015). The number of vessels participating in the IFQ fishery has ranged from 9 to 11 during the same period. On average, 14 vessels were active in the fishery during the baseline period (Table 6 and Figure 1). While the number of vessels participating in the IFQ fishery has decreased over time, the number of allocations issued has remained relatively unchanged. However, the percent allocation to large and small shareholdings accounts increased by 26.17 and 8.50%, respectively, from 2010 to 2015, while a slight decrease occurred for medium accounts. This indicates that small and larger accounts could have landed a larger proportion of the overall IFQ quota in 2015 when compared with 2011 (Tables 4 and 6).

Following the fleet consolidation pattern, there was an early decline in the total number of trips taken by the fleet, but the trend began reversing in 2013. Nevertheless, the number of trips post-IFQ implementation has been below the baseline period each year (with the exception of 2014: that year, the number of trips was the same as it was during the baseline period), ranging from 9% in 2015 to 30% in 2011. On average, the number of trips post-IFQ implementation (116 trips) is 16% below the number of trips taken during the baseline period (Table 6 and Figure 1). The number of days at sea also showed a pattern of early decline that began reversing in 2012. During the baseline period, the fleet had 1,074 days at sea; this value decreased to 719 days at sea in 2010 and 548 days at sea in 2011. However, the number of days at sea started to increase the following year: 634 days at sea were taken in 2012, and in 2013, 846 days at sea were taken. In 2014 and 2015, the number of days at sea taken was relatively close to the number taken during the baseline period (Table 6 and Figure 1).

The increase in the number of trips and days at sea that the fleet has experienced in the last few years may be associated with industry reports of increasing dogfish and skate interactions, and with poor winter weather.[30] As the total amount of time vessel operators spend at sea increases, the labor employed to perform fishing operations tends to increase as well. A more detailed discussion regarding productivity changes in the IFQ fishery will be presented below.

As previously indicated, the combined full-time Tier 2 and part-time permit categories exceeded the golden tilefish quota for their respective allocations several times prior to IFQ implementation (full-time Tier 1 permit category never exceeded their quota allocation; Table 2). Early closures in these permit categories resulted in a shortening of the fishing season, which averaged 310 days during the baseline period. Since the IFQ system was implemented, the

[30] According to industry members, dogfish interaction reduces golden tilefish catches and strongly affects where people fish. The dogfish have been reported to be thick in recent years and, when fishermen encounter them, they have no choice but to move to other fishing areas. The dogfish interaction used to be about 2 or 3 months in the winter. However, in the last 5 years (2012–2016), dogfish presence averages about 8 months, and extends to June. Skate interaction also reduces tilefish catches; this is limited to the winter period. Skates can severely damage tilefish gear. When fishermen encounter skates they move to other fishing areas.

fishery has not experienced early closures and the season's duration is year-round for all participants (Table 6).

Golden tilefish inflation-adjusted revenues have been higher every year since IFQ program implementation when compared with those in the baseline period (Table 6 and Figure 2). The increase in total revenue in 2010 was mainly due to landings, as the average price per pound for golden tilefish was nearly identical to that of the baseline period average. Each year since IFQ program implementation, the average inflation-adjusted price received for golden tilefish has shown an increase in price, except for 2014. The largest increase in prices occurred in 2011 and 2015, resulting in a 10% (from $2.76 per pound to $3.03 per pound) and 22% (from $3.16 per pound to $3.85 per pound) increase over the prior year (Table 6 and Figure 2). Industry members have indicated that the increase in price for golden tilefish is the result of the fleet avoiding market gluts, spreading landings throughout the year, and increased marketing efforts. (See Section 5.2.6, Market Stability, for additional discussion. Additional details regarding price and landings information are presented in Section 5.2.4, Mitigating the Race to Fish).

The directed golden tilefish fishery is a very clean fishery with very small amounts of other species caught in those directed trips. Golden tilefish are caught in the target fishery in deep water using bottom longline gear. Revenues from other species caught in the directed golden tilefish fishery are small and have declined since the IFQ program was implemented. For example, during the baseline period the proportion of revenues derived from species other than golden tilefish on trips that landed golden tilefish under the IFQ program was approximately 4.0% of the total trip revenue. During the 2011–2014 period, the proportion of revenue from species other than golden tilefish ranged from 0.1% to 0.7%, and in 2015, it was 1.0% (Table 6).

The increase in total revenue (inflation-adjusted) coupled with fewer active vessels have resulted in a revenue increase per vessel each year when compared with the baseline period ($358,000), ranging from 78% in 2011 ($636,000) to 32% in 2015 ($471,000). Revenues per trip and revenues per day have also generally been higher since IFQ implementation when compared with the baseline period (Table 6 and Figure 2).

Pre-ITQ (2002–2009) and post-ITQ (2010–2015) landings and values (unadjusted) by fishing category are presented in Table 7.

Table 6. Fishery Performance measures for the Golden Tilefish IFQ program (Fishing Year).

	Baseline [a]	2010	2011	2012	2013	2014	2015
Catch and Landings							
Quota allocated to Catch Share (CS) Program	1,861,829	1,895,248	1,895,248	1,895,248	1,895,248	1,895,248	1,667,138
Aggregate landings (CS Program)	1,743,924	1,924,338	1,884,695	1,835,103	1,800,749	1,785,954	1,331,288
% Utilization	94%	102%	99%	97%	95%	94%	80%
ACL exceeded [b]	No	No	No	No	No	No	No
Effort							
Entities holding shares (number)	NA	13	13	12	12	12	12
Active vessels (number)	14	11	9	11	10	11	11
Days at sea (days)	1,074	719	548	634	846	1,073	1,065
Trips (number)	138	115	97	101	118	138	126
Season length (days)	310	365	365	366	365	365	365
Revenues ($) [c]							
CS Program revenue	4,810,403	5,302,558	5,717,641	5,626,622	5,758,396	5,638,734	5,127,030
Non-CS Program revenue [d]	200,858	16,091	5,563	13,594	39,544	21,286	51,366
Non-CS species revenue [e]	9,195,793	3,320,487	2,937,005	4,772,687	3,675,234	3,615,011	2,294,329
Average price ($/pound) CS species	2.75	2.76	3.03	3.07	3.20	3.16	3.85
CS revenue per active vessel	342,957	482,051	635,293	511,511	575,840	512,612	466,094
Non-CS revenue per vessel	14,347	1,463	618	1,236	3,954	1,935	4,670
CS revenue per day at sea	4,471	7,375	10,434	8,875	6,807	5,255	4,714
Non-CS revenue per day at sea	187	22	10	21	47	20	48
CS revenue per trip	34,793	46,109	58,945	55,709	48,800	40,860	40,691
Non-CS revenue per trip	1,455	140	57	135	335	154	408
Other							
Gini Coefficient	0.61	0.51	0.45	0.52	0.52	0.51	0.60
Herfindahl-Hirschman Index (HHI)	1,150	1,431	1,431	1,435	1,599	1,805	1,805
Excessive share cap	NA	49%	49%	49%	49%	49%	49%
Cost recovery fee collected ($) [f]	NA	21,438	21,353	14,242	35,966	14,662	20,744

[a] Baseline period did not have an IFQ program in place. During that period, a limited entry program was in place. Values presented under the baseline column are for the limited access fishery. [b] Overall fishery ACL (IFQ + Incidental). [c] All price and revenue data have been adjusted by the GDP deflator indexed for 2014. [d] During the baseline years, golden tilefish were landed by limited access golden tilefish permit holders on trips in which golden tilefish was not a targeted species. Revenues from other species (not golden tilefish) when fishing under the CS Program. [e] Revenues from other species when not fishing under the CS Program. [f] Source: https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/tilefish/. NA = not applicable.

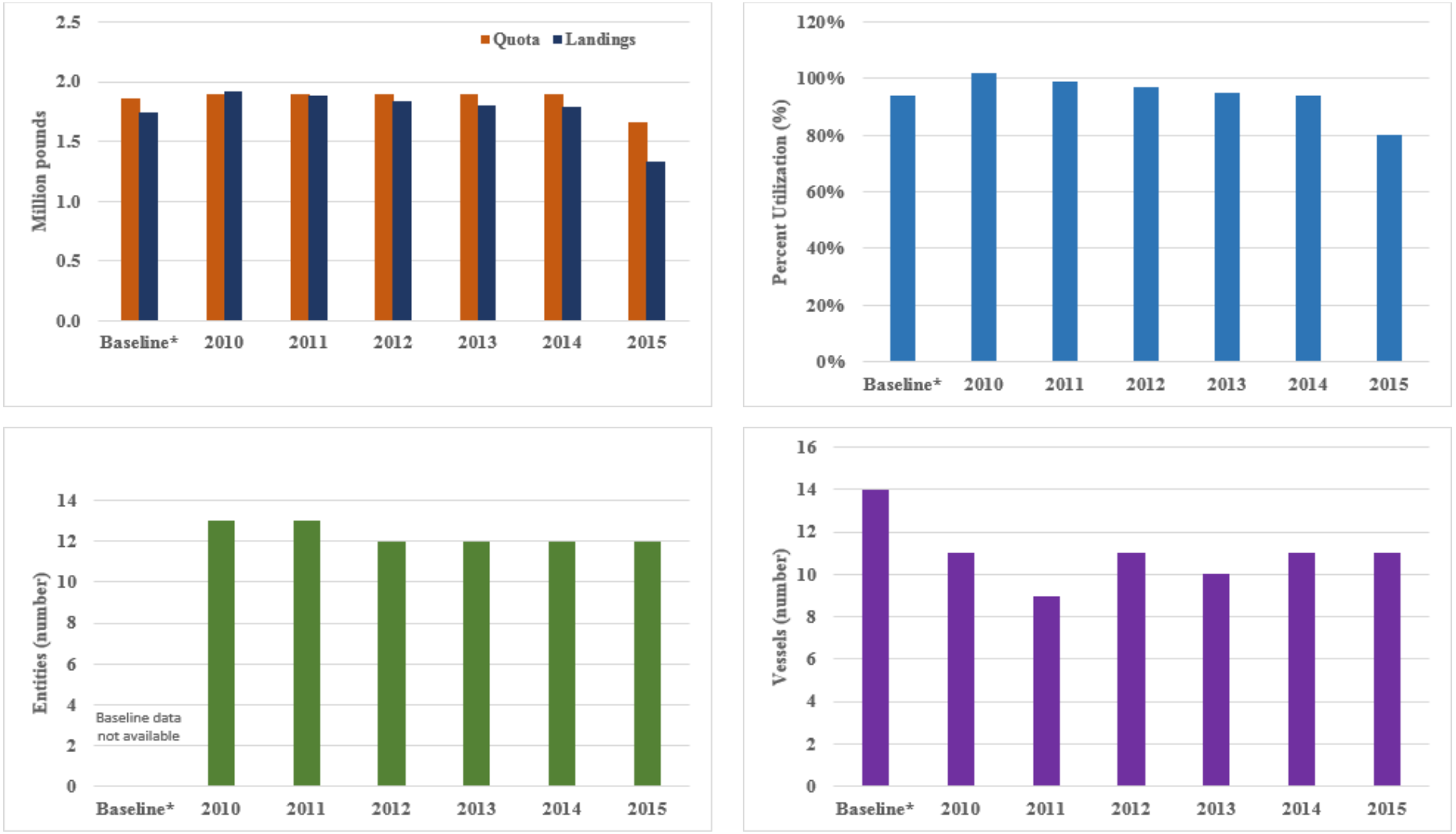
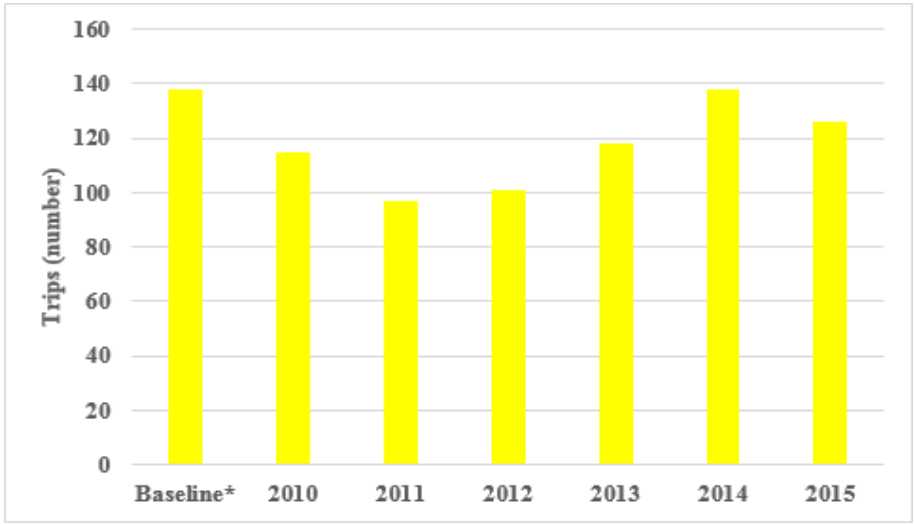


Figure 1. Baseline and post-IFQ quotas and landings, percent utilization, number of entities, number of vessels, number of trips, and number of days at sea in the mid-Atlantic Tilefish IFQ Program (Fishing Year).



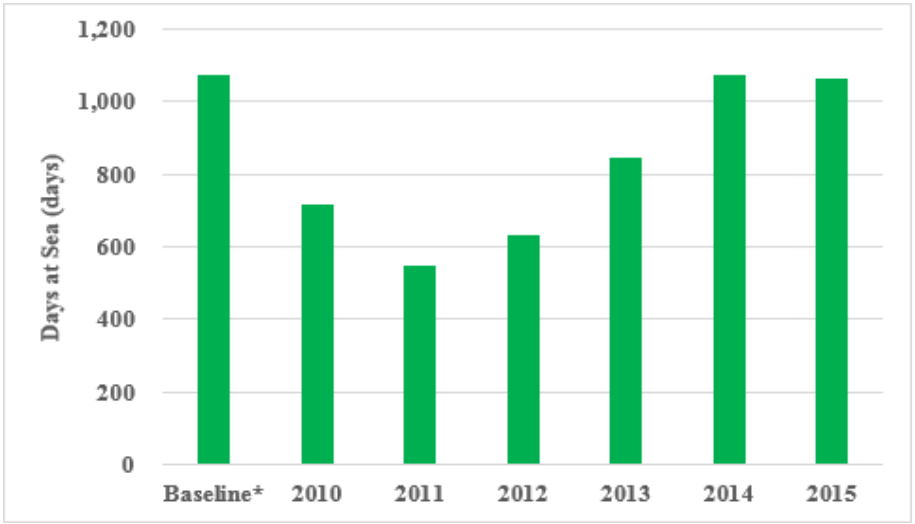


Figure 1 (Continued). Baseline and post-IFQ quotas and landings, percent utilization, number of entities, number of vessels, number of trips, and number of days at sea in the mid-Atlantic Tilefish IFQ Program (Fishing Year).

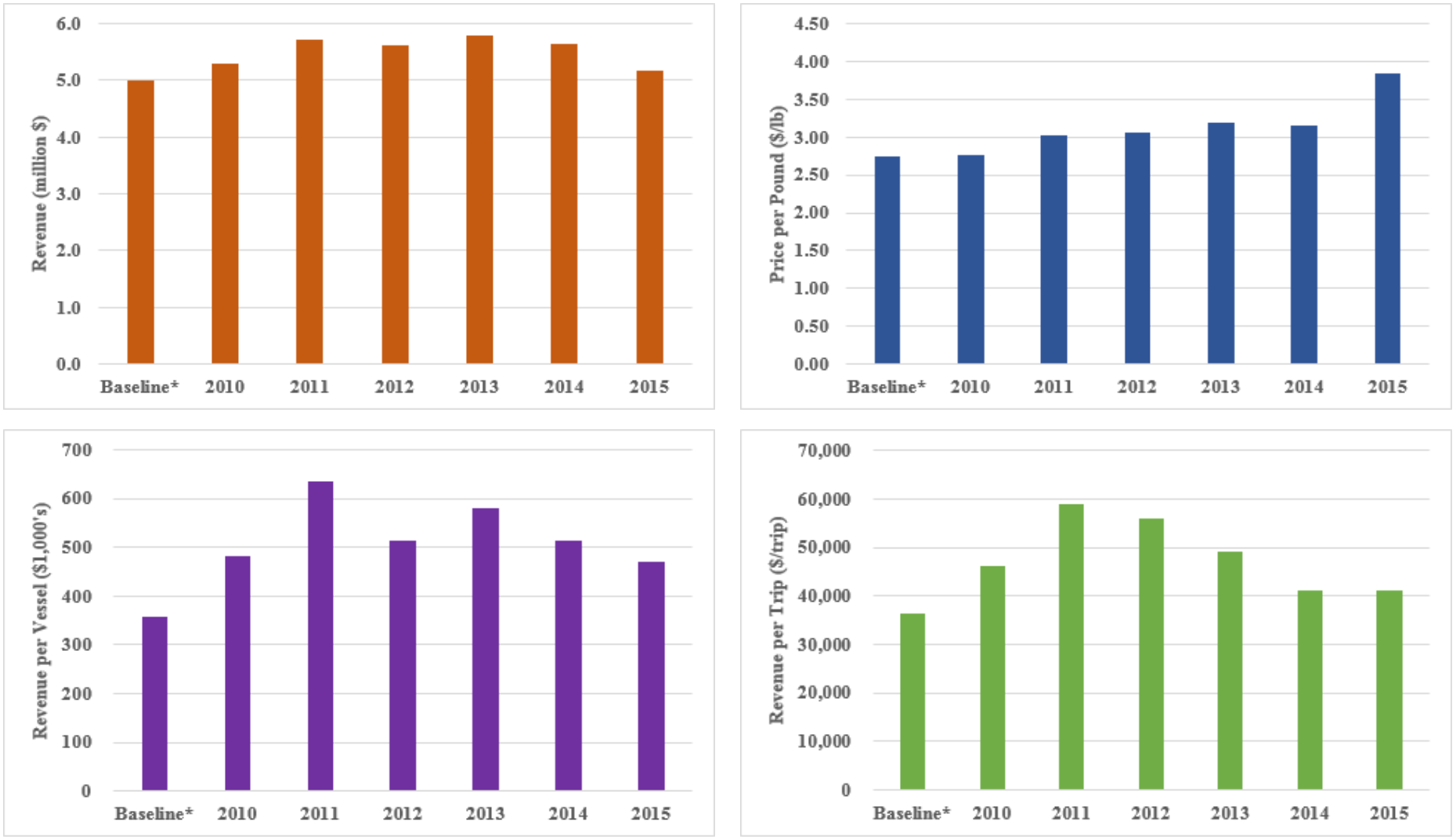


Figure 2. Baseline and post-IFQ (inflation-adjusted 2014 dollars) total revenue (golden tilefish and non-golden tilefish), average price per pound, revenue per vessel, revenue per trip, and revenue per day at sea for vessels fishing in the mid-Atlantic Tilefish IFQ Program (Fishing Year).

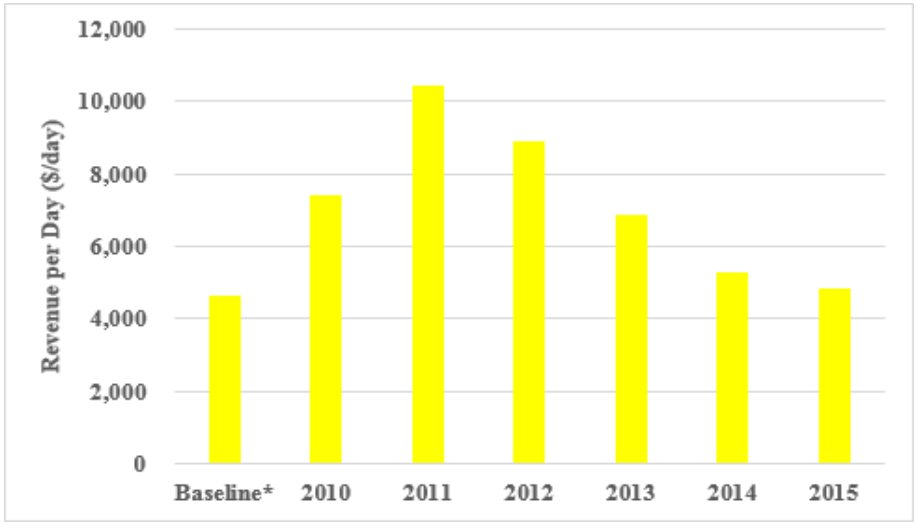


Figure 2 (Continued). Baseline and post-IFQ (inflation-adjusted 2014 dollars) total revenue (golden tilefish and non-golden tilefish), average price per pound, revenue per vessel, revenue per trip, and revenue per day at sea for vessels fishing in the mid-Atlantic Tilefish IFQ Program (Fishing Year).

Table 7. Pre- and post-IFQ golden tilefish landings statistics by fishing category.

Fishing Year	Total Landings and Value		Limited Access Permits		Incidental Permits	
Pre-IFQ	**Landings (Live pounds)**	**Value ($)**	**Landings (million live pounds)**	**Value (million $)**	**Landings (Live pounds)**	**Value ($)**
2002	1,935,977	3,567,646	1.7	3.4	170,741	112,289
2003	2,318,290	3,453,561	2.1	3.3	212,260	163,233
2004	2,643,794	3,453,422	2.1	3.0	538,800	447,904
2005	1,448,658	3,200,725	1.3	3.0	148,702	249,382
2006	1,897,489	4,630,544	1.8	4.5	52,897	121,606
2007	1,776,535	4,592,610	1.7	4.4	67,628	159,536
2008	1,671,741	4,474,310	1.6	4.4	30,974	40,669
2009	1,887,677	4,195,867	1.9	4.2	31,875	40,984
Fishing Year	**Total Landings and Value**		**IFQ Fishery**		**Non-IFQ Fishery**	
Post-IFQ	**Landings (Live pounds)**	**Value ($)**	**Landings (million live pounds)**	**Value (million $)**	**Landings (Live pounds)**	**Value ($)**
2010	1,989,324	5,045,950	1.9	4.9	65,842	117,100
2011	1,923,257	5,626,352	1.9	5.6	38,562	73,083
2012	1,871,828	5,533,177	1.8	5.4	36,725	93,208
2013	1,839,365	5,833,021	1.8	5.7	38,616	108,239
2014	1,829,114	5,708,323	1.8	5.6	43,160	123,633
2015	1,338,598	5,188,640	1.3	5.1	14,329	50,812

5.2.2 Productivity Changes in the Fishery

Productivity is the relationship between the quantity of fish produced and the amount of inputs used to harvest fish. In these terms, productivity is referred to as "multi-factor" productivity since the concern is with the production of fish using multiple inputs such as capital (e.g., fishing vessels), crew, fuel, ice, bait, etc. (Walden et al. 2014). Catch share programs are expected to result in ending the "race-to-fish" behavior that is prevalent under open access programs. This, in turn, is expected to result in improved productivity in the fishery by eliminating redundant capital and allowing fishing to become more technically efficient in its harvesting operations by changing the composition of inputs and outputs (Thunberg et al. 2015).

In this section, updated productivity changes in the golden tilefish fishery developed by Walden at al. (2014) are updated to the most recent year of available data. A detailed description of the methodology used to assess productivity changes, as well as input, output, and biomass data, is reported in Walden et. al. (2014).

5.2.2.1 Productivity – From Baseline Period (2007–2009) to 2015[31]

Productivity refers to multi-factor productivity, which is also known as total factor productivity (TFP). TFP is defined as a ratio of aggregate outputs to aggregate inputs, and TFP change is the ratio of aggregate output change to aggregate input change during an appropriate time period, which for our purposes is a fishing year. Aggregate output and input changes can be measured through construction of output and input quantity indices, using prices as weights for the different outputs and inputs. As was done in the national productivity report, fixed prices for both outputs and inputs are used as weighting factors, and the subsequent TFP measure is called the Lowe index. The numerator in the Lowe index is the value of all landings on all trips in a fishery during a year using a fixed base price, while the denominator is the value of all inputs from all trips in a fishery during a year, using fixed prices on the same trips. In this manner, the construction of the index results in a measure of productivity change at the aggregate fishery level.

Productivity estimates are for vessels in the IFQ fishery only, and these extend previous estimates between FY 2010–2012 to FY 2013–2015. Vessels included use hook gear and predominantly land golden tilefish, although they also land other species as bycatch. Both tilefish and the other outputs are included in the output index. Inputs include capital, labor (number of crew times days spent at sea), energy (fuel used on each trip) and materials (ice). Days at sea and crew size per trip were obtained from vessel logbook data. Vessel length data for the capital calculation was taken from vessel permit files. Quantities of fuel and ice used on each trip were estimated using regression models. There were no estimates of bait used on each trip due to a lack of data to construct a regression model for tilefish vessels. Trip outputs and inputs from each vessel were then aggregated for each year, and then summed across vessels in a year to arrive at estimates for total output produced from the fishery, and total inputs used producing the outputs.

5.2.2.2 Discussion

Vessels in the Golden Tilefish IFQ program increased outputs relative to the baseline average during the first full year of the IFQ program. Between FY 2011 and FY 2013, output was still greater than the baseline, before declining below baseline levels in FY 2014 and FY 2015 (Table 8). Total inputs declined compared with the base time period between FY 2010 and FY 2012, and then increased between FY 2013 and FY 2015; but total inputs were still below the baseline levels. This was driven by over a 43% reduction in days at sea from the baseline average between FY 2010 and FY 2012 (Table 6 and Figure 1), which led to much lower input costs (Table 8). This trend was reversed in FY 2013, FY 2014, and FY 2015. Although the number of vessels fluctuated little, effort increased by almost 300 days in total, leading to higher costs.

Since outputs during the time period FY 2010–2013 were higher than the baseline average, the output index was above one (Table 9). This changed in FY 2014 and FY 2015 as outputs

[31] The information presented in this section was provided by John Walden and Barbara Rountree (Social Science Branch, NEFSC).

dropped below the baseline time period, resulting in an output index of less than one. The biomass-unadjusted Lowe productivity index is a ratio of output change-to-input change. With an output index greater than one between FY 2010 and FY 2013, and an input index less than one, the resulting index was greater than one. Although the output index in FY 2014 and FY 2015 was less than one, the input index was lower than the output index, which also resulted in an index greater than one. During the entire six-year period FY 2010–2015, the biomass-unadjusted productivity was greater than the baseline average, with the index being greater than one throughout, and peaking in FY 2012 with a value of 2.12.

Between FY 2010 and FY 2015, biomass generally improved slightly, as can be seen by the declining biomass index (Table 9). The biomass index uses the initial baseline time period in the numerator, which means that the index is constructed inversely to the way the productivity index is constructed. The biomass-adjusted productivity index is then the product of the productivity index and the biomass index. The resulting biomass-adjusted productivity index was greater than one for all years, except FY 2015, meaning that productivity was higher than the baseline time period for all years except for FY 2015. However, after FY 2011 yearly productivity change was generally less than one, meaning that although productivity was higher than the baseline period, it was declining between consecutive years. On a yearly basis, the biggest productivity gain occurred in FY 2010, the first full year of the IFQ program.

Table 8. Outputs produced and inputs used, northeast Golden Tilefish IFQ program.

Year	Output	Capital	Labor	Energy	Material	Total Inputs
2007	3,409,778	66,239	374,080	330,910	51,594	822,822
2008	3,868,301	107,629	750,945	343,074	98,937	1,300,584
2009	4,735,154	105,843	797,804	759,196	115,097	1,777,940
Baseline Average	4,004,411	93,237	640,943	477,727	88,543	1,300,449
2010	4,893,878	97,753	488,636	303,028	83,866	973,283
2011	4,582,646	73,719	378,122	222,174	41,360	715,376
2012	4,303,568	67,139	405,360	141,158	44,907	658,565
2013	4,713,078	69,498	554,908	193,651	67,690	885,747
2014	3,855,480	61,400	578,376	200,892	88,273	928,941
2015	3,098,587	68,094	610,350	205,040	98,453	981,938

Table 9. Output, input, productivity indices, northeast Golden Tilefish IFQ program.

Year	Output Index (Yearly)	Input Index (Yearly)	Productivity Index	Biomass Index	Productivity Index Bio-Adjusted	Yearly Change
Baseline	1	1	1	1	1	--
2010	1.22	0.75	1.63	0.96	1.56	1.56
2011	1.14	0.55	2.08	0.86	1.79	1.15
2012	1.07	0.51	2.12	0.83	1.75	0.98
2013	1.18	0.68	1.73	0.90	1.55	0.88
2014	0.96	0.71	1.35	0.88	1.18	0.76
2015	0.77	0.76	1.02	0.83	0.85	0.72

5.2.3 Achievement (or Harvesting) of Optimum Yield

Table 10 shows in aggregate the total fishery overages and underages by year. From FY 2010–2015, Golden Tilefish IFQ allocation usage has been trending down, with a net overage of 18,769 pounds in FY 2010 to a net underage of 333,295 pounds in FY 2015 (Table 10). In FY 2015, a medium IFQ account (11%; see Table 4) was sold. That year, the vessel associated with harvesting those IFQ shares did not fish due to mechanical problems. This account contributed with approximately 50% of the overall underage in FY 2015.

The average percentage of overages has remained relatively low throughout the time series. Allocation overages during the first couple of years of the Golden Tilefish IFQ fishery may have been because allocation holders were not aware they needed to account for the head-on, gutted- versus whole-weight conversion factor. Allocation weights are given in live or round weight pounds, but fish are landed dressed (with head on and guts removed). The conversion factor for landed-to-live golden tilefish is 1.09 (i.e., every pound of dressed golden tilefish is assumed to have weighed 1.09 pounds when the fish was alive).

In order to maximize profits, there is an incentive to land all of an individual allocation or perhaps to land slightly more than the individual allocation within each year since carryover is not allowed (Figure 3). Catch rates (CPUE) are mainly determined by year class strength as the strong year classes move through the fishery. The catch rates were declining as the last strong year class ages in FY 2015 (Figure 4). A decline in the CPUE results in longer trips and higher costs.

However, lower catch rates and higher expenses were somewhat mitigated by strong tilefish market with higher prices. The ability to land individual allocations may be more of a constraint for the larger IFQ holders in which the time to catch the fish over the course of the year becomes more of a limiting factor (Figure 3). In addition, some of the larger IFQ holders also chose to invest in maintenance and upgrades to their vessels during a time when the catch rates were lower and fishing costs were higher. This may also have contributed to inability to land the entire yearly allocation for some of the larger IFQ holders. However, the decision to invest in the vessels themselves also suggests there is underlying confidence that catch rates will increase in the future and that the status of the stock is positive.

Table 10. Golden tilefish individual fishing quota allocation information for FY 2010–2015.

Fishing Year	Sum of individual allocations after deductions for overages	Total Golden Tilefish IFQ landings (pounds)	Total IFQ overage/ underage	Sum of charged individual IFQ overages	Sum of IFQ individual underages	Average percent overage, individual IFQ allocations
2010	1,895,248	1,914,017	18,769	24,000	5,231	3.1%
2011	1,871,248	1,884,695	13,447	13,786	339	0.9%
2012	1,881,462	1,835,017	-46,445	10,511	56,956	1.2%
2013	1,889,955	1,800,749	-89,206	8,844	98,050	0.2%
2014	1,895,248	1,785,035	-110,213	2,986	113,199	0.4%
2015	1,664,152	1,330,857	-333,295	1,257	334,552	0.1%
Total	11,097,313	10,550,370	-546,943	61,384	608,327	1.0%

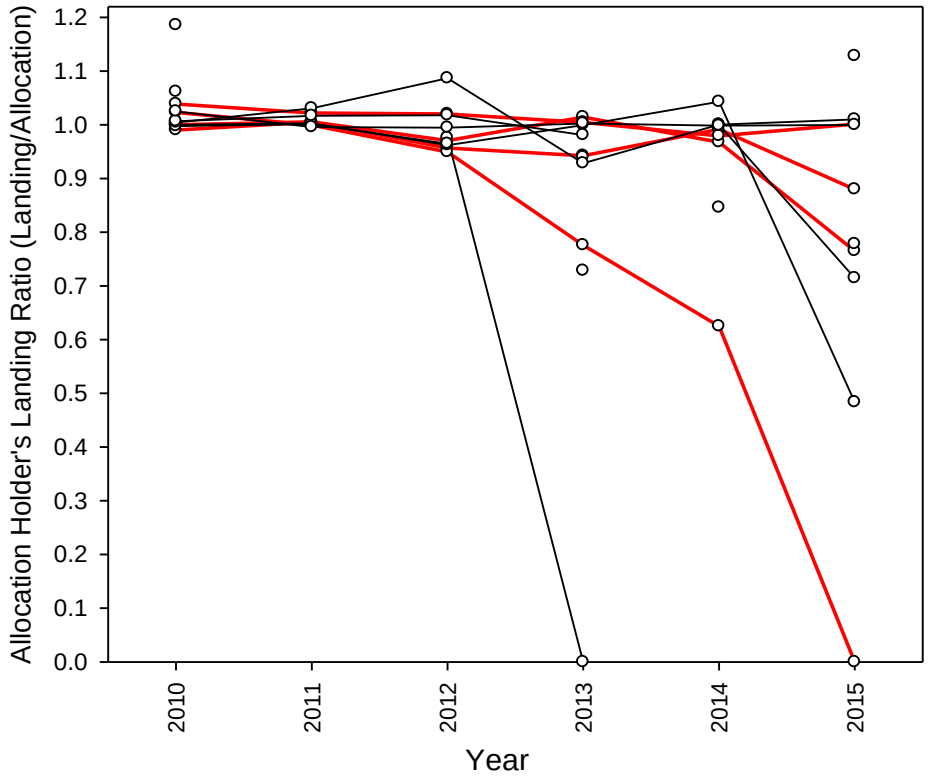


Figure 3. Individual IFQ landing to allocation ratios from 2010–2015. The red line IFQ holders signify the top four holding during this time period.

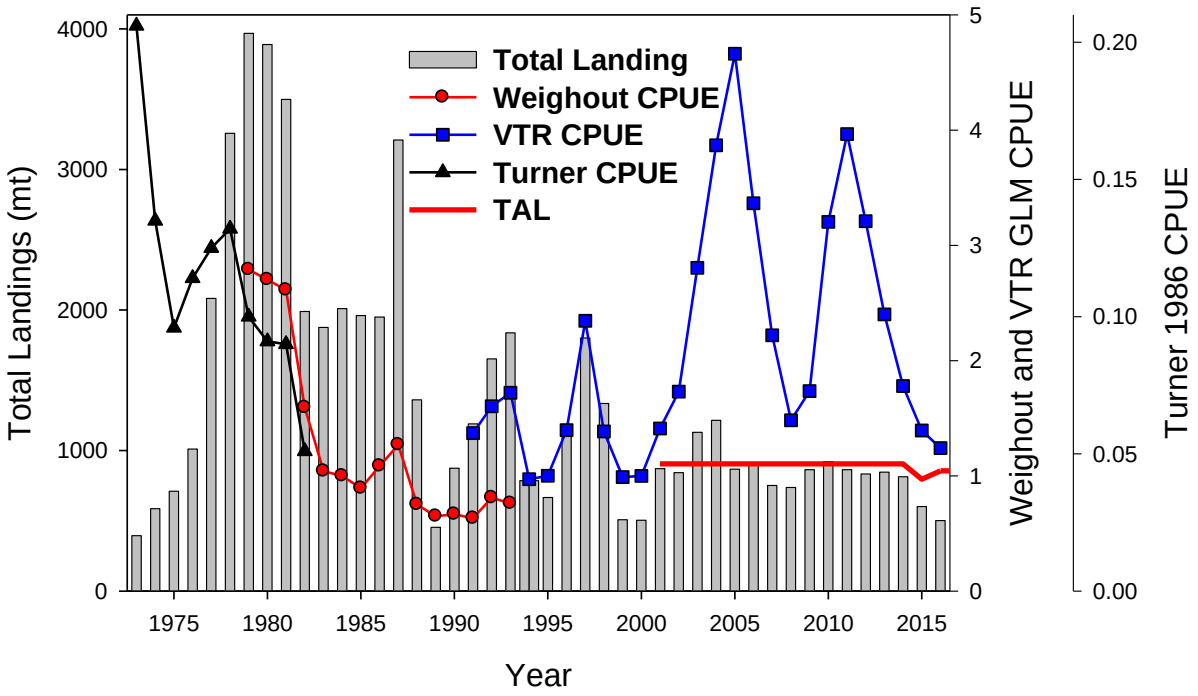


Figure 4. General Linear Model CPUE for the Weighout and VTR data. Total landings in the gray bars are also shown. Red line is the TAL.

5.2.4 Mitigating the Race to Fish

While there were benefits derived from the establishment of the limited access management system and stock rebuilding strategy under the original Tilefish FMP, the new management system resulted in competition among fishermen to land as much fish as possible before the annual limit for their respective category was reached. Derby-style fishing led to early closures in the full-time Tier 2 and part-time categories under the limited access system. In addition, derby-style fishing led to fishing in unsafe conditions especially for smaller-sized vessels (typically part-time vessels <50 ft.) as they were forced to fish during the winter (e.g., November – March) in order to compete for a portion of their category allocation.

The full-time Tier 1 vessel category (participants in this fleet are located in Montauk, New York) did not experience early closures as these participants developed an informal agreement to make the most efficient use of their portion of the catch. To avoid derby-style fishing, the fishermen divided the category's share based on each individual's historical landings (Kitts et al. 2007). This cooperation was facilitated by the fishermen's close proximity to one another, their strong personal relationships, and their ability to share a designated portion of the allowable landings. As a result of their cooperative agreement, fishermen in the category benefited from safer fishing conditions, improved stability for their businesses, and higher market prices for their fish (Kitts et al. 2007).

A goal of the IFQ system was to eliminate derby-style fishing and the associated race to fish that occurred under the limited access management system. Derby-style fishing can result in shorter fishing seasons, market gluts causing depressed prices, and unsafe fishing conditions. The fishing patterns of vessels that formerly fished under the limited access system and currently hold allocation will be examined in this document in order to determine whether the goal of eliminating derby-style fishing has been met. Since the original limited access management system allocated quotas to three fishing categories (i.e., full-time Tier 1, full-time Tier 2, and part-time categories),[32] the fishing practices under the current IFQ system for selected vessels (i.e., those that are currently active) would be contrasted with the pre-IFQ fishing practices for vessels under each of the previous fishing categories.

Stakeholders fishing under the part-time category (pre-IFQ) consistently indicated that as soon as the fishery opened on November 1 of each year, the system's incentives compelled them to fish early in the fishing year in order to catch as much fish as possible before the overall quota for their category was taken. They also indicated that they had to fish under severe weather conditions during the winter season (e.g., November – March), a particularly dangerous time, especially for smaller-sized vessels.

One of the most visible changes since the implementation of the IFQ system for vessels that formerly fished under the part-time category has been a shift in the landings' timing throughout the year. Part-time vessels that qualified for IFQ shares and are currently participating in the fishery (six vessels) used to land 76% of their tilefish during the November – March period and 24% during the April – October period. However, post-IFQ implementation, these vessels landed 30% of their tilefish during the November – March period and 70% during the April – October period, indicating a significant shift in landings away from the winter period also occurred for vessels that participated in this fishing category (Figure 5). Average ex-vessel prices (dollars/pound) have also increased post-IFQ with smaller variability from month-to-month. The amount of golden tilefish pounds landed by the part-time category vessels increased by approximately 55% between the pre-and post-IFQ period[33] and the value of those landings increased by 162%.

The IFQ program eliminated the need to race to fish during the winter months. It was reported during the development of the directed longline fishery that tilefish catch rates tend to increase during the winter months since golden tilefish are more concentrated in a narrow temperature band along the upper slope of the continental shelf where the temperature remains relatively constant (Grimes et al. 1980, Grimes and Turner 1999). However, more recently effort has shifted away from the winter months, given the overall improvements in the stock status, a strong tilefish market with higher prices, better weather conditions, and fewer issues with dogfish interactions during the summer.

[32] While the stakeholders participating in the full-time Tier 1 category did not engage in race-to-fish fishing practices, changes in fishing practices pre-IFQ compared to post-IFQ are also presented in this section for this fishing category for comparison purposes.

[33] For discussion purposes under this section, pre-IFQ period = years 2004–2009 (years associated with early closures in the full-time Tier 2 and/or part-time categories under the limited access system); post-IFQ period = years 2010–2015.

Full-time Tier 2 vessels that qualified for IFQ shares and are currently participating in the fishery (one vessel) used to land 63% of its tilefish during the November – March period and 37% during the April – October period. However, post-IFQ implementation, this vessel landed 45% of its tilefish during the November – March period and 55% during the April – October period, indicating that a shift in landings away from the winter period also occurred for vessels that participated in this fishing category (Figure 6). Average ex-vessel prices (dollars/pound) have also increase post-IFQ with smaller variability from month to month. The amount of golden tilefish pounds landed by the full-time Tier 2 category vessels increased by approximately 113% between the pre-and post-IFQ period and the value of those landings increased by 192%.

Full-time Tier 1 vessels that qualified for IFQ shares and are currently participating in the fishery (three vessels) used to land 36% of their tilefish during the November – March period and 64% during the April – October period. However, post-IFQ implementation, these vessels landed 33% of their tilefish during the November – March period and 67% during the April – October period, indicating that a very slight shift in landings away from the winter period also occurred for this fishing category (Figure 7).[34] Average ex-vessel prices (dollars/pound) have also increase post-IFQ with smaller variability form month to month. The amount of golden tilefish pounds landed by the full-time Tier 1 category vessels increased by approximately 40% between the pre-and post-IFQ period and the value of those landings increased by 74%.

In addition to adjusted timing of fishing activity post-IFQ implementation, commercial fishing activity for the entire directed fishing fleet changed. For example, the average number of fishing trips was reduced from 138 (FY 2007–2009 pre-IFQ period) to 116 (FY 2010–2015 post-IFQ), and the number of days absent decreased from 1,074 (pre-IFQ) to 815 (post-IFQ). However, the number of days absent per trip remained relative unchanged (7.8 pre-IFQ versus 6.9 post-IFQ). While the number of fishing trips, number of days absent, and number of days absent per trip showed a downward trend during the early years of the IFQ system implementation (e.g., FY 2010–2012), for the last few years (FY 2013–2015) the trend has reversed to values that are relatively similar to pre-IFQ values (Table 6 and Figures 1 and 8).

Trends in the number of trips and days-at-sea metric that results in trip length (number of trips/days at sea) are likely more due to changes in tilefish population dynamics effects rather than effects from the implementation of the tilefish IFQ program. Trip length trends are usually influenced by the catch rates (CPUE) within a year. As catch rates decline the trip length increases since it takes more time to fill the vessel's fish hold. Catch rates are due to growth of strong year classes that move through the fishery over time as the year class ages.

[34] It is likely that the shift in landings is associated with the increasing dogfish interactions that golden tilefish vessels are experiencing during the winter period in recent years. Dogfish interaction reduces tilefish catches and strongly affects where people fish and when fishermen encounter them, they have no choice but to move to other fishing areas. According to stakeholders, the dogfish interaction used to be about 2 or 3 months in the winter. However, in the last 5 years (2010–2015), dogfish presence is about 8 months, and extends to June.

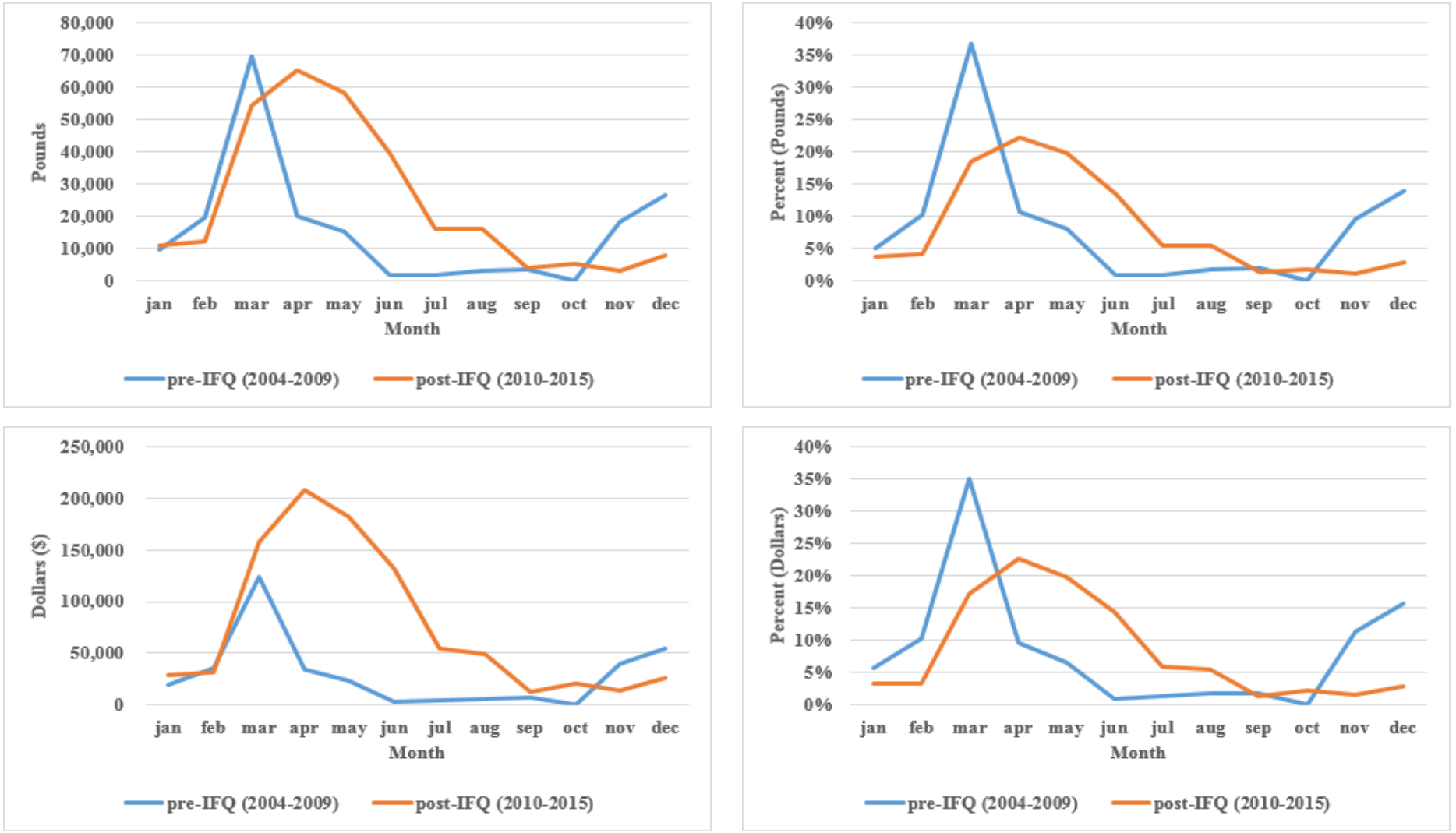


Figure 5. Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound) for all previous part-time vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

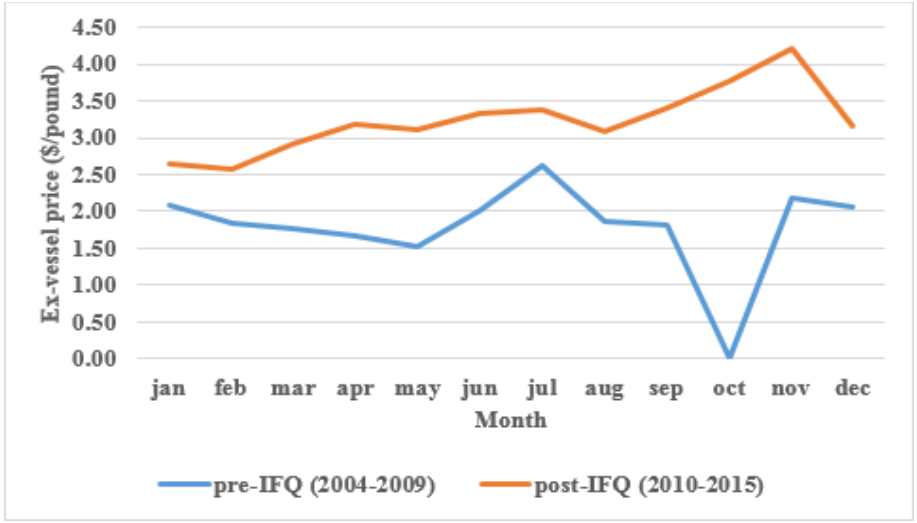


Figure 5 (Continued). Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound) for all previous part-time vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

Figure 6. Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound), for all previous full-time Tier 2 vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

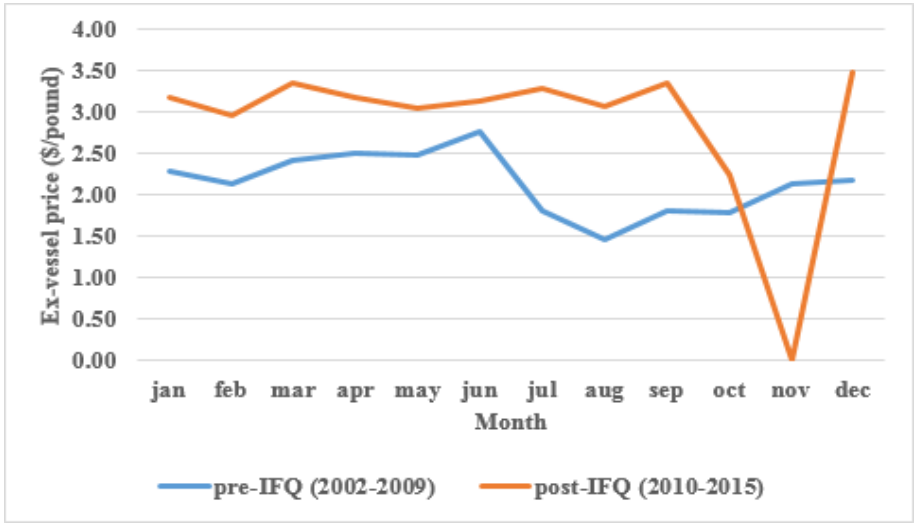


Figure 6 (Continued). Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound), for all previous full-time Tier 2 vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

Figure 7. Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound), for all previous full-time Tier 1 vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

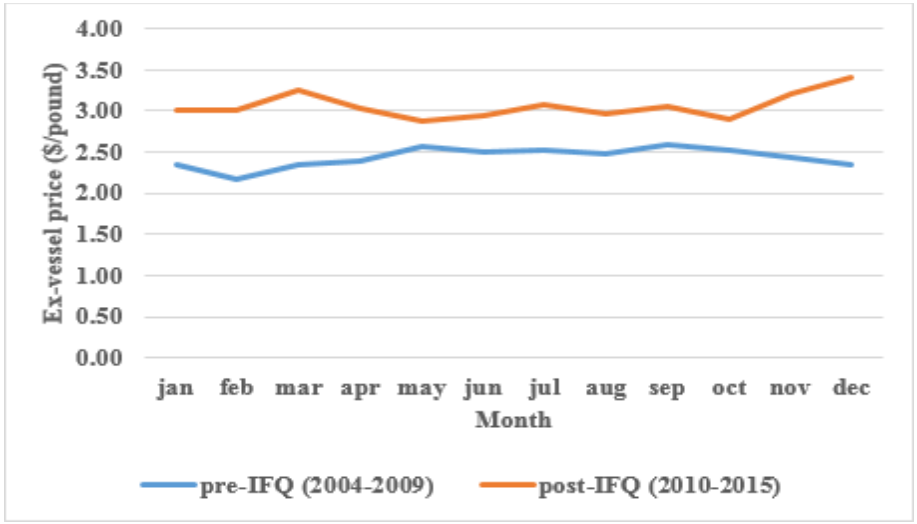


Figure 7 (Continued). Pre-and post-IFQ average monthly golden tilefish landings (pounds), monthly landings percent, average monthly ex-vessel value (dollars), monthly percent value, and average monthly ex-vessel price (dollars/pound), for all previous full-time Tier 1 vessels that qualified for IFQ and are currently active in the fishery (Calendar Year).

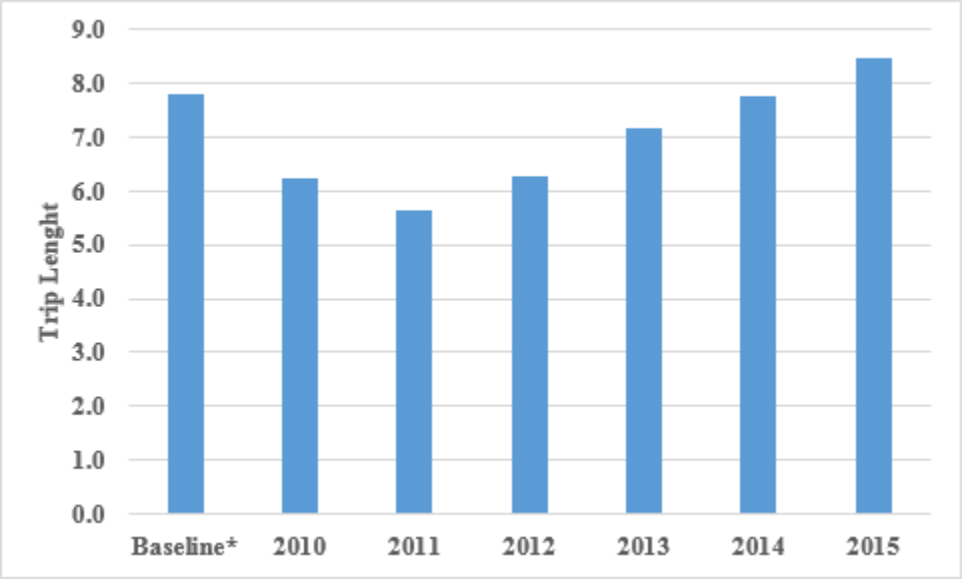


Figure 8. Golden Tilefish trip length.

5.2.5 Quota and Allocation Markets

5.2.5.1 Golden Tilefish IFQ Allocation Permanent Transfers

Golden Tilefish IFQ allocation has been permanently transferred between allocation holders (Table 11) every year from FY 2010–2015, except one (FY 2014). Recipients of permanent transfers have included both original allocation holders (i.e., an allocation granted in FY 2010, the first year of the IFQ fishery) and new allocation holders (i.e., holders of IFQ allocation generated after FY 2010; Table 11). An annual average of 5.8% of permanent IFQ allocation has been transferred from FY 2010–2015. A total of 635,114 pounds of IFQ allocation has been permanently transferred over the period. Average annual reported price for permanent IFQ allocation transfers has ranged between $1.00 per pound and $5.02 per pound.

5.2.5.2 Golden Tilefish IFQ Allocation Leasing

From FY 2010–2015, 32 leases of Golden Tilefish IFQ allocation were transacted, with a maximum of 6 transactions each FY 2013, 2014, and 2015 (Table 12). Average annual leased pounds were 254,088 pounds over the time period. Between 10% and 18% of the overall golden tilefish total IFQ allocation was leased annually over the period. For transactions in which price information was reported, average price (real prices, that is not adjusted for inflation) per pound ranged from $0.49 to $0.97, with an average price of $0.73 over the six-year period (Table 11 and Figure 9).

An extensive analysis of the lease and quota market is beyond the framework of this report. However, for the years for which information is available, the changes in the ratios of lease prices-to-quota price as well as the ratio of golden tilefish price-to-quota prices are shown in Table 13. In a competitive market, quota prices reflect the expected present value of the net economic returns from the fishery, considering expectations and uncertainties in golden tilefish prices, in landings, and in ecological and biological factors. Hence, increases in tilefish price,

decreases in costs, increases in quota demand, and declines in uncertainties regarding future stock conditions and health may all contribute to increased quota prices.

As indicated in Table 13, there are very few data points to make meaningful statements regarding price ratios trends in the IFQ fishery (lease price-to-quota share price, quota price-to-tilefish price). The average quota price increased by 144% from FY 2010–2011, greater than the increase in tilefish price (13%) and fuel price (28%) for the same time period. Other factors that could help explain those changes include the changes in the relative rate of return from buying quota relative to leasing quota. From FY 2010–2011, there was a decline in the ratio of lease price to quota price from 23.8% to 12.7%. This ratio reflects the implicit discount in the quota; a quota price should equal the expected present value of the net economic returns from the fishery, subject to the expectations and uncertainties in golden tilefish prices, landings, ecological, and biological factors. A decrease in this ratio could be a sign of a decline in the perceived uncertainties about future returns.

In FY 2015, a large amount (11%) of golden tilefish quota was sold by an entity that had not fished that year (also, this entity in FY 2014 was not able to land its entire allocation due to mechanical problems with the vessel primarily used to harvest the allocation). Because of confidentiality issues, the average reported price per pound of permanent allocation transfer for FY 2010, FY 2011, and FY 2015 cannot be reported. In FY 2011, the average price of the quota allocation sold was double the average price of quota allocation sold in FY 2010. In addition, the lease price-to-quota price in ratios for FY 2011 was half the FY 2010 lease-to-quota price ratio. This decrease in the lease price-to-quota price represents a decrease in uncertainty about future returns during that time period. Unfortunately, there is not sufficient price data for permanent allocations transfers to assess trends on the ratios of lease price-to-quota price and quota price-to-tilefish price (Table 13). Lastly, the average non-zero price of the quota allocation sold in FY 2010–2015 was $2.69 per pound.

Lease prices have increased at a relatively stable rate since the implantation of the IFQ system (with the exception on FY 2012). The increase in ex-vessel prices appears to be one of the important factors that affected the lease prices. In a competitive market, the lease price should reflect either the annual marginal profit flow or the difference between price of fish and marginal costs of fishing. For example, the average lease-in prices increased by 47% in FY 2014, exceeding the increase in golden tilefish prices (23%) in the same year compared with FY 2010. The increase in fuel prices by 28% in the same period was another important factor contributing to the increase in lease prices. Other factors that could affect average lease prices include asymmetric information held by buyers and sellers, fish stock conditions, and climate uncertainties.

Table 11. Golden tilefish IFQ allocation permanent transfers by year, FY 2010–2015.

Fishing Year	Annual IFQ Allocation	Sum of pounds permanently transferred	Proportion of IFQ allocation transferred to original allocation holders*	Proportion of IFQ allocation transferred to new entrants**	Proportion of IFQ allocation transferred
2010	1,895,248	87,452		5.4%	5.4%
2011	1,895,248	15,442		0.8%	0.8%
2012	1,895,248	240,638	5.5%	7.2%	12.7%
2013	1,895,248	104,615	5.5%		5.5%
2014	1,895,248				0.0%
2015	1,667,138	184,101		11.0%	11.0%
Total	10,859,091	635,114			Avg. 5.8%

*An original allocation holder for this table means a permanent transfer occurred and the allocation was sold to one of the original allocation holders who was first issued and qualified for IFQ in 2010.

**A new entrant for this table was determined by identifying new allocation numbers that were generated as a result of the permanent transfer.

Table 12. Golden tilefish IFQ allocation temporary (lease) transfers by year, FY 2010–2015.

Fishing Year	Sum of total leased pounds	Annual IFQ Allocation	Proportion of IFQ Allocation Leased	Number of lease transactions	Proportion of leased pounds to new entrants	Avg. price per pound[a]	Maximum lease price per pound[a]	Minimum lease price per pound[a]
2010	292,080	1,895,248	15.4%	4	0%	$0.49	$0.49	$0.49
2011	340,361	1,895,248	18.0%	5	0%	$0.64	$0.75	$0.52
2012	254,379	1,895,248	13.4%	5	0%	$0.95	$0.97	$0.92
2013	190,813	1,895,248	10.1%	6	57%	$0.71	$0.73	$0.67
2014	208,907	1,895,248	11.0%	6	48%	$0.72	$0.73	$0.64
2015	237,990	1,667,138	14.3%	6	50%	$0.76	$0.83	$0.70
Total	1,524,530	11,143,378	13.7%	32	20%	$0.73	$0.97	$0.49

[a] Real prices.

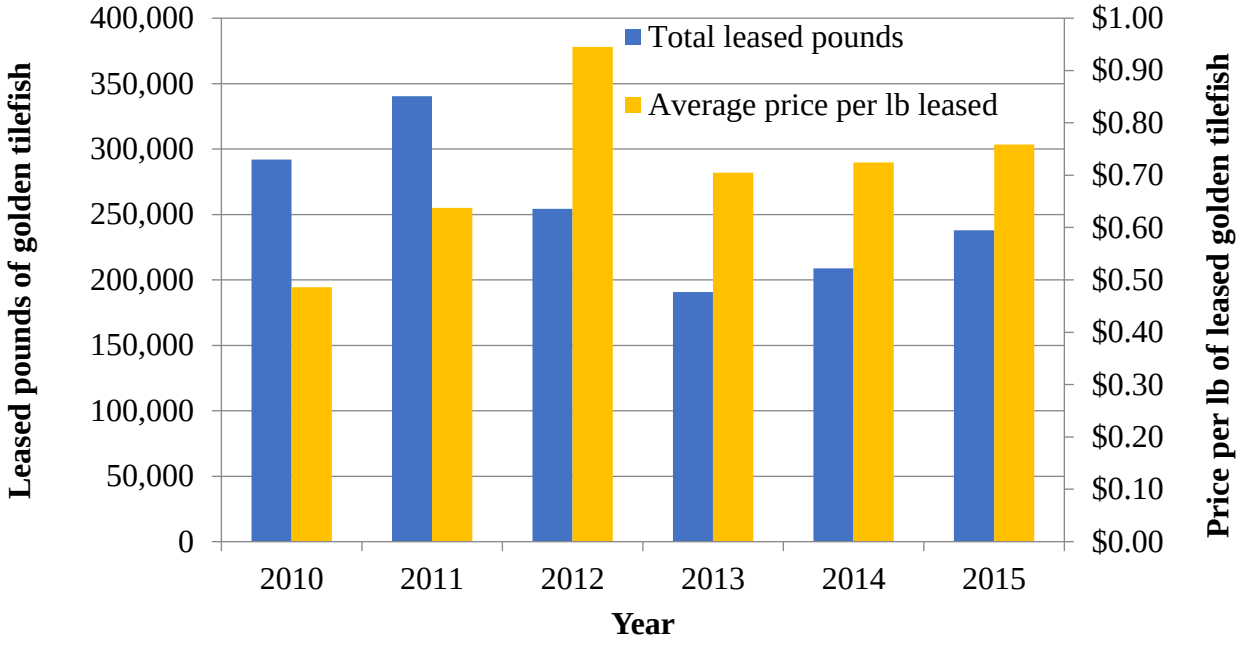


Figure 9. Golden tilefish IFQ allocation leased pounds and average price (real prices) per leased pound by year, FY 2010–2015.

Table 13. Lease and quota price ratios (real prices).

Variable/Fishing Year	2010	2011	2012	2013	2014	2015
Avg. lease price	0.49	0.64	0.94	0.71	0.72	0.76
Tilefish ex-vessel price	2.56	2.88	2.96	3.14	3.16	3.89
Ratio lease to tilefish price	0.19	0.22	0.32	0.23	0.23	0.20
Change in lease price from 2010		31%	92%	45%	47%	55%
Change in tilefish price from 2010		13%	16%	23%	23%	52%
Fuel prices	3.0	3.8	4.0	3.9	3.8	2.7
Change in fuel price from 2010		28%	33%	31%	28%	- 10%
Quota price	C	C				C
Change in quota price from 2010		144%				-51%
Ratio of lease price to quota price	C	C				C
Ratio of quota price to tilefish price	C	C				C

C=Confidential data.

5.2.6 Market Stability

Industry members have reported that golden tilefish prices have been strong and have increased since the IFQ system came into place (Tables 6 and 14; Figures 5–7). They have indicated that a

major reason for this is that the golden tilefish industry is able to coordinate times of landings to avoid market gluts and spread the tilefish landings throughout the year.[35]

The implementation of the IFQ system has particularly benefited vessels that were in the former part-time and full-time Tier 2 fishing categories under the old Limited Access program. As indicated in Section 5.2.4 (Mitigating the Race to Fish), after IFQ implementation, these vessels were able to spread landings more evenly throughout the year when compared with the pre-IFQ period. By spreading landings through the year, the tilefish fleet has been able to provide a stable supply of golden tilefish to the market throughout the year which, according to stakeholders, has benefited market expansion and improved prices (while also avoiding price fluctuation). Golden tilefish marketing practices (e.g., product form, transportation, and packaging) have not significantly changed as a result of the IFQ program implementation. Most golden tilefish continue to be sold fresh (whole or gutted fish). When the catch arrives at the dock, it is sorted, washed, weighed, boxed, and iced in 60-pound cartons. Golden tilefish are generally transported to the Fulton Market by truck. The number of dealers has remained steady since the transition of catch shares.

Golden tilefish is carried as a specialty item in the Fulton Market for mostly ethnic customers (traditionally, most of the tilefish landings were sold to Korean customers). However, since approximately 2014, stakeholders have indicated that due to marketing efforts, tilefish has become a more well-known, popular item. Tilefish are now found in some local fish markets, as well as some grocery stores such as Whole Foods. Businesses such as Sea to Table (a door-to-door seafood delivery service) has also helped make the product available at a larger geographic scale.

While Golden Tilefish IFQ stakeholders have to work diligently to secure stable fish supplies by spreading their landings throughout the year (and avoid market gluts and price fluctuations), the price of golden tilefish tends to decrease when tilefish landed in the South Atlantic "derby" fishery enters the New York market. This typically occurs for a few months per year as the South Atlantic tilefish fishery typically closes early in the season. Golden Tilefish IFQ allocation holders in the Mid-Atlantic account for this when planning fishing activity.

Price differential indicates that larger fish tend to bring higher prices (Table 13). Nevertheless, even though there is a price differential for various sizes of golden tilefish landed, Golden Tilefish IFQ fishermen land all fish caught, as the survival rate of discarded fish is very low (Nolan pers. comm. 2006, Kitts et al. 2007). Furthermore, Amendment 1 to the Tilefish FMP prohibited the practice of highgrading (MAFMC 2009). In 2016, industry reported that they have been getting specific requests for extra-large fish. Rather than discarding the head and the rack of an extra-large fish, soups and broth are being made and the waste is eliminated.

[35] See golden tilefish FPR for 2013–2016 at: http://www.mafmc.org/fishery-performance-reports/.

Table 14. Golden tilefish adjusted ex-vessel price (dollars/pound; real prices) by market category, from Maine thought Virginia.

Market Size Category	Baseline period (2007–2009) Average Price ($/pound) [a,b,c]	Post-IFQ period (2010–2015) Average Price ($/pound) [a,b,c]	Approximate Market Size Range (pounds)
Extra large	3.12	3.97	> 25
Large	3.61	4.18	7 – 24
Large/medium [d]	NA	4.01	5 – 7
Medium	2.20	3.31	3.5 – 5
Small or kittens	2.19	2.75	2 – 3.5
Extra small	3.17	2.32	< 2
Unclassified	3.42	3.34	NA
ALL	2.82	3.48	NA

[a] Values are for both IFQ and incidental landings combined.
[b] All prices have been adjusted by the GDP deflator indexed for 2014.
[c] Calendar year.
[d] Large/medium code was developed in 2014–2015. Prior to that, golden tilefish sold in the large/medium range were sold as unclassified fish.

5.3 Biological Outcomes

The SSC reviewed an updated tilefish assessment in 1999, which was used in the development of the Tilefish FMP since the stock was declared overfished, and overfishing was still occurring. Rebuilding the golden tilefish stock to B_{MSY} was based on a ten-year constant harvest quota of 1.995 million pounds (905 mt). This quota remained in place from 2001 until 2015. The model and rebuilding projections were based on a data-poor surplus production model, which does not consider recruitment fluctuations and demographic changes in the population.

Improvements in the fishery and CPUE appeared to have occurred during management under the 1.995 million pounds (905 mt) constant harvest rebuilding years, even though management was based on a relatively simple, data-poor model, which did not account for demographic changes and year class effects. It appears that at least two strong year classes have sustained the tilefish fishery with management controls on total effort through the 1.995 million pounds (905 mt) constant quota that was implemented under the Tilefish FMP in FY 2001. This constant quota strategy appears to have promoted the rebuilding of the stock. That is, tilefish management after the FMP was implemented appears to have resulted in the prolonged survival of a strong incoming year class relative to the previous time period (1980s and 1990s), before there were management controls on the stock.

In addition, constant harvest management and limited access has promoted a small group of permit holders in the full-time Tier 1 to coordinate fishing activity in order to bring a constant supply of product to the market over the course of the year, which has improved prices and revenue for the golden tilefish fishery.

The last benchmark stock assessment was in SARC 58 in 2014 (with a terminal year of 2012 data) (NEFSC 2014). The golden tilefish stock was not overfished, and overfishing was not occurring in 2012 relative to the SARC 58 accepted biological reference points. The stock was declared rebuilt in 2014 by NMFS based of SARC 58 results which indicated that SSB was at 101% of the accepted SSB_{MSY}. A new model, ASAP, was used in this assessment to incorporate newly available length and age data. The ASAP model integrates more realistic life history information on size and growth into a single model framework and better characterizes the population dynamics of the golden tilefish stock.

However, projections from the ASAP model from SARC 58 using the MAFMC SSC control rule resulted in a reduction in the 2015 estimated quota and ABC to 1.766 million pounds (801 mt). The ABCs were projected to increase within the projection in 2016 and 2017 to 1.898 million pounds (861 mt) and 1.949 million pounds (884 mt), respectively. The MAFMC held the ABC for 2017 constant at the 2016 estimate of 1.898 million pounds (861 mt) based on input from industry. The desire for industry to stabilize supply and market prices has led to additional conservation benefit for the stock, according to the assumptions within the projections. The IFQ management under Amendment 1 and the older IFQ-like management from industry on this stock appear to have contributed to stock rebuilding, which also has resulted in higher fishery revenue.

With the implementation of ABC control rules under the reauthorization of the MSA and the use of a more sophisticated forward projecting model came more variation in quotas through projections. A model update in February 2017 provided ABC and OFL estimates that the SSC considered for FY 2018–2020. The stock status did not change in the 2017 update; the golden tilefish stock was not overfished, and overfishing was not occurring in 2016 relative to the newly updated biological reference points. Projected ABCs in 2018–2020 from the updated model did require a reduction in the ABC to 1.636 million pounds (742 mt) average from 2018–2020. However, there was an indication of the strong 2013 year class beginning to enter the directed longline fishery in 2016. CPUE in the directed fishery should increase as this year class continues to recruit to the fishery. However, concerns still exist with the true underlining uncertainty from the limited data to support the newer, more complicated data-hungry model. Future experience under the new model will indicate whether the projections are reliable for determining the appropriate changes in the OFLs and ABCs for this fishery over time.

5.3.1 Fishing Mortality

Fishing mortality on the fully selected age class (age 5, F_{MULT}) increased with the development of the directed longline fishing from near zero in 1971 to 1.18 in 1987. Fishing mortality then remained relatively high through the 1990s. Fishing mortality has been lower since 1999 and was estimated to be 0.25 in 2016. F_{MULT} 90% confidence intervals were 0.18 and 0.36 in 2016.

5.3.2 Spawning Stock Biomass

Spawning stock biomass decreased substantially early in the time series from 63.070 million pounds (28,608 mt) in 1974 to 5.712 million pounds (2,591 mt) in 1998, the lowest in the time

series. SSB has since increased to 18.693 million pounds (8,479 mt) in 2016. Spawning stock biomass 90% confidence intervals were 8.953 and 28.413 million pounds (4,061 and 12,888 mt) in 2016.

Average recruitment from 1971 to 2016 was 1.4 million fish. Recent large year classes have occurred in 1998 (2.93 million), 1999 (3.02 million) and 2005 (2.05 million). A large year class was estimated in 2013 (2.85 million). However, this year class has just started to enter the directed longline fishery in 2016, and so this estimate has higher uncertainty than those earlier year classes.

5.3.3 Quota Overruns

As indicated in Sections 4.1.1 (Path to Developing Initial Management Regime), 5.2.1.2 (Fleet and Effort Consolidation), and 5.2.3 (Achievement (or Harvesting) of Optimum Yield), there have not been significant IFQ quota overruns since the IFQ system became effective. It appears the minor quota overruns that had occurred in the fishery did not have any substantial impacts on the overall status of the stock.

5.3.4 Discards

The IFQ fishery does not generate commercial discards because all fish caught (given the standard hook size/type used by industry) are marketable. Furthermore, the FMP prohibits discarding (i.e., highgrading) when fishing under an IFQ allocation. However, discarding by vessels in the incidental catch category by vessels targeting other species can occur. The goal is to avoid setting the incidental category trip limits too low in the attempt to minimize the amount of golden tilefish discards, and to avoid setting the trip limits too high in the attempt to encourage potential targeting of golden tilefish by the incidental fishery. Limited observer data in the past as well as overall low discarding in the incidental fisheries have prevented inclusion of this source of removals in past stock assessments. Future benchmark assessments will reconsider the use of this source of removals in the stock assessment, with potential improvements in observer coverage rates.

Tilefish discard estimations in commercial fisheries (mostly large/small mesh trawls and gillnets) appear to be low (several mt per gear type) as obtained from the "Discard Estimation, Precision, and Sample Size Analysis" conducted by the NEFSC. For the last five years (2012–2016), on average, 9,393 pounds (4.26 mt) of tilefish discards have been estimated.[36]

5.3.5 Discard Mortality

It is assumed that 100% mortality occurs on golden tilefish due to the barotrauma that results from the depths that golden tilefish occupy. This was the justification for full retention of golden tilefish in the directed fishery, and for the lack of minimum size regulations in the commercial fishery. It is illegal to discard golden tilefish in the directed IFQ fishery.

[36] 2012–2016 Discard Estimation, Precision, and Sample Size Analysis. Available online at: http://www.nefsc.noaa.gov/femad/fsb/SBRM/.

5.4 Social and Community Impacts

Several new and ongoing data collection efforts support social science research on the region's fisheries. The Social Sciences Branch of the NOAA Fisheries NEFSC began developing surveys in order to address gaps in the social and economic performance measures of regional fisheries.

The Social Sciences Branch staff conducted annual commercial vessel cost data collection programs in 2007, 2008, and 2009 (Das 2014a). A survey of vessel owners was conducted again in order to collect annual fishing costs for calendar years 2011 and 2012. This cost information, along with the trip cost data collected by the Northeast Fisheries Observer Program (NEFOP), helps the Social Sciences Branch improve its economic analyses.

Das (2014b) gives an overview of eight years of trip cost data, from 2005 to 2012. She explains the data collection process, types of data collected, and data coverage and quality. An econometric modeling framework for estimation and prediction of costs is also included, allowing estimation of vessel-level aggregate trip cost which, in combination with a vessel's annual cost, can provide an overall fisheries cost assessment. Commercial fishing vessels typically incur two major types of costs: annual costs and trip costs. Annual costs include all those costs which fishing vessel owners bear irrespective of whether they take a fishing trip or not. Trip costs are those costs which are typically incurred during a fishing trip. This document focuses on fishing vessels' trip-related cost data. These operating costs include expenses on items such as fuel, food, bait, ice, fishing supplies, and communication. Fishing business costs include mooring fees, office expenses, permit fees, business travel costs, interest paid on loans, etc.

Performance measures were developed by the Social Sciences Branch staff after an extensive literature review and were refined through communication with industry, policy, and academic stakeholders (Clay et al. 2014). One of the most important goals of the performance measures was to track trends over time and across fisheries in order to provide enhanced analysis of the social and economic impacts of regulations. The Social Sciences Branch staff identified five primary components of fishery performance – (1) financial viability, (2) distributional outcomes, (3) stewardship, (4) governance, and (5) well-being. Indicators of these performance components were developed by using existing data and the development of new data collections (Clay et al. 2014). While the work performed by Clay et al. (2014) used the performance indicators to specifically assess the Sector Program in the Northeast Multispecies FMP, efforts are underway to broaden the use of these social and economic metrics to other fisheries.

Community profiles, social impact assessments, determination of fishing dependence, and assessments of natural disasters are a few of the growing number of areas using secondary data.

The "Survey on the Socioeconomic Aspects of Commercial Fishing Vessel Owners in the New England and Mid-Atlantic," (owner survey) provides an overview of the survey's development, its implementation, and basic statistical summaries of the questions asked (Cutler et al. 2017). The results presented in this technical memorandum provide a baseline for further inquiry and investigation into the attitudes and beliefs among specific subgroups in the general commercial

fishing population at the regional level, namely, vessel owners in the Northeast and Mid-Atlantic. The owner survey provided valuable information for understanding issues related to the management of fisheries in the Northeast and Mid-Atlantic and their impacts on commercial-fishing vessel owners in these regions. The survey indicates that respondents "… largely felt responsible to participate in the management process and reported having participated in the past, but many expressed distrust of management and feeling excluded from or not sufficiently integrated into the process by managing authorities." Vessel owners were split on their level of satisfaction with the amount and predictability of their earnings. Most respondents reported being satisfied with the challenges and adventures that come along with the job and with the opportunity to be their own boss. They also reported being proud to be fishermen and having strong connections to other fishermen (Cutler et al. 2017).

A companion survey of fishing crew, the "Survey on the Socioeconomic Aspects of Commercial Fishing Crew in the Northeast and Mid-Atlantic" (Crew Survey), was implemented approximately one year prior to the owner survey and was documented in a technical memorandum published in September, 2014 (Henry and Olson 2014). The survey provided valuable information for understanding the attitudes, impacts, and issues of concern to commercial fishing crew in the Northeast. The survey indicates that crew members rarely participate in the management process, often feel as though their opinions are irrelevant, and exhibit a high level of mistrust in management. Many crew members indicated that they do not have access to health insurance and that earnings predictability is a concern. Nevertheless, survey participants "exhibit a high level of attachment to fishing as an occupation and satisfaction with the non-economic aspects of fishing as a career" (Henry and Olson 2014).

Vessel activity post-IFQ implementation for entities that did not qualify for Golden Tilefish IFQ allocation but previously had fished for golden tilefish under the limited access system is presented in Section 5.4.4 (Perceived Inequalities).

5.4.1 Reduction of Overcapacity

As discussed in Section 5.2.1 (Reduce Overcapitalization), there have been various reductions in the number of participants (i.e., vessels) in the directed fishery since the management system for golden tilefish was first implemented. The first reduction in the number of participants occurred when the original FMP implemented a limited entry program. The second reduction occurred when the IFQ system was implemented under Amendment 1 to the FMP. As indicated in Section 5.2.1.2 (Fleet and Effort Consolidation), prior to IFQ program implementation there were approximately 31 vessels in the limited access fishery that were eligible to participate in the IFQ system. However, due to inactivity in the fishery during the years chosen for IFQ share allocation (2001–2005 landings activity), only a fraction of those were issued a quota allocation. It is estimated that the number of vessels participating in the directed golden tilefish fishery was 14 during the baseline period (prior to IFQ implementation; Table 6). During the 2010–2015 period (after IFQ implementation), on average, 11 vessels have participated in the fishery (ranging from 9 vessels in 2011 to 11 vessels for most years; Table 6). On average, the number of vessels participating in the directed golden tilefish fishery has been reduced by 21% since the catch share program was implemented.

The purpose of the IFQ management system was to reduce overcapacity and latent fishing effort in the commercial fishery, and to eliminate, to the extent possible, the problems associated with derby-style fishing, in order to assist the Council in achieving OY. In general, the existence of excessive harvesting capacity signals the presence of unwarranted investment, which can affect the profitability of the fleet and as such are economically undesirable. Theory suggests that catch shares appear to lower fishing costs by eliminating redundant capacity. While it is expected that an IFQ program would reduce overcapacity in the fishery, there are factors that can limit the speed of such transformation (see Section 5.2.1, Reduce Overcapitalization).

The fleet consolidation after the IFQ system was implemented appears to indicate that an orderly and slow reduction in the number of vessels participating in the fishery have occurred since the IFQ system was implemented. It is likely that the capacity reduction in the fleet has not had significant adverse social impacts on fishing communities (see Section 5.4, Social and Community Impacts). Additional information on effort consolidation is presented in Section 5.2.1.2 (Fleet and Effort Consolidation).

5.4.2 Elimination of the Derby Fishery

As discussed in Section 5.2.4 (Mitigating the Race to Fish), the limited access system (initiated under the original Tilefish FMP), led to derby-style fishing and early closures in the full-time Tier 2 and part-time fishing categories. The early closures resulted from the competition between vessel operators and the practice of landing as much fish as possible before the annual limit for their respective category was reached. Landings patterns for vessels under the old full-time Tier 2 and part-time fishing categories indicate that, after the IFQ system was implemented, golden tilefish landings have tended to be more evenly spread throughout the year with less monthly variability when compared with the pre-IFQ period. Ex-vessel price for golden tilefish (dollars/pound) are also higher and have tended to show a smaller monthly variation.

In addition, there has been a shift in landings from the November – March period to the April – October period. This indicates that a portion of the landings that occurred during the winter months (e.g., November – March), when severe weather conditions tend to occur, has shifted to the summer period (see Section 5.2.4, Mitigating the Race to Fish). Stakeholders have indicated that, under the limited access system, they had to fish under severe weather conditions during the winter season, a particularly dangerous time especially for smaller-sized vessels.

While it appears that derby-style fishing has subsided and ex-vessel prices have improved under the IFQ system, it is not possible to make a definite statement about the impact of the Golden Tilefish IFQ program on derby-style fishing solely based on the data presented. There may be other important factors that may have affected changes in landings patterns (e.g., dogfish and skate interactions, changes in market demand, weather, etc.). Spreading landings throughout the year and avoiding market gluts may have also played an important role in the observed increase in ex-vessel price and increase in price stability throughout the year that has been observed post-IFQ implementation. Lastly, changes in landings patterns for old full-time Tier 2 and part-time fishing categories vessel indicate that a proportion of the landings that were occurring during the

winter period (November – March; pre-IFQ implementation) have been shifted to other periods (April – October) with less severe fishing conditions.

5.4.3 Share Consolidation

As indicated in Section 5.2.5 (Quota and Allocation Markets), about 35% (635,114 pounds) of the annual issued IFQ allocations have been permanently transferred since the IFQ system became effective. It is estimated that 11% of those shares were transferred to original allocation holders, while the rest (24%) were transferred to new entrants. Most of the allocation shares are still geographically located with stakeholders that fish off New York (Montauk) and New Jersey (Barnegat Light).

5.4.4 Perceived Inequalities

Discussions of fairness and equity are limited because both terms are open to interpretation. What is considered fair and equitable may not be the same between groups or between individual fishermen. Therefore, all documents recommend creating as clear and open a process as possible.

Section 10.5 of Amendment 1 to the Tilefish FMP summarizes the Administrative Procedure Act and the steps taken in the development of Amendment 1 in order to ensure public access to the Federal rulemaking process, and to give the public formal notice and an opportunity to comment before the agency promulgates new regulations. In addition to implementing an IFQ system, Amendment 1 also addressed many other important issues for the fishery. For example, Amendment 1 also updated both the essential fish habitat (EFH) designation and the habitat area of particular concern (HAPC) designation. Amendment 1 also implemented measures to reduce gear impact of EFH (gear restricted canyon areas), recreational fishing measures, and reporting requirements, among others. The development of this amendment provided many opportunities for public review, input, and access to the rulemaking process. Amendment 1 was developed as a result of a multi-stage process lasting over three years that involved review by affected members of the public.

Some comments regarding the IFQ system during the scoping process and public hearings included: 1) IFQ allocation - some individuals were concerned regarding the time period used for IFQ allocation purposes; 2) share accumulation under an IFQ system - some individuals considered important to cap the amount of IFQ shares that a single individual could accumulate; 3) latent effort in the tilefish fishery - some parties suggested that the Council address the issue of latent effort and to evaluate the elimination of latent effort form the fishery.

The Council reviewed all comments provided by stakeholders, the public, and other interested parties when it selected the final suite of preferred alternatives to be included in the final amendment document.

Of the 31 limited access golden tilefish permits, 18 did not qualify for any Golden Tilefish IFQ allocation at the beginning of the IFQ period. Of these 18 permits, 8 had dealer-reported landings of golden tilefish between 2000 and 2009. Of these 8 permits, 5 landed between 0 pounds and

40,000 pounds of golden tilefish from 2000–2009, while 3 permits landed greater than 40,000 pounds of golden tilefish between 2000 and 2009. In the post-IFQ era (2010–2015), 4 of the 8 vessels focused primarily on the scallop fishery; the other 4 vessels were involved in the mixed groundfish and squid fisheries, the pelagic fishery (e.g., tuna and swordfish), or the surfclam/ocean quahog fishery. In addition, 4 of the 8 vessels that did not qualify for Golden Tilefish IFQ and had golden tilefish landings between 2000 and 2009 landed some amount of golden tilefish between 2010 and 2015.

In 2011–2012, the MAFMC conducted a visioning and strategic planning project in order to develop a comprehensive, stakeholder-informed vision for managed fisheries in the mid-Atlantic.[37] Of the participants, 16 completed the golden tilefish visioning survey and provided information on fishery-specific themes.[38] Input on golden tilefish was provided in 36% of commercial meetings and 40% of the recreational meetings. Of the respondents, 63% rated the tilefish stock as good or excellent in the Health category. However, data were insufficient to identify trends in rating tilefish management in the Effectiveness category. Throughout the course of the project's data-gathering phase, the Council received stakeholder input on all 12 of its managed species. Input was received through fishery-specific surveys, as well as through roundtable sessions. This input was compiled into themes for each of the Council's managed species. Fishery-specific themes were developed based on the input that was received. The golden tilefish commercial industry theme and associated observations are presented below.

Commercial Industry Theme. For those who have access to sufficient quota, the Golden Tilefish ITQ system has helped stabilize the fishery. Stakeholders provided the following observations: 1) For those who own sufficient quota in the golden tilefish ITQ system, it has been easier to run a fishing business. Business can work together to plan out trips to minimize effort and maximize/stabilize prices; 2) those that do not own significant quota in the ITQ system, especially those that were early participants in the fishery, are frustrated and feel as though they were pushed out of the fishery; and 3) some fishermen are frustrated that ITQs were set based on arbitrary qualification dates that benefited certain fishing businesses.

As indicated in Section 4.2.1.1 (Allocation Formula for IFQ Program), the MAFMC evaluated 18 alternatives with several different time period of landings (e.g., calendar year 1988 through 1998; 2001–2005; best five years from 1997–2005) and allocation schemes (i.e., allocations to qualifying vessels in each permit category can be based on the percentages associated with landings for each of these time periods, or by distributing the overall quota for each permit category equally among all vessels in each category) for IFQ program development. The preferred alternative selected by the Council for implementing the IFQ allocation system allowed the flexibility for an IFQ system to be established for any combination of limited entry permit categories, time periods, and/or allocation schemes (MAFMC 2009). The Council took into consideration input from all stakeholders that participated in the process to develop the IFQ system, and from fishermen actively engaged in the fishery.

[37] Further information about the MAFMC Visioning and Strategic Planning Project can be found at: http://www.mafmc.org/strategic-plan.

[38] During the Visioning and Strategic Planning project, the Council gathered feedback from more than 1,500 individuals through multiple methods.

5.5 Incidental Fishery

Prior to the implementation of the IFQ system, there were four commercial fishing permit categories in place. The commercial fishing categories during the limited access period were full-time Tier 1, full-time Tier 2, part-time, and incidental permit categories. When the IFQ system was implemented, one single commercial permit requirement replaced all previously-used commercial permit categories. Vessels possessing this "open access commercial/incidental" permit (this category includes all gear types) are allowed to possess or land tilefish in or from the EEZ, north of the Virginia/North Carolina border, up to the incidental trip limit (currently 500 pounds whole weight or 458 head-on and gutted pounds) per trip. In order for any vessel to possess more than the incidental golden tilefish trip limit, the vessel must also fish under the authorization of an IFQ Allocation permit. On average, there were 2,068 vessels with "open access commercial/incidental" permits post-IFQ implementation (2010–2015) compared with 2,334 vessels with incidental permit category permits during the baseline period (Pre-IFQ; 2007–2009).

The incidental fishery is allocated 5% of the quota, and trip limits are used to achieve the incidental target quota. During the baseline period, the incidental quota was set at 99,750 pounds each year and landings, on average, were 71% below the incidental quota established for that time period. During the post-IFQ implementation, the incidental quota was 99,750 pounds for the 2010–2014 period and 87,744 pounds for 2015. Post-IFQ implementation, the incidental landings were on average 58% below the incidental quota established for that time period.[39]

Industry members have indicated that non-IFQ tilefish vessels are targeting golden tilefish and this activity does not qualify as incidental landings. They have argued that this activity goes against the intent of the incidental fishery as presented under the original FMP. This issue was brought to the Council's attention for discussion and, as a result, the Council is proposing to establish landings ratios/qualifiers for the incidental fishery under Framework 2 (currently under review by NMFS; see Section 7.3, Issues to be Addressed Under Framework 2 to the Tilefish FMP). More specifically, the Council is proposing that tilefish-permitted vessels that are not fishing under an IFQ allocation cannot land golden tilefish in excess of 50%, by weight, of their total landings. This measure, if approved, would likely deter incidental permit holders from targeting golden tilefish under the incidental permit regulations.

Since FY 2010, there have been approximately 4,000 fishing trips that have landed one or more pounds of non-IFQ golden tilefish incidentally (Figure 10). Relatively few of those trips landed close to the incidental landing limit of golden tilefish, which was raised from 300 pounds to 500 pounds per trip over the time period (Figure 10).

[39] During the baseline period, the incidental trip limit was 300 pounds whole weight (or 274.8 pounds head-on and gutted pounds; see Table 1) and post-IFQ implementation it has ranged from 300 pounds whole weight (2010–2011) to 500 pounds whole weight (or 458 pounds head-on and gutted pounds; 2012–2015).

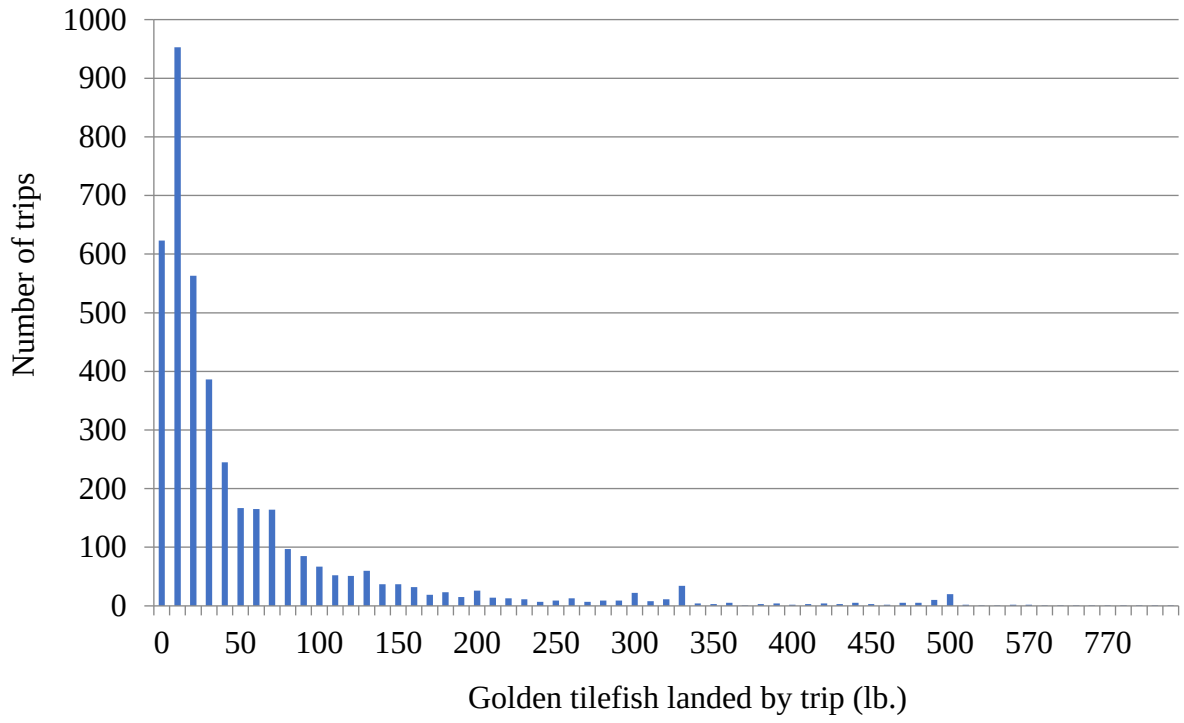


Figure 10. Distribution of golden tilefish incidental landings by trip, FY 2010–2015.

5.6 Recreational Fishery

A small recreational fishery came about during the mid 1970s, with less than 100,000 pounds annually (MAFMC 2001). Subsequent recreational catches were low for the 1982–2015 period, ranging from zero for most years to approximately 30,000 fish (PSE between 77 and 91) in 2010 according to NMFS recreational statistics. In 2016, approximately 8,500 fish (PSE = 106) were caught.[40] Recreational catches appear to be a minor component of total removals and the only management measure for the recreational fishery in the FMP is a recreational bag-limit of eight fish per angler per trip. Framework 2 to the Tilefish FMP would also implement recreational gear requirements (see Section 7.3, Issues to be Addressed Under Framework 2 to the Tilefish FMP).

VTR data indicates that the number of golden tilefish caught by party/charter vessels from Maine through Virginia is low, ranging from 81 fish in 1996 to 7,633 fish in 2015. Mean party/charter effort ranged from less than one fish per angler in 1999 throughout 2002 and 2005 to approximately eight fish per angler in 1998, averaging 2.4 fish for the entire time series (MAFMC 2016).
According to VTR data for the 1996–2015 period, the largest amount of golden tilefish caught by

[40] Source: Recreational Fisheries Statistics Queries: http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/queries/index. PSE (proportional standard error) expresses the standard error of an estimate as a percentage of the estimate and is a measure of precision. A PSE value greater than 50 indicates a very imprecise estimate. 2016 values are preliminary.

party/charter vessels were done so by New Jersey vessels (29,162), followed by New York (9,256), Virginia (663), Delaware (512), Massachusetts (496), Maryland (338), Rhode Island (182), and Connecticut (3). Party/charter boats from New Jersey have shown a significant uptrend in the number of golden tilefish caught during the time series while the boats from Rhode Island have shown a significant downward trend in the number of fish caught (MAFMC 2016).

The number of golden tilefish discarded by recreational anglers is low. According to VTR data, on average, party/charter recreational anglers discarded approximately six fish per year for the 1996–2015 period. The quantity of golden tilefish discarded by party/charter recreational anglers ranged from zero in most years to 64 in 2015 (MAFMC 2016).

Recreational anglers typically fish for golden tilefish when tuna fishing, especially during the summer months (Freeman, pers. comm. 2006). However, some for hire vessels from New Jersey and New York are golden tilefish fishing in the winter months (Caputi pers. comm. 2006). In addition, recreational boats in Virginia are also reported to be fishing for golden tilefish (Pride pers. comm. 2006). However, it is not known with certainty how many boats may be targeting golden tilefish. Nevertheless, accounting for information presented in the FPRs (2012–2014) and a brief Internet search conducted by Council Staff in 2014 indicates approximately 10 head boats have been actively engaged in the tilefish fishery in the Mid-Atlantic canyons in recent years. It is estimated that approximately 4 of these boats conducted direct tilefish fishing trips, while the other 6 boats may have caught tilefish while targeting tuna or swordfish, or fishing for assorted deep water species. In addition, it appears that recreational interest onboard head boats for tilefish has increased in the last few years as seen in the FPRs, Internet search conducted by Council staff, and recent VTR recreational party/charter statistics (MAFMC 2014).

Anglers are highly unlikely to catch golden tilefish while targeting tuna on tuna-fishing trips. However, these boats may fish for golden tilefish at any time during a tuna trip (i.e., when the tuna limit has been reached, on the way out or on the way in from a tuna fishing trip, or at any time when tuna fishing is slow). While fishing for tuna, recreational anglers may trawl using rod and reel (including downriggers), handline, and bandit gear.[41] Rod and reel is the typical gear used in the recreational golden tilefish fishery. Because golden tilefish are found in relatively deep waters, electric reels may be used to facilitate landing (Freeman and Turner 1977).

Current golden tilefish regulations stipulate a recreational possession limit of eight fish per angler per trip. Framework 2 to the Tilefish FMP (currently under review by NMFS; see Section 7.3) would clarify the gear allowed for recreational fishing. More specifically, Framework 2 would restrict the golden tilefish recreational fishery to rod and reel gear only, with a five hook maximum per rod. Rod and reel is the typical gear used in the recreational tilefish fishery (MAFMC 2001). The Council believes that limiting the number of hooks used while fishing with rod and reel gear for golden tilefish to five hooks (per rod) approximates the limit currently used by recreational anglers. The proposed recreational gear requirement under Framework 2 is not

[41] Bandit gear is a vertical hook and line gear with rods attached to the vessel when in use. Manual, electric, or hydraulic reels may be used to retrieve lines.

expected to have any impact on recreational fishing methods and practices and is not expected to result in changes in fishing effort or redistribution in fishing effort.

The golden tilefish recreational sector theme and associated observations derived from the visioning and strategic planning project (see Section 5.4.4, Perceived Inequalities, for additional details) indicated that an expanding effort in recreational fishing is an industry concern.

Recreational Sector Theme. There is concern that an increase in recreational fishing of golden tilefish will deplete the resource. Stakeholders provided the following observations: 1) There has been increased recreational fishing effort towards golden tilefish as the seasons for other key recreational species have shortened, and 2) because tilefish is a slow growth species and the bag limit is relatively high, some recreational anglers are worried that the increased recreational effort will deplete the resource.

Recreational catches are estimated to be low and were not included as a component of the removals in the assessment model. The SSC has noted that the level of recreational catch for golden tilefish is poorly-described, and therefore is currently unaccounted for within the stock assessment. The SSC also has indicated that if the recreational harvest is substantially larger than currently believed, they recommend accounting for this source of removals in the assessment.[42]

5.7 Safety at Sea

Commercial fishing is a dangerous occupation despite decades of regulatory initiatives aimed at making it safer (Pfeiffer et al. 2016). The competitive nature of such fisheries results in risky behavior such as fishing in poor weather, overloading vessels with fishing gear, and neglecting maintenance. In theory, the individual allocation of fishing quota can improve safety by solving many of the problems associated with competitive race to fish activity. Pfeiffer et al. (2016) explored this assumption in an economically important West Coast sablefish fishery by looking at the change in risk-taking behavior of vessel operators after the management shift to catch shares. The authors found a 79% decrease in the annual average rate of fishing in poor weather or high wind days, and accredited this change to economic incentives provided by rights-based management. While interesting, this finding is of limited value for all catch share situations. The golden tilefish fishery operates in a different region with differing weather conditions, vessels, and regulations.

Prior to the onset of IFQ allocations in the golden tilefish fishery, the fishery was managed with three separate permit categories, each with a separate quota. As mentioned, then full-time Tier 1 fishery was never closed due to achievement of total allowable landings from FY 2003–2009 (Table 2). However, for full-time Tier 2 and part-time categories, the fishery was closed in each year of the fishery except the first two (Table 2).

The tilefish IFQ program no longer has tiered categories, which has eliminated the need for mid-year closures due to vessels harvesting their categories total catch limit well before the end of the

[42] Report of the March 2017 SSC Meeting. Available online at: http://www.mafmc.org/ssc/.

fishing year. The IFQ program instead has replaced the derby-style fishing practice that was occurring in the full-time Tier 2 and 3 categories with individual quotas. The IFQ fishery now provides allocation holders more flexibility to plan around potentially hazardous weather since individuals have the entire season to plan their fishing activities.

As indicated in Section 5.2.4 (Mitigating the Race to Fish), full-time Tier 2 and part-time vessels shifted a portion of their landings away from the winter period, distributing them across the year. Though derby-style fishing has subsided and ex-vessel prices have risen, it is not possible to make a definite statement about the impact of the Golden Tilefish IFQ program on safety at sea. Overall, there have been very few documented issues related to safety and enforcement of this IFQ program. However, the level of enforcement presence overall seems to be limited.

In 2010, The National Institute for Occupational Safety and Health (NIOSH) published an in-depth study of commercial fishing fatalities due to traumatic injury that occurred in the United States during 2000–2009. NIOSH recently completed a five-year update (2010–2014) to the previous study in order to identify current hazards among fisheries in four different regions of the country. The East Coast document summarized fatality and vessel disaster data for 19 different known fisheries along the East Coast. The lobster fishery had the highest number of fatalities, followed by the scallop fishery. Vessel disasters are sinkings, capsizings, groundings, fires, or other events that force crews to abandon ship. During the 15-year period 2000–2014, 225 commercial fishing deaths occurred in East Coast fisheries, averaging 15 fatalities annually. In the updated 5-year period, 2010–2014, 60 fatalities occurred (NIOSH 2017).

Commercial fishing fleets have different numbers of vessels, fishermen, and season lengths. Because of these operating differences, we cannot use the number of fatalities in each fleet to compare their risk for fatalities. The tilefish fleet has a small number of vessels and crew, who have the flexibility to choose whether to fish depending on weather or other at-sea conditions.

The number of Coast Guard-reported marine casualty incidents has decreased in the post-IFQ era. During the baseline period (2007–2009) there were, on average, 5 marine casualties[43] per year associated with fishing vessels that participated in the golden tilefish fishery. After the implementation of the IFQ system (2010–2015), there was, on average, 1 marine casualty per year (Bennet pers. comm. 2017). However, this reduction cannot necessarily be tied to the introduction of catch shares.

5.8 Enforcement

The FMAT is not aware of any documented issues related to enforcement of the IFQ program. However, the level of enforcement presence overall seems to be very limited. As such, it is difficult to evaluate the performance of this variable with limited information.

[43] Marine casualties are defined as: allisions, collisions, crewmember injury, damage from rouge wave, fire, flooding, grounding, loss/reduction of vessel propulsion/steering, and struck a submerged object.

5.9 Overall Fishery Discards

The directed golden tilefish fishery is a relatively clean fishery with very small amounts of other species caught in those directed trips. Golden tilefish fish are caught in the target fishery in deep water using bottom longline gear.

As previously indicated, discarding is illegal in the directed golden tilefish fishery (i.e., IFQ fishery). Commercial discards are not generated by the IFQ fishery because all fish caught (given the standard hook size/type use by the industry) are marketable. In addition, even though there is a price differential for various sizes of golden tilefish landed, golden tilefish are landed as caught because the survival rate of discarded fish is very low (Nolan pers. comm. 2006, Kitts et al. 2007). Furthermore, Amendment 1 to the Tilefish FMP prohibited the practice of highgrading (MAFMC 2009). The discards of other species caught in directed golden tilefish trips is also very small. According to VTR data, very little (< 0.3%) discarding of other species was reported by longline vessels that targeted golden tilefish for the 2005–2014 period (MAFMC 2016). The 2014 golden tilefish stock assessment indicates that golden tilefish discards in the trawl and longline fishery are negligible (NEFSC 2014).

As indicated in Section 5.2.1.2 (Fleet and Effort Consolidation), the revenues from other species caught in the directed golden tilefish fishery are small and have declined since the IFQ program was implemented. During the 2011 to 2014 period, the proportion of revenue from species other than golden tilefish ranged from 0.1% to 0.7%, and in 2015, it was 1.0% (Table 6).

5.10 Program Administration

Several other useful sources of data aid in the administration of the Golden Tilefish IFQ Allocation Program. An allocation holder must identify the vessel permit number(s) and time period(s) of any vessel landing golden tilefish against their IFQ allocation for each fishing year. NOAA Fisheries also maintains a database for tracking original and updated IFQ allocation percentages and permanent transfers between and among allocation holders over time.

Two other data sources maintain IFQ administrative records for tracking leases and lease usage for cost recovery and accounting purposes: 1) On lease exchange applications (including allocation lease price information) and 2) on allocation accounting transactions, including IFQ allocation overage adjustments, leases and permanent IFQ allocation transfers.

Permit holders are responsible for ensuring they do not exceed their annual allocation. Should a vessel owner's reported landings exceed his allocation, NMFS will subtract the amount of the overage from the following year's allocation.

5.10.1 Changes to the GTF-IFQ Program

There have been minor corrections, clarifications, and modifications to the regulations implementing the GTF-IFQ program. The purpose of these changes was to make the regulations clearer and easier to understand. The changes to the tilefish regulations made in 2013 included:

- Clarifying the difference between quota share and quota pounds
- Changing regulatory text regarding the Interactive Voice Response (IVR) call-in report
- Extending the annual deadline for IFQ leases
- Updating the regulations governing the cost recovery fee collection system
- Correcting some cross references within the regulations

These changes were administrative changes that clarified measures and allowed the IFQ program to operate more efficiently with little to no effect on fishing activities. Specific changes to the regulations are available at: https://www.greateratlantic.fisheries.noaa.gov/nr/2013/August/13tilefishamendcorfrphl.pdf.

In addition, in 2013–2014, a new marketing code (medium/large) was added to the market categories in the existing database to accommodate a newly-developed size range of fish sold/marketed by the industry. See Section 5.2.6 for additional details (Market Stability).

Lastly, Tilefish Framework 2 to the FMP would modify the incidental possession limit, clarify allowed gear for recreational fishing, and make several improvements to the tilefish IFQ program. See Section 7.3, Issues to be Addressed Under Framework 2 to the Tilefish FMP, for additional details.

5.10.2 Data Collection and Reporting Issues

When the golden tilefish IFQ fishery was implemented, the date used to monitor landings in this fishery was changed from the dealer-reported date of sale to the vessel-reported landing date of a trip. The change was designed to accommodate the allocation-based monitoring program that was to be implemented in the new IFQ fishery. The change in monitoring date alleviated the burden on vessels to land well prior to the end of a particular monitoring period in an attempt to allow for all sales and transfers of golden tilefish to take place in the target monitoring period (e.g., landing on 10/29 to ensure that all sales would be final before 10/31 after shipping, etc.). This change transferred reporting of the monitoring date from fish dealer to fishing vessel. The change did necessitate the integration of two separate sources of reporting, vessel trip reports and dealer electronic reports, to derive both an amount of golden tilefish landed as reported by dealers and the exact landing date, as reported by vessels via a VTR.

Seven market categories exist in the dealer electronic reports database. From smallest to largest these categories are: extra small, small, kittens, medium or select, large-medium (not mixed), large and extra-large as well as an unclassified category and a ‘mixed or unsized’ category. Differences in the naming convention and classification among ports can cause some confusion. For example, small and kitten categories reflect similar size fish. Small is the naming convention used in New Jersey whereas the kitten market category is used primarily in New York ports. As mentioned in 5.10.1, a new code was recently developed for the large-medium (not mixed) category in 2013 and 2014. In 2014, it appears that fish which would have been called unclassified in the past are now being correctly coded as large-mediums.

Cost recovery in the golden tilefish IFQ fishery requires that costs be recovered for each pound of IFQ golden tilefish landed based upon the reported value of those landed fish. Thus, accurate reporting of price information by market and grade of fish for every transaction is very important in this fishery. If price information as reported by fish dealers is inaccurate, recovery of costs for managing this IFQ fishery from a particular IFQ allocation holder may be affected.

Currently, costs are recovered in the golden tilefish IFQ fishery on a calendar year basis, while the IFQ monitoring, IFQ leasing year, and incidental landings monitoring correspond to the golden tilefish fishing year, November 1 – October 31. Among the many potential drawbacks to this lack of synchrony is that the cost recovery year straddles two fishing years, and vice versa. Unused IFQ leases expire during a cost recovery year, not at the end of a monitoring period. Costs then need to be recovered from two separate IFQ leasing years. To potentially streamline IFQ monitoring, cost recovery, and incidental landings monitoring, a single period for all programs could be considered. Moving all programs to the calendar year is suggested as this would also bring monitoring into temporal line with the stock assessment schedule.

6.0 Research Needs

6.1 Biological Needs

A fishery-independent index of abundance does not exist for golden tilefish. A commercial CPUE index is used as the sole index of abundance in the stock assessment model. As with most commercial CPUE indices of abundance, questions and uncertainty remains with effort standardization, stock coverage changes over time, and possible hyperstability that can occur with fishery-dependent data. The assumed dome-shaped selectivity in both the index of abundance and the commercial fishery adds to the uncertainty in the assessment model. In addition, relying on commercial selectivity provides limited information on recruiting year classes (pre-recruits) into the fishery. This results in high uncertainty within projections since there is no information to estimates year class strengths in the population near the terminal year of the model that are not yet selected to the fishery.

A pilot tilefish longline survey is being conducted in the summer of 2017 to inform tilefish stock abundance and distribution, hook gear selectivity, and the appropriate design of a tilefish longline survey using an industry-based platform in the future. Information from the pilot longline survey could be used to help design and initiate an industry-based survey designed similarly to a fishery-independent survey to collect more intensive size and catch information on a haul-by-haul basis using two or three designated fishing trips per year. The pilot survey will also provide information on reductions in catch rates that will likely occur on these survey trips relative to normal fishing operation. The benefits of a survey design to the stock assessment will likely surpass a more intensive and burdensome haul by haul data collection on trips during normal fishing operation. A well-designed industry-based survey could also provide information on recruitment for the assessment model and projections with the use of smaller hooks relative to what is used in the commercial fishery. The use of larger hooks in the survey relative to the sizes used by the fishery may also inform the dome-shaped selectivity pattern used in the assessment

model. An appropriately designed survey is essential to address the major data limitations within the present stock assessment, including questions with regards to hyperstability that are associated with commercial CPUE indices.

An additional important research need is to determine what factors are contributing to the large variability in recruitment and the apparent cyclical pattern in recruitment. For example, determining if year class strength is related to a particular environmental factor could help with forecasts, which could result in better management through the setting of more accurate ABCs and OFLs.

6.2 Economic Needs

The predominant research need in economics continues to be the need for cost data in order to examine both net revenue and profit. Commercial fishing vessels typically incur two major types of costs: trip costs and annual costs. Trip costs are those costs which are typically incurred during a fishing trip and are collected as part of the NEFOP data collection effort by observers. Given that the level of observer coverage is low on tilefish vessels, it would be beneficial to increase that coverage to enable collection of fishing trip costs. A fixed cost survey of 1,700 Northeast vessel owners was implemented in August 2012, but almost no tilefish vessels participated.

Das (2014b) gives an overview of the latest eight years of trip cost data, from 2005–2012. It explains the data collection process, types of data collected, and data coverage and quality. It also covers the extent of coverage in major fisheries and gear types. An increase in the quantity of observed longline vessel trips would be helpful, even if not on a tilefish-directed trip. Annual costs include all those costs which fishing vessel owners bear, irrespective of whether they take a fishing trip or not. To get an idea of this second type of costs, the Social Sciences Branch of the NEFSC completed a survey of vessel owners about their annual fishing costs for calendar year 2011 and 2012. Again, the longline fleet was poorly represented but an overview is presented in a different publication (Das 2014b).

6.3 Social and Community Needs

We stated previously that the perception of social consequences of a new program is important. A survey of crew members and vessel owners who were omitted from the IFQ fishery would be helpful to gauge the level of stress and impact the decisions of management had on them and their families.

6.4 Enforcement and Safety Needs

No enforcement or safety needs were identified.

7.0 Recommended Program Changes

The FMAT made specific recommendations for administrative charges for the Council to consider that may facilitate and improve the accounting process in the IFQ system. These specific recommendations have not been reviewed by enforcement personnel and their implementation could create additional administrative burdens.

7.1 Cost Recovery

The first issue identified by the FMAT relates to the administration of the cost recovery program. Under the current cost recovery system, the initial allocation holder is responsible for recoverable costs associated with the program. Allocations that are leased and landed must be traceable back to the initial allocation holder. Therefore, subleasing is prohibited due to the difficulty in tracking landings of leased pounds. Also, if a vessel exceeds the allocation leased, the lessor is responsible for the incurred overage if the lessee has no base allocation (i.e., quota share).

One option for increased flexibility in the Golden Tilefish IFQ fishery would be to recover costs of the administration of the fishery from the allocation that lands the golden tilefish. By doing so, the need to track landings of leased pounds back to the lessor allocation would be unnecessary. This change would potentially increase efficiency in the IFQ fishery because it allows for the possibility of sub-leasing of IFQ allocation (allocation could be transferred multiple times without the need to track golden tilefish landings at each transfer). However, a downside to this alternative is that there may be less incentive to pay if there is no quota share, which could result in full costs not being recovered.

7.2 Fishing Year

The second issue relates to the golden tilefish fishing year. The golden tilefish fishing year, under which IFQ allocation usage is monitored, extends from November 1– October 31 of the following year. However, costs are recovered in the Golden Tilefish IFQ fishery on a calendar-year basis. This discrepancy has, at times, caused some difficulties in the administration of the cost recovery program, as the cost recovery year traverses two fishing years, and vice versa. To ease the administration of the cost recovery in the Golden Tilefish IFQ fishery, unifying the allocation usage monitoring and the cost recovery time periods to a single 12-month period should be considered. The calendar year is strongly recommended as this is also the time period upon which stock assessments are based. Changing the golden tilefish fishing year could potentially decrease administrative costs recovered from the industry. However, changing the fishing year may have additional implications to the workload for GARFO and the Council.

7.3 Issues to be Addressed Under Framework 2 to the Tilefish FMP

Tilefish Framework 2 to the FMP would modify the incidental possession limit, clarify allowed gear for recreational fishing, and make several improvements to the tilefish IFQ program. The

proposed management measures that would improve the tilefish IFQ program include eliminating the IVR requirements, prohibiting vessels from fishing more than one IFQ allocation at a time, and requiring golden tilefish to be landed with the head attached.

The IVR requirements were first implemented when the FMP was initiated in 2001 as a way to track quota landings in the fishery in a timely fashion. However, with the implementation of electronic dealer reporting in 2004, and with improved VTR reporting processing by the agency, the information provided by vessel operators using the IVR system has become redundant. Currently, GARFO uses landings reported in the dealer system as the primary tool to track landings in the fishery. Eliminating the IVR requirements is not expected to have any impact on fishing methods and practices and is not expected to result in changes in fishing effort or redistribution in fishing effort of the IFQ fishery. While eliminating the IVR requirements is a purely administrative issue, it is likely that neutral-to-slightly positive economic and social impacts would be obtained from not reporting landings via the IVR system, as this reporting system currently requires some time and effort on the part of vessel operators, and is deemed no longer necessary.

Framework 2 would also prohibit vessels from fishing more than one allocation at a time. Golden tilefish IFQ holders designate vessels to land their IFQ. Under our current monitoring system, a vessel is authorized to land for a specific time period, not for a specific number of pounds. During the period a vessel is authorized to harvest, all of its tilefish landings are counted against the allocation. The system is not designed to allow a trip to be split between multiple IFQ allocation numbers. A vessel can change which allocation it harvests for, but that harvesting must be on distinct dates, i.e., different allocation harvesting cannot overlap in time.[44] Prohibiting this practice would still leave the industry with alternatives for how to harvest remaining IFQ. One IFQ holder could lease pounds to another or the vessel owner/operator could fish under his/her own allocation number and lease in pounds from multiple allocation holders. GARFO has indicated that since the IFQ system was implemented (6 years ago), its staff has only encountered one case in which a vessel was performing harvesting services for two allocation holders, each of which had small amounts of golden tilefish pounds remaining at the end of the fishing year. In that case, when the vessel landed the harvested golden tilefish, there was no mechanism available to the vessel or dealer to correctly allocate fish landed to the specific allocation numbers used by the vessel performing the harvesting services. In that case, GARFO staff had to manually track landings and talk with the vessel captain/allocation holders in order to apportion golden tilefish landings to their respective allocation numbers.[45,46] Industry

[44] This potential development was not foreseen when the regulations for the IFQ program were drafted, and it has not been an issue until recently. The practice has arisen from IFQ holders trying to find new opportunities to use the last of their quota. The changes that would be needed to the reporting systems to allow this practice would increase the reporting burden on vessels and dealers, with a corresponding increase in recoverable costs.

[45] It is important to note that this deficiency could be corrected, if the NMFS were to create a reporting mechanism to facilitate vessels and dealers to report specific IFQ allocation numbers and associated pounds landed for each fishing trip. However, this would create additional reporting burden for all vessels and dealers and the cost of IFQ-specific reporting would likely be recoverable, and therefore billed to the industry.

[46] Current golden tilefish accountability measures (50 CFR §648.293(a)) state that if the ACL is exceeded, the amount of the ACL overage that cannot be directly attributed to IFQ allocation holders having exceeded their IFQ

members have indicated that the implementation of this action would not affect their fishing practices and thus would not create efficiency issues or affect the IFQ leasing system. The proposed action is purely administrative; therefore, it would not alter the catch and landings limits for this species or the allocation of the resource among user groups; no direct impact on fishing effort or effort distribution in the golden tilefish fishery would be anticipated.

Lastly, Framework 2 would also make an administrative change that would require vessels to land golden tilefish with the head attached. In spring 2014, the Analysis and Program Support Division (APSD) and the NEFSC removed the "head-off" category from the dealer-reporting software in order to avoid dealers mistakenly reporting head-on fish as head-off (golden tilefish are landed with the head-on). The rationale for this action would be to close the loop on the change already made to dealer reporting, as well as to help GARFO change to specifying the annual IFQ allocations and the incidental landing limit as landed weight, rather than as whole weight. As a result, monitoring IFQ and incidental limits would be easier and more logical for industry and enforcement. This administrative change is not expected to have any impact on fishing methods and practices, and is not expected to result in changes in fishing effort or redistribution in fishing effort of the IFQ fishery.

NMFS is currently reviewing the framework environmental assessment document and preparing a proposed rule. However, because of anticipated delays related to the upcoming change in administration, a proposed rule may not publish until mid-2017.

7.4 Industry Concerns

Industry members have indicated support for a provision that would allow unused IFQ to be carried over to the next fishing year. The FMAT discussed this issue and recommended that such administrative change not be implemented because, under the catch and landings limits and accountability measures, the ABC equals the ACL and, as such, there are implications for overfishing the following year.

Stakeholders have reported that some vessels fishing under the IFQ system (small allocation entities) may be performing highgrading on their catch to select and land fish that are more valuable. MAFMC and NEFSC staff used dealer data in a preliminary evaluation of golden tilefish landings' market category for IFQ vessels, and did not observe any significant differences in the patterns of landings by fish size (market size category) among vessels.

Industry members have indicated that it is difficult for them to plan for cost recovery expenses due to variability of recoverable costs from year to year. In the golden tilefish fishery, recoverable bills are calculated at the end of the year based on actual revenues and on administrative costs rather than on the projected revenues and administrative costs. In response to industry concerns, GARFO notifies the Council of anticipated costs as early as possible.

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allocation will be deducted from the ACL in the following fishing year. All overages directly attributable to IFQ allocation holders will be deducted from the appropriate IFQ allocation(s) in the subsequent fishing year, as required by 50 CFR §648.294(f).

Industry members have raised concerns about the increase in recreational landings in the golden tilefish fishery. They have indicated that as recreational effort increases this may affect resource availability, which could potentially impact IFQ allocations. The SSC and the Tilefish Monitoring Committee are monitoring recreational efforts in the fishery. The SSC indicated that if the recreational harvest is substantially larger than currently believed, it would recommend that efforts should be made to directly account for this source of removals in the assessment.

8.0 Summary and Conclusions of This Review

This report was developed to provide the first comprehensive review of the GTF-IFQ Program as required under the FMP. The purpose of this review is to assess the progress of the IFQ program in meeting its goals, and to propose any necessary modifications to the program in order to better achieve these goals. The primary goals of the program were to: 1) Reduce overcapacity and latent fishing effort; 2) to eliminate, to the extent possible, the problems associated with derby-style fishing (e.g., reduce discards and waste for permit categories experiencing early closures, safety at sea, market gluts, improve price at the dock, etc.). The following discussion summarizes the principal conclusions of this review and recommendations identified by the FMAT during this review.

8.1 Participant Consolidation and Overcapacity

Overcapacity exists when a vessel/fleet's harvesting capacity exceeds a management target. In other word, overcapacity is the difference between capacity and the desired output level (e.g., quota). In the golden tilefish fishery, overcapacity resulted in derby-style fishing conditions, shorter seasons for some fishing categories (i.e., early closures), market gluts, and low ex-vessel prices. Since the implementation of the IFQ program, the number of active vessels participating in the fishery has decreased by 25%. Nevertheless, the number of allocations holders have remained relatively stable. The number of dealers remained steady since the transition of catch shares.

Finding #1: The GTF-IFQ program has resulted in a moderate reduction of overcapacity.

8.2 Mitigating the Race to Fish

Prior to the implementation of the GTF-IFQ program, the average season length was 310 days (base line period). Derby-style-fishing led to early closures in the old full-time Tier 2 and part-time categories. As a result, the average season length for those permit categories was substantially shorter. Overall, derby fishing caused market gluts, decrease in ex-vessel price, and inefficient harvesting practices. With the implementation of the IFQ system, fishermen had the opportunity to better plan when to fish, how much to fish, and when to land the fish harvested in order to maximize ex-vessel price (by avoiding market gluts and spreading landings throughout the year). The added flexibility under the IFQ system resulted in a year-round fishing season.

While it appears that derby-style fishing has subsided and ex-vessel prices have improved under the IFQ system, it is not possible to make a definite statement about the impact of the Golden

Tilefish IFQ program on derby-style fishing solely based on the data presented. There may be other important factors that may have affected changes in landings patterns (e.g., dogfish and skate interactions, changes in market demand, weather, etc.).

Average ex-vessel price (dollars/pound) also increased post-IFQ with smaller variability from month to month when compared with the pre-IFQ period. Overall ex-vessel prices (inflation-adjusted) increased by 39% from the baseline period to 2015. In addition, there was a slight upward trend in the average price of temporary lease of IFQ allocations. Fishermen have reported that increased marketing efforts and product availability has allowed them to maximize profits. Due to the limited number of lease transactions and other associated data limitations, meaningful statements regarding price ratios trends (lease price to quota share price, quota price to tilefish price) in the IFQ fishery are not possible.

Landings patterns for vessel in fishing categories that had experience early closures pre-IFQ implementation (old full-time Tier 2 and part-time categories) show a shift in landings away from the winter period after the IFQ system was implemented. Prior to IFQ implementation, derby fishing was exacerbated due to the November 1 start of the fishing season, which in some instances forced smaller-sized vessels to go to sea during unsafe weather conditions in order to compete for a share of the quota. The number of Coast Guard-reported marine casualty incidents (e.g., collisions, allisions, mechanical difficulties, crewmember injury, fire, flooding, etc.) appears to have decreased in the post-IFQ era. However, this reduction cannot necessarily be tied to the introduction of catch shares.

Finding #2: The GTF-IFQ program was successful in mitigating the race to fish. The program has allowed fishermen to land golden tilefish year-round.

The results of this IFQ program review indicate that the tilefish IFQ program has largely meet the initial program goals of reducing overcapacity and ending the race to fish. Prior to the implementation of the IFQ program, the golden tilefish fishery was managed under a constant harvest quota strategy that led to the successful rebuilding of the stock in 2012. The results of this report show that fleet-wide economic trends have been positive since the implementation of the IFQ program. As a result, major modifications to the program are not needed, although minor improvements to the program are possible.

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