

U.S. Catch Share Markets: A Review of Characteristics and Data Availability

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U.S. Department of Commerce

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List of Acronyms

ABC — Allowable Biological Catch
ACL — Annual Catch Limits
AFA — American Fisheries Act
ACE — Annual Catch Entitlement
BSAI — Bering Sea Aleutian Islands
CDQ — Community Development Quota
CP — Catcher-Processors
CPO — Catcher-processor Owner Shares
CPC — Catcher-processor Crew Shares
CQ — Cooperative Quota
CV —Catcher Vessel
CVC — Catcher Vessel Crew Shares
CVO — Catcher Vessel Owner Shares
DAS — Days at Sea
EDC — Economic Data Collection Program
EDR — Economic Data Report
EEZ — Exclusive Economic Zone
FMP —Fishery Management Plan
GC — General Category (scallops)
GOM —Gulf of Mexico
GT— Grouper-tilefish
IPA — Incentive Plan Agreements
IPQ — Individual Processor Quota
IFQ — Individual Fishing Quota
IPHC — International Pacific Halibut Commission
ITQ — Individual Transferable Quota
LAPPs — Limited Access Privilege Programs
LLP — License Limitation Program
MSA — Magnuson-Stevens Fishery Management and Conservation Act
NEFMC — New England Fishery Management Council
NMFS —National Marine Fisheries Service (or NOAA Fisheries)
NPFMC — North Pacific Fishery Management Council
PQS — Processor Quota Share
PSC — Prohibited Species Catch (Alaska, Pacific); Potential Sector Contributions (New England)
QP — Quota Pound(s)
QS — Quota Share(s)
SP — Sector Program
TAC — Total Allowable Catch

Abstract

A growing number of U.S. fisheries are managed with catch share systems, which allocate exclusive shares of the total allowable catch from a fish stock to individuals, cooperatives, communities, or other entities. All of these catch share programs allow transferability of catch privileges in some form. Information on these transfers, particularly prices, can be valuable to fishery managers and to fishery participants and other stakeholders. We document the availability and quality of data on transfers of catch privileges in fourteen U.S. catch share programs, including programs in every U.S. region except the Pacific Islands. The catch share programs reviewed include several individual fishing quota (IFQ) programs as well as a number of programs that allocate catch privileges to self-organized cooperatives. We provide a short synopsis of each catch share program and quota market including a short description of the fishery, the management system, and the rules for transferring quota share(QS) and quota pounds (QP). Each synopsis also includes a description of the information collected on QS and QP transfers and an evaluation of the availability and quality of QS and QP price information and other useful information that can be derived from transfer data. We do not attempt to evaluate the efficiency of any of the catch share markets, nor provide in-depth analysis of market data, but we do provide some evaluation of the potential to use catch share market data to provide useful information to stakeholders and managers. We make recommendations on how to improve the design of catch share systems and associated data collection systems to facilitate effective catch share markets, collection of catch share market data, and better use of information from catch share markets.

I. Introduction

A growing number of fisheries worldwide are managed with catch share systems, which allocate exclusive shares of the allowable catch from a fish stock to individuals, cooperatives, communities, or other entities. The term catch share includes individual fishing quotas (IFQs), but is broader, encompassing individual or group control of catch privileges. Catch shares may also provide exclusive privileges to fish in an area, a territorial use right (TURF), but we do not review any TURF systems in this study. Catch share systems around the world have been found to be effective both at improving profitability of fisheries and maintaining and rebuilding fish stocks (OECD 1997; Costello, Gaines and Lynham 2008). Catch share systems based on cooperatives have been used for centuries, perhaps most notably in Japan, which continues to use cooperatives as the primary means of managing near shore fisheries (Ruddle, Hviding and Johannes 1992, Yamamoto 1995). In these systems a defined group of individuals or vessels is allocated a joint catch privilege which they harvest according to an agreed set of rules or internally agreed sub-allocations. Several U.S. catch share systems are based on cooperatives. Catch shares allocated to individuals or companies, e.g., Individual fishing quotas (IFQs), are a more recent innovation, first suggested by Francis Christy (1973). Both New Zealand and Iceland implemented comprehensive IFQ systems for their fisheries in the mid-1980s. Other countries, including the U.S., followed suit, though generally only for specific fisheries as opposed to a comprehensive national catch share system. Bonzon et al. (2010) estimate that by 2010 there were 275 catch share systems in 35 countries. Arnason (2012) estimates that one-quarter of the world's marine fish are caught under catch shares.

Most catch share systems, including those based on cooperatives, allow transfers of shares between individuals. This allows catch shares to be transferred (voluntarily) to operations that can generate more profit from catch (by increasing value or reducing costs). Catch shares often enable some

consolidation of fishing operations, which can reduce overall costs when excess capacity existed prior to implementation of the catch share system. Typically, both short term transfers and permanent transfers of the catch share are allowed. However, for cooperatives, permanent transfers generally require selling all of the catch privileges associated with a permit or vessel. In some catch share systems, short term transfers of catch privileges are done by leasing of the long term catch privilege (e.g., leasing quota shares), but most U.S. catch share programs create an annual form of the catch privilege denominated in pounds that can only be used during a particular fishing year. These annual catch privileges are referred to in different programs as “quota pounds”, “quota allocation”, “IFQ”, or “annual catch entitlements.” In the synopses on specific catch share programs, we use the specific terms used for the quota instruments in that fishery (see Appendix 1 for a list of these terms). However, in the introduction, conclusions, and recommendations we use the term quota pounds (QP) as a generic term to refer to the annual form of quota in a catch share system and quota shares (QS) as a generic term to refer to the long-term catch privileges generally denominated as shares of the total allowable catch (TAC) for a species, area, and/or fishery sector.

The primary purpose of this study is to facilitate future analysis of QS and QP markets in U.S. catch share programs by creating a comprehensive description of the structure and characteristics of U.S. catch share markets. We document the availability and quality of data on QS and QP transfers in fourteen U.S. catch share programs, including programs in every region except the Pacific Islands¹. We do not attempt to evaluate the efficiency of any of the catch share markets, nor provide in-depth analysis of market data, but we do provide some evaluation of the potential to use catch share market data to provide useful information to stakeholders and managers. We also make recommendations on how to improve the design of catch share programs and associated data collection systems to facilitate

¹ The Cap Log Group LLC (2012) produced a report in 2012 that reviewed the design and function of quota markets in seven U.S. federal catch share systems. We do not draw from that report directly, and we review additional programs that Cap Log did not review. However, there is significant overlap in these reports and Cap Log provides some additional useful information on market mechanics that we do not provide here.

effective catch share markets, collection of catch share market data, and better use of information from catch share markets.

The remainder of the report is organized as follows. Section II describes the information collected for each catch share market. Section III describes the role quota markets play in catch share systems and the potential value of information that can be derived from quota markets. Section IV provides a synopsis of each of the catch share programs and markets evaluated. The synopses include a description of each program and the management system, a description of the catch share privilege, and a description of the catch share market including an assessment of data availability and quality and how data are used. Section V summarizes findings from the study. Section VI makes recommendations on how to improve collection and use of catch share market data. Detailed descriptions of each catch share market are available in an online appendix (URL to be added at later time).

II. Description of study

This study describes and catalogs markets for catch privileges in fourteen federally managed U.S. fisheries with catch share programs in place as of 2012 (Table 1). Our discussion excludes the Western Alaska Community Development Quota (CDQ) program which provides catch allocations for a number of different fisheries to six groups representing Western Alaskan communities, and the Alaska Freezer Longline Conservation Cooperative which is a self-organized voluntary cooperative with internal allocations managed by private contract. The catch share programs reviewed include several IFQ programs as well as a number of programs that allocate catch privileges to self-organized cooperatives.

Table 1: Catch Share Systems in Federally Managed U.S. Fisheries

Region	Fishery	Year Implemented	Type of Catch Share
North Pacific	Western Alaska Community Development Quota	1992	CDQ
	North Pacific Halibut & Sablefish	1995	IFQ
	Bering Sea American Fisheries Act (AFA) Pollock	1999	Co-op
	BSAI King & Tanner Crab	2005	IFQ-IPQ/Co-op
	BSAI Non-pollock Groundfish Trawl CP (Amendment 80)	2008	Co-op
	Freezer Longline Conservation Cooperative	2010	Co-op
	Central Gulf of Alaska Rockfish	2012	Co-op
Pacific	Pacific Coast Fixed Gear Sablefish	2001	IFQ
	Pacific Coast Groundfish Trawl	2011	IFQ/Co-op
Gulf of Mexico	Gulf of Mexico Red Snapper	2007	IFQ
	Gulf of Mexico Grouper and Tilefish	2010	IFQ
South Atlantic	South Atlantic Wreckfish	1992	IFQ
Mid-Atlantic	Surfclam & Ocean Quahog	1990	IFQ
	Mid Atlantic Golden Tilefish	2009	IFQ
New England	Northeast Multispecies Groundfish	2010	Co-op (Sector)
	General Category Atlantic Scallops	2010	IFQ

For each program, where information is available, we document the following:

- species managed under the program;
- key characteristics of the management system and the nature of the catch privilege including duration and constraints on ownership, transfer and use;
- information that is being collected on catch share transfers, the quality of that information (e.g., completeness, accuracy and reliability), and the availability of the information;
- whether the data collected are sufficient to provide useful QS and/or QP prices for some or all species (i.e., prices that are believable and appear representative);

- key characteristics of the markets and data including the volume and prevalence of different types of transfers (e.g., internal company trading, quota swaps and barter, cash sales, etc.);
- future plans and expectations for data collection (e.g., efforts to improve or revamp the data collection systems or fix problems and trends in coverage and quality of data);
- how information on catch share transfers is being used presently or may be in the future;
- impediments to collecting catch share market data for the fishery and how those impediments can be reduced or eliminated;
- aspects of catch share program design that facilitate or hinder effective, efficient, and transparent catch share markets.

III. The Role of Quota Markets and Quota Prices

In addition to improving economic efficiency in the fishery, QS and QP transfers can reveal valuable information to fishery managers and stakeholders. Theoretically, QP and QS prices should provide an indication of profitability of the fishery and expectations of future profitability (Newell, Papps and Sanchirico 2007). Prices of QP should provide a measure of the marginal change in profit that can be generated from an additional pound of quota in the current year. In a single species fishery, we would expect this to equal the profit that could be generated with an additional pound of catch. In a multispecies fishery, the value of QP may be more complex since an additional pound of quota for one species may allow more catch of other species for which QP is not limiting (Anderson, 1989; Holland 2013). QS and QP prices can convey useful information about the economic effects of commercial-recreational allocation and reallocation decisions by providing an estimate of the marginal value of quota allocation to the commercial fishery (Agar and Carter, 2014). QS and QP prices may also be an important source of information for five-year reviews required by the Magnuson-Stevens Fishery Management and Conservation Act (MSA) for most catch share programs (Agar et al. 2014). They can provide indications of whether profitability (and future expectations of profits) has changed over the prior five years. Shifts of QS and QP ownership between regions, vessel classes or gears may reveal differences in relative profitability.

In well-behaved markets, prices for QS should be equal to the capitalized value of the catch privilege— i.e., the net present value of the stream of future profits that can be generated with the catch privilege. Since QS are generally for a share of the TAC, which may rise or fall in the future, the value of QS theoretically reflects expectations about future changes in the fish stock and TAC, expected changes in prices or costs that may affect profitability, and the discount rate applied to future profits (Asche

2001). As Newell, Papps, and Sanchirico (2007) point out, analysis of the relationship between QP and QS prices can reveal expectations of market participants about changes in future TACs and the financial risk associated with holding QS if the two can be disentangled.

QP and QS prices are important criteria for decisions to enter or exit a fishery, or to expand or contract individual fishing activity (Squires et al. 1998; Weninger and Just 2002; Newell, Papps, and Sanchirico 2007; Nostbakken, Thebaud, and Sorenson 2011). Prices of QP and QS may also provide signals to policymakers about the economic and biological health of a fishery. For example, Arnason (1990) showed that, under the assumption of a perfectly competitive market, monitoring the effect of changing the TAC on QS price could be used to determine the economically optimal TAC (*i.e.*, the TAC that generates the highest expected net present value of future profits from the fishery). Bastone and Sharp (2003) provide empirical support for Arnason's proposition in their study of the New Zealand snapper fishery.

Catch share markets and prices may also play an important role in ensuring economically efficient and sustainable utilization of the resource, particularly in multispecies fisheries (Sanchirico et al. 2006). If the quota market is efficient, then for species that are constraining harvest of other jointly caught species, QP prices would be expected to increase, reducing the profitability of catching that species and potentially creating a penalty for doing so. This should encourage fishers to change targeting behavior to reduce relative catch rates of fish stocks for which TACs are relatively more constraining and thereby allow fuller utilization of TACs of species that are more abundant. QP prices in cases such as this may provide fishery managers with an indication of relative changes in stock abundance of the species involved. For example, if the abundance of an incidentally caught species has actually increased, but its assessment has not been updated, and the TAC has not been increased, the price of QP for the incidentally caught species may rise because it has become harder and more costly to avoid and the

total QP available has become more constraining.² QP prices would then be expected to rise as demand increases for a fixed supply. QP prices near or above ex-vessel prices may create incentives for illegal discarding and provide a signal to managers that they may need to increase or target compliance efforts on trips likely to encounter these species. Of course, the utility of information from quota markets in incentivizing efficient behavior or informing management depends on whether prices reflect the true marginal value of QP. This may not always be the case in a complex multispecies fishery so it is important to evaluate whether the QP market is operating efficiently (Holland 2013).

QS and QP prices can be useful to quantify how the design of the catch share system impacts the economic value of the fishery. Most catch share programs include some restrictions on use and transferability of catch privileges that are designed to address social and distributional objectives. Examples include limits on the percentage of quota an individual entity can own or use during a year, requirements for the quota owner to operate the vessel that uses the quota, and restrictions or prohibitions on transfer between sectors (e.g., at-sea vs. shore-based sectors, or gear related sectors). While these restrictions may achieve important social objectives, they can also limit economic efficiency gains from trading, and it is important to understand the potential trade-offs between economic efficiency and other objectives. The magnitude of any decrease in efficiency may be difficult to quantify without detailed information about the profitability of different sectors or economies of scale. In some cases, when restrictions on quota ownership or use differ across sectors or over time, evaluation of quota prices can enable quantification of these costs (e.g., Sanchirico, Kroetz and Lew 2011).

Prices of QP and QS are not the only useful information that can be gained from analysis of QP and QS transfers. Transfers of QP and QS may reveal geographic and sectoral shifts of catch share ownership and fishery participation that are important to fishery managers and stakeholders. These can

² A change in QP price by itself is unlikely to be an accurate measure of the change in relative abundance of jointly caught species since it could be caused by other factors such as a change in the spatial distributions of constraining and target species on the fishing grounds. Nevertheless, it may provide a signal that TACs have not kept up with changes in abundance.

be particularly important in evaluating and minimizing adverse economic impacts on, as well as providing for the sustained participation of, fishing communities as mandated by National Standard 8 of the MSA, and potentially for evaluating optimal yield under National Standard 1 of the MSA. Information on transfers may also be used to construct social networks that reveal how the market is structured and how thick the market is, which may be helpful in identifying impediments to market efficiency.

To make the best use of the information contained in quota prices, and to ensure that the structure of catch share programs facilitates effective quota markets, requires a better understanding of how quota markets operate and how they are affected by the structure of the catch share program. Although IFQs have been used to manage fisheries in New Zealand, Iceland, Canada and Europe for decades, there has been relatively little study of catch share markets and these studies find mixed results regarding the efficiency of quota markets and consequently the utility of the information that may be contained in quota prices.

Newell, Sanchirico, and Kerr (2005) and a related paper by Newell, Papps, and Sanchirico (2007), are the only comprehensive studies of a multispecies quota market. These studies find evidence of economically rational pricing. Newell, Sanchirico, and Kerr state that “these markets are operating reasonably well, implying that IFQs can be effective instruments for efficient fisheries management.” However, an analysis of barter trading (quota swaps) in the British Columbia groundfish IFQ suggests that one needs to be cautious about relying on QP values as an indicator of the underlying value of catch privileges in multispecies fisheries (Holland 2013). Holland’s analysis suggests that the British Columbia groundfish QP market may not have been operating efficiently and that the implicit values of QP revealed by trades generally do not reflect the full value for species that are constraining catch of other species.

Even single species quota markets can be complex and present challenges for deriving and using information about quota values. Sanchirico, Kroetz, and Lew (2011) present a preliminary evaluation of

quota markets in both the Alaska halibut and sablefish IFQ fisheries. While they find evidence of well-functioning markets, the restrictions on quota in the halibut and sablefish result in 55 different unique types of halibut quota and 30 unique types of sablefish quota, each of which is likely to have its own market. They note that values vary by area, vessel class, and according to the restrictions on aggregation which vary for particular shares of quota. Their preliminary analysis suggests that quota prices could reveal information about the costs of restrictions on use and aggregation of quota, but note that quantifying these costs is challenging due to the practice of selling QS and QP together, the existence of many small sub-markets, and multiple rule changes through time. Kroetz, Sanchirico, and Lew (2013) estimate these restrictions resulted in a reduction of 32% of the value of the halibut fishery and 22% of the value of the sablefish fishery.

IV. Quota Markets in U.S. Catch Share Programs

Adoption of catch shares in federally managed fisheries in the U.S. has been relatively slow but has increased in the last decade. The Mid Atlantic surf clam and ocean quahog IFQ, which was implemented in 1990, was the first U.S. catch share system. It was followed by IFQs for South Atlantic wreckfish in 1992 and for Alaska halibut and sablefish in 1995. The 1996 reauthorization of the MSA imposed a five-year moratorium on new IFQ programs for federally managed fisheries. A 1999 catch share system based on cooperatives in the Bering Sea Aleutian Islands (BSAI) pollock fishery bypassed the moratorium via the U.S. Congress passing the American Fisheries Act, and in 2001 the Pacific Coast Fixed Gear Sablefish permit stacking program, which was not legally considered an IFQ, was implemented. No new IFQ programs were implemented under the MSA until 2005 when the Bering Sea crab fishery implemented an IFQ-IPQ/Co-op system.

The 2007 reauthorization of the MSA specified new standards and processes for the design and implementation of limited access privilege programs³ (LAPPs) which includes IFQs. In 2010, NOAA implemented a “Catch Share Policy.” The policy “encourages the consideration and adoption of catch shares wherever appropriate in fishery management and ecosystem plans and their amendments, and will support the design, implementation, and monitoring of catch share programs.” Nine new catch share programs have been implemented since the 2007 MSA reauthorization, and by the end of 2012, there were a total of 16 catch share programs operating in federally managed U.S. fisheries (Table 1). The majority of U.S. catch share programs allocated IFQs, but several allocate catch privileges to cooperatives.

All of these catch share programs allow transferability of catch privileges in some form creating markets for QS and/or QP, though in some cases these transfers are private contractual exchanges internal to cooperatives. We provide a short synopsis of each catch share program and quota market below. Each synopsis includes a short description of the fishery, the management system, and the rules for transferring QS and QP. Each synopsis also includes a description of the information collected on QS and QP transfers and an evaluation of the availability and quality of QS and QP price information and other useful information that can be derived from transfer data. More detailed information is available from the authors on request.

North Pacific Halibut and Sablefish IFQ Program

Halibut in the North Pacific are commercially targeted only with longline gear. They are also caught as bycatch in other commercial fisheries but cannot be retained. There are two types of vessels that

³ The term ‘limited access privilege’ was included in the 2007 reauthorization of the MSA and is defined as (A) a Federal permit, issued as part of a limited access system under section 303A to harvest a quantity of fish expressed by a unit or units representing a portion of the total allowable catch of the fishery that may be received or held for exclusive use by a person; (B) includes an individual fishing quota; (C) does not include community development quotas as described in section 305(i). (16 U.S.C. 1802).

participate in the halibut IFQ fishery: catcher vessels that deliver their catch onshore, and catcher processors that catch and process catch at sea. In addition to the commercial halibut fishery, there is a substantial recreational sector of charter operations which, as of 2014, are able to lease commercial IFQ quota in southeast and south-central Alaska. A percentage of the Bering Sea and Aleutian Islands (BSAI) quota, which varies by halibut management area, is allocated to communities through the CDQ Program.

Sablefish in the North Pacific are commercially caught by both catcher vessels and catcher-processors using longline, pot, and trawl gear, but the IFQ program only applies to longline and pot gears. There is not a substantial recreational sector for sablefish in the North Pacific. Twenty percent of the BSAI sablefish IFQ quota is allocated to the CDQ program.

The Alaska Halibut and Sablefish IFQ Program is managed by two different management agencies: the International Pacific Halibut Commission (IPHC) and the North Pacific Fishery Management Council (NPFMC). The IPHC is responsible for the biological management of the halibut resource, including establishing the Total Constant Exploitation Yield, which is equivalent to the allowable biological catch (ABC), and catch limits for the directed longline fishery. The NPFMC is responsible for establishing Annual Catch Limits (ACLs) for sablefish and allocating the U.S. catch limits for both sablefish and halibut among various user groups. It is through this latter authority that the fixed gear halibut and sablefish IFQ program was developed by the NPFMC and implemented by NOAA Fisheries in 1995. Prior to the IFQ program, both fisheries operated as derbies which often only lasted a few days per year (depending on the area). Quota Share (QS) for halibut and for sablefish was initially issued to persons based on both historic and recent participation of persons who, in 1988, 1989, or 1990, owned vessels with qualifying landings. QS was issued in amounts commensurate with creditable landings during the “best five” of 6 years for sablefish or 7 years for halibut. Holders of QS can be individuals or non-individuals (such as a corporation), although the latter are restricted in several ways. The primary

objectives of the IFQ Program are to 1) eliminate gear conflicts; 2) address safety concerns; and 3) improve product quality and value.

There are two forms of quota in the halibut and sablefish fisheries, QS and annual IFQ (analogous to QP) derived therefrom. At the beginning of each calendar year, IFQ is allocated to QS holders based upon their QS holdings, the total amount of quota in each management area (QS pool), and the TAC in each area. QS is a revocable indefinite privilege that entitles the holder to a share of the total species, area, and vessel class-specific IFQ allocated each year. IFQ are valid only for one year, but there are provisions that allow QS holders to carry over to the next year up to 10% of their unused IFQ and any overages (up to 10%) are taken from the following year's IFQ allocation. The quota for each species is unique according to the area, the vessel class that can use it, whether it is "fishdownable" (which means that it can be harvested by smaller vessels, but not larger vessels), and whether it is unblocked or blocked, which limits aggregation. Individuals can only own two blocks of sablefish QS and three blocks of halibut QS in a given management area. In all, there are a total of 55 unique types of halibut quota and 30 unique types of sablefish quota, each of which is likely to have its own market.

QS can be sold with or without IFQ it generated that year (plus adjustments from prior year QS used). QS are transferable to other initial recipients or to those who have become transfer-eligible through obtaining National Marine Fisheries Service's (NMFS) approval by submitting an Application for Eligibility to Receive QS/IFQ. Potential QS/IFQ recipients must have 150 or more days of experience working as part of a harvesting crew in any U.S. commercial fishery. IFQ can be leased annually to other eligible permit holders under limited circumstances. There are limitations on the types of entities⁴ (individuals, corporate entities, and non-profit Community Quota Entities) that may receive QS outside

⁴ The type of person refers to individuals vs. entities vs. Community Quota Entity (CQE) groups, which differ as to how each type of person can become eligible to acquire shares. For individuals: 150 days U.S. commercial harvesting active time as crew in any U.S. fishery. For entities: existing entities can only purchase catcher/processor QS. New solely owned corporations formed by an individual initial issuee with their own initially issued QS can purchase catcher vessel QS. Additionally, the CQE Program allows eligible communities to purchase QS and lease annual IFQ to community residents.

of designated vessel QS type and length categories. There are use and ownership share caps on individuals as well as entities. No individual can hold/control more than 0.5%-1.5% of halibut or sablefish QS in combinations of areas. Entity caps are 1% of total QS and 1% of TAC caps for annual vessels landings. Communities with CDQ are not subject to excessive share provisions.

Catch Share Market Information

All transfers of QS or IFQ must be approved by the NMFS. Transfer applications are submitted in writing to NMFS and must be notarized. Transfer applications are evaluated by NMFS to verify that the transferor possesses the QS or IFQ to transfer, the transferee is eligible to receive QS or IFQ, and that the transferee would not exceed the accumulation limit resulting from the transfer. The transfer application includes the following information: the transaction date, the NMFS ID for both the buyer and the seller, addresses of the buyer and the seller, information on the price paid/received, the reason for the transfer, information on how the buyer and seller found one another, details on the relationship (if any) between the buyer and seller, whether a broker was used, if there are any existing liens on the QS or IFQ, the primary source of financing of the purchase, and details of the QS or IFQs transacted (e.g., species, area, vessel class, blocked or unblocked, and fishdownable). Reporting the price paid/received for QS or IFQ is mandatory. As NMFS IDs are required for both buyers and sellers, it is possible to track how QS and IFQ are moving geographically as well as tracking how the demographics of ownership is changing.

There have been over 18,850 quota transactions since the IFQ program was implemented in 1995 through 2012. Approximately 80% of those transactions included both QS and IFQ, while roughly 11% of transactions were for QS only and 9% of transactions were for IFQ only. Of those, nearly 12,000 (62%) were between unrelated individuals (i.e., appear to be arm's length transactions), and over 10,000 have a positive transaction price. While there are a large number of observations overall, because there are so many different unique types of quota, the submarket for some areas and classes may be fairly

small. The data appear to be sufficient to calculate meaningful QS and IFQ prices (although it is difficult to disentangle the relationship between QS and IFQ given the large number of transactions with both types of quota) for a number of the more frequently traded areas and vessel classes, but not for all distinct markets. However, NMFS should be able to estimate the overall value of QS and IFQ in the fishery reasonably accurately because the various areas and vessel classes with thin markets are small portions of the total catch. In a preliminary analysis of this transactions data, Sanchirico, Kroetz, and Lew (2011) find evidence of a well-functioning market with the most flexible quota trading at higher prices than other forms of quota. Price dispersion is greater in the QS market than the IFQ market with no clear trend in dispersion over time.

Bering Sea American Fisheries Act (AFA) Pollock Cooperatives

Walleye pollock are found from the southern Sea of Japan north through the Bering Sea and down to northern California with the highest concentrations occurring in the eastern Bering Sea. Pollock in the U.S. waters of the Bering Sea are targeted only with pelagic (midwater) trawl gear. The fishery is managed by the North Pacific Fishery Management Council (NPFMC) under the BSAI groundfish FMP. With catches averaging approximately 1 million metric tons per year, the fishery represents 40% of global whitefish and is the largest fishery in the U.S. by volume. There are three distinct industry sectors that participate in the Bering Sea pollock fishery: inshore catcher vessels that deliver their catch to onshore processors, catcher-processors that catch and process their catch at sea along with catcher vessels that deliver to them, and motherships that are at-sea processors that do not catch fish but receive fish from catcher vessels that deliver to them. Ten percent of the Bering Sea pollock TAC is allocated to communities through the CDQ Program. There is not a substantial recreational sector for pollock in the North Pacific.

The AFA Pollock Cooperatives Program was established by an act of Congress in 1998. It was implemented for the catcher-processor sector in 1999 and the shoreside catcher vessel and mothership sectors in 2000. The goals of the AFA were to resolve frequent allocation disputes between the inshore (shoreside catcher vessel) and offshore (catcher-processor and mothership) sectors and reduce negative consequences of the race for fish under the existing system (e.g., excess capacity, reduced product quality, waste, etc.). The AFA established minimum U.S. ownership requirements, vessel and processor participation requirements, defined the list of eligible vessels, finalized the TAC allocation among sectors, provided an allocation to the CDQ program, and authorized the formation of cooperatives. The allocation of the TAC (after the 10% allocation to the CDQ program is deducted), as specified in the AFA, is 50% to the inshore catcher vessel sector, 40% to the catcher-processor sector, and 10% to the mothership sector. Additionally, nine catcher-processor vessels were removed from the fishery (eight were scrapped and one barred from commercial fishing) at a total cost of \$90 million paid to the owner of those vessels. Of this cost, \$75 million was financed with a loan repaid by a landings tax on pollock delivered to shoreside plants (as it was the inshore sector that absorbed the catch allocation associated with the decommissioned vessels). Taxpayers financed the remaining \$15 million of the vessel buyout.

Participation in the AFA pollock fishery is tied to the specific vessels listed in the AFA, and those eligible vessels are authorized to form cooperatives. Seven inshore cooperatives have formed between catcher vessels and eligible shoreside processors. Catcher vessels are required to deliver 90% of their Bering Sea pollock to a cooperative member processor. Each inshore catcher vessel cooperative is allocated exclusive harvest privileges based on the catch history of its member vessels. The catcher-processor and mothership sectors have each formed a voluntary cooperative and each receive sector allocations, though the share of the TAC going to each sector is fixed.

Catch share privileges are indefinite in duration but are revocable. Since there is a single cooperative in the catcher-processor and mothership sectors, each sector has developed contracts

among members of the cooperative to allocate their catch across vessels. Inshore catcher vessel cooperatives are able to exchange quota among their member vessels as they see fit. However, since inshore catcher vessel cooperative allocations are based solely on the membership of their vessels, the only means for one cooperative to permanently exchange quota to another cooperative is by transferring vessels among cooperatives. When a vessel owner decides to change cooperatives, they are not allowed to participate in the cooperative system for one year, but can fish competitively in the limited access fishery which receives an allocation based on the aggregate catch histories of the inshore catcher vessels not enrolled in inshore cooperatives.

Inshore catcher vessel cooperatives are also able to contract with non-member AFA eligible vessels to harvest a portion of their allocation which must be approved by both the non-member vessel and that vessel's cooperative. This is similar to a quota lease. NMFS receives information that this type of contract is being entered into and how to allocate the vessel's catch to the different cooperative allocations for purposes of catch accounting, but collects no details on the value of the transaction. There are also excessive use caps in both the harvesting and processing sectors which state that no entity can harvest more than 17.5% or process more than 30% of the directed pollock fishery allocation.

Catch Share Market Information

As the catch share privilege is tied to the vessel, there are no data on quota transfers for this fishery. There are, however, data on the transfer of license limitation program (LLP) licenses, which can be tied back to the AFA eligible vessels. There have been a total of 56 voluntary LLP license transactions for AFA eligible vessels since 2000 (the first year of the LLP); however, a price was not recorded on 40 of those transactions and one LLP was sold for \$1 and two for \$10,000. After excluding these outliers, there have only been 13 LLP transfers, which have a mean price of over \$9 million (in \$2005 using the CPI personal consumption expenditures deflator). With so few trades and coupled with the fact that the value of the permit is tied to the vessel history, it is unclear whether these are representative prices.

BSAI King and Tanner Crab Rationalization

The BSAI King and Tanner Crab Rationalization program was implemented in 2005 following several capacity reduction programs including a moratorium on new vessels in 1996, a license limitation program in 2000, and a vessel buyback program in 2004. The program allocates exclusive harvesting privileges to license owners and crew members, and exclusive processing privileges to eligible individuals for 9 different crab fisheries in the Bering Sea/Aleutian Islands region managed by the North Pacific Fishery Management Council (NPFMC) under the BSAI king and Tanner crab FMP. The crab fisheries include Bristol Bay red king crab, Bering Sea snow crab, Western Aleutian Islands (Adak) golden king crab, Eastern Aleutian Islands golden king crab, Western Aleutian Islands red king crab, Pribilof Islands red and blue king crab, St. Matthew Island blue king crab, Eastern Bering Sea Tanner crab and Western Bering Sea Tanner crab.

The BSAI King and Tanner Crab Rationalization Program was created to address the race for fish, reduce bycatch and discard mortality, increase safety, address conservation goals, improve product quality and reduce deadloss⁵, and to balance the interests of those who depend on crab fisheries. One novel aspect of the program is that it allocates both harvester QS as well as processor QS (PQS), the so called “two pie” system. PQS was incorporated to preserve the geographic distribution of landings and the communities and processors that depend on the crab fishery and to maintain a competitive market among processors. The program also allows for the formation of harvest cooperatives to manage their allocations. There are two community protection programs included in the Program: an allocation to the CDQ Program, and a specific allocation to the community of Adak.

There are five unique types of QS and one type of processing quota (PQS) in the Crab Rationalization program: Catcher vessel owner (CVO) shares, catcher vessel crew (CVC) shares, catcher-

⁵ Crab must be delivered to port live for processing. Deadloss refers to crab that died in the hold before or during unloading.

processor owner (CPO) shares, catcher-processor crew (CPC) shares, converted CPO shares (created by combining North PQS and North CVO QS), and processor quota share (PQS). QS are assigned to license holders or qualified crew members and PQS was allocated to eligible persons (i.e., processors). Annual allocations of individual fishing quota (IFQ) and individual processing quota (IPQ) are derived from an individual's ownership of QS and PQS. These shareholders may choose to use IFQ and IPQ individually or as part of a cooperative. The owner harvest shares represent 97% of the harvest allocation while crew shares are the remaining 3% of the harvest allocation. In addition, there are also CDQ shares that are assigned to CDQ groups, which are allowed to buy QS and processor QS. Consequently, many CDQ groups have been expanding their ownership (primarily of QS) since program inception.

At the beginning of each crab fishing year, fishery- and region-specific IFQ and IPQ are allocated to QS holders based upon a person's holdings of QS. IFQ are analogous to QP but must be matched with IPQ. Class A IFQ, which represents 90% of the CVO allocation, is required to be matched with IPQ, while Class B IFQ (the remaining 10% of the CVO allocation), CPO IFQ, CPC IFQ, CVC IFQ, and CDQ crab can be landed without matching with IPQ.

QS and PQS are revocable privileges that entitle the holder to a share of the total IFQ or IPQ distributed each year. QS may be sold and IFQ may be leased annually to other harvesters. PQS can be sold and processor IPQ can be leased annually to other eligible processors, subject to some limitations. Ownership share caps are in place for all harvest QS pools; for vessel owner QS, the share cap varies from 1%-20% of initial QS pool based on fishery, quota type, and entity type; for crew share QS pool, the cap varies from 2-20% of the initial QS pool. These caps are based on the initial QS pool tables published in regulations, which dictate an "individual and collective" approach based on ownership of QS owning entities. There is no cap on harvest share holdings for cooperatives, but there is a 30% cap on processing shares by fishery.

Catch Share Market Information

The implementation of the BSAI King and Tanner Crab Rationalization Program, and subsequent sales of QS and leasing of IFQ has led to a significant decrease in the number of active vessels in the fishery; from 262 vessels operating in the three years prior to implementation on average to 76 active vessels in the 2011-2012 season. Data on the IFQ lease market are limited, but data on the QS market are adequate to provide estimates of value.

All QS and PQS transfers must be recorded, and of the 1,451 recorded QS and PQS transactions, 912 (63%) include a price (PQS trades account for 43 of those transactions and there are 17 priced transfers). Additionally, there are 54 IFQ only transfers with prices and 75 combined QS and IFQ transfers with prices for a total of 1,041 transactions with prices and 719 arms-length transactions with prices. Overall, there were 610 arm's-length QS transactions, which have a mean of 335,271 QS units and a mean price of \$0.54 per QS unit. This indicates that the mean QS transaction was worth over \$182,000. The 13 arm's-length PQS transactions with price information average over 2 million PQS units with a mean price of \$0.27 per PQS unit for a mean transaction value of over \$560,000. For some of the more actively traded species (Bristol Bay Red averaged 20 and Snow crab averaged 29 arm's-length QS transactions per year) with a sufficient number of arm's-length transactions, the QS prices should represent market value. However, with so little PQS transactions data, it is impossible to determine whether or not observed PQS prices reflect market value or not.

From 2005-2007 for IFQ lease transfers, NMFS required the parties to submit the full contractual details of the transfer which were often difficult to neatly enter into a database, particularly because many of the contractual details were conditional on future prices. During this period, there were 12 lease transactions priced in dollars and 48 lease transactions where a price was recorded as a percentage of ex-vessel value of crab, and a total of 143 arm's-lengths IFQ only lease transactions. The lease transactions priced in dollars averaged \$4.80/pound while the percentage transactions averaged

53% of ex-vessel value. Anecdotal evidence suggests that there is an active lease market for crab IFQ with lease prices nearing 70% of the ex-vessel price of the landed crab for Bristol Bay red king crab. However, because the majority of these leases are done within the same cooperative, these lease rates cannot be confirmed as data on intra-cooperative transfers are not collected.

In addition to the above data, as part of the annual economic data report (EDR), vessels are required to specify both the quantity and revenue from each species quota that they leased and also the quantity and expense related to leasing quota. These are not transaction-level data (with dates), but some data are available on the value of each species' quota at an annual level. However, these data were deemed to be inadequate for use in policy analyses presented to the North Pacific Fishery Management Council.

BSAI non-Pollock Trawl Catcher-Processor Groundfish Cooperatives (Amendment 80)

The Bering Sea/Aleutian Islands non-Pollock Trawl Catcher-Processor Groundfish Cooperatives Program (also known as Amendment 80) was implemented in 2008 for those groundfish trawl catcher-processors fishing in the Bering Sea/Aleutian Islands (BSAI) region that did not qualify for the American Fisheries Act (AFA) pollock fishery cooperatives program. The fishery is managed under the BSAI groundfish FMP by the North Pacific Fishery Management Council (NPFMC), and the cooperative program was created by Amendment 80 to the FMP. Prior to the Amendment 80 program, these vessels primarily produced head and gutted products from a variety of groundfish species. But as the race for fish has been eliminated, and because Amendment 80 implemented increased groundfish retention standards, the vessels are increasingly producing other product forms.

The goal of the Amendment 80 program is to improve retention, utilization, and to reduce bycatch for the catcher-processor trawl sector of the non-pollock groundfish fishery in the BSAI region. The program authorizes these vessels to form cooperatives and provides them with allocations of six

groundfish species including Atka mackerel, Aleutian Islands Pacific ocean perch, flathead sole, Pacific cod, rock sole, and yellowfin sole, as well as a prohibited species catch (PSC) allowance for halibut and crab. There are also “sideboard” restrictions which limit catches of five species outside the BSAI by the 28 eligible trawl catcher-processor vessels.

QS are tied to the participating vessels and are allocated to their cooperative based on each vessels’ catch history. QS are revocable privileges that entitle the holder to a share of the total quota distributed each year. There are excessive share and use caps that limit an owner’s share to less than 30% of the aggregate Amendment 80 quota and a vessel to less than 20% of the initial catch limit assigned to the non-AFA trawl catcher-processor sector. Vessels not participating in a cooperative don’t receive an allocation and they fish competitively in the limited access sector. Only one cooperative formed in 2008 that included 16 vessels while the other vessels participated in the limited access sector until 2011 when those vessels all joined a second cooperative.

QS can be transferred by selling the vessel, its permits, and accompanying catch history. It is also possible to sell QS without selling a vessel, but sellers are required to sell all of their Amendment 80 QS for all species simultaneously and leave the Amendment 80 fishery. Cooperatives (and consequently members) are allocated cooperative quota (CQ), the annual form for the catch privilege, based on the QS owned by their members. Cooperative members can transfer CQ to other eligible vessels within and between cooperatives. NMFS has to approve inter-cooperative CQ transfers, but does not receive any information about the transfers other than the quantities of CQ by species that are being transferred. Intra-cooperative transfers are not reported; but, as part of the annual economic data report (EDR), vessels are required to specify both the quantity and revenue from each species CQ that they leased and also the quantity and expense related to leasing in CQ. The majority of transfers between vessels are CQ swaps across species which are not recorded with a price, and there are few CQ for cash transactions, so these data are not likely to be reliable.

Catch Share Market Information

As the catch share privilege is tied to the vessel, there are no data on QS transfers for this fishery, and the CQ transfers (leases) are not reported with price information. However, there are data on the transfer of license limitation program (LLP) licenses which can be tied back to the Amendment 80 vessels. There have been a total of 13 voluntary Amendment 80 LLP license transactions since 2008, but only 3 transactions have a recorded price. The other transactions appear to be self-transfers within an entity to another vessel they own or the result of corporate reorganization. The 3 transactions have a mean price of \$3.7 million (in \$2005 using the CPI personal consumption expenditures deflator). With so few trades, and as the value of the permit tied to the vessel history, it is unclear whether these are representative prices.

There have been a number of CQ and PSC transactions between the two cooperatives occurring between 2011 and 2013 (the only years with more than one cooperative), with roughly half of the transactions being for CQ and half for PSC. As there are only two cooperatives making transfers with each other, no values for the transactions can be reported so as to maintain confidentiality.

Central Gulf of Alaska Rockfish Program

The Central Gulf of Alaska Rockfish Program (Rockfish Program) was implemented by the North Pacific Fishery Management Council in 2012 under the Gulf of Alaska groundfish FMP. It is a ten-year extension of a pilot program that ran from 2007-2011 under similar guidelines. Prior to 2007, the fishery operated under the License Limitation Program (LLP). The Rockfish Program is a cooperative program that allocates exclusive harvesting privileges to catcher vessel and catcher-processor vessel cooperatives using trawl gear for rockfish “primary” and “secondary” species as well as an allocation for halibut prohibited species catch (PSC). The primary species are northern rockfish, Pacific ocean perch, and pelagic shelf rockfish. The secondary species are Pacific cod, rougheye rockfish, shortraker rockfish,

sablefish, and thornyhead rockfish. The rockfish program includes a small entry level longline fishery, but vessels participating in the entry level longline fishery are not eligible to join cooperatives and therefore are not allocated any exclusive harvesting privilege and do not have quota. From 2009-2011, there were approximately 46 vessels operating in the Rockfish Program with total ex-vessel revenues of \$7.6 million per year.

The Rockfish Program was designed to improve resource conservation and improve economic efficiency by establishing cooperatives that receive exclusive harvesting privileges. The four goals of the program were to: 1) reduce bycatch and discards, 2) encourage conservation-minded practices, 3) improve product quality and value, and 4) provide stability to the processing labor force. The Rockfish Program allows catcher-processors to form cooperatives and allows catcher vessels to form cooperatives in association with shoreside processors in Kodiak, AK, but these catcher vessels are not required to deliver to the processor with which their cooperative has formed an association.⁶ This allows the shoreside processors in Kodiak to better time deliveries of rockfish and salmon from catcher vessels in the summer months.

QS are allocated to eligible LLP license holders, but LLP licenses must be assigned to a rockfish cooperative in order to participate in the Rockfish Program. Cooperative quota (CQ) is allocated annually to the cooperatives based on the QS ownership of its membership. QS are allocated to LLP license holders based on their catch history, so LLP owners have a limited ability to sell their QS, which can be transferred only by selling their LLP. Cooperatives within a sector can transfer shares, subject to

⁶ Under the rockfish pilot program (2007-2011), catcher vessels and processors were linked together in cooperatives and catcher vessels were required to deliver to a processor in their cooperative. Since 2012 under the Rockfish Program, each catcher vessel cooperative is required to be formed “in association” with a rockfish processor (which must be within the city limits of Kodiak). The cooperative does not receive their CQ until a shoreside processor that is eligible to receive rockfish CQ has “indicated that it may be willing to receive rockfish CQ from that cooperative.” But the cooperative is under no obligation to deliver their rockfish to that processor. Source: 50 CFR 679.81.

excessive share limits. Catcher vessel cooperatives cannot sell CQ to catcher-processor cooperatives, but catcher-processor cooperatives are allowed to sell CQ to cooperatives in either sector (with the exception of rougheye or shortraker rockfish CQ).

The Rockfish Program allocated revocable shares and the program is only authorized until December 31, 2021 (10 years from the start of the program). There are also excessive share and use caps. No person may hold or use more than 4% of the catcher vessel QS, or 40% of the catcher-processor QS. No catcher vessel cooperative may hold or use more than 30% of the catcher vessel CQ. No vessel may harvest more than 8% of the catcher vessel CQ or 60% of the catcher-processor CQ. No processor may receive or process more than 30% of the catcher vessel CQ.

Catch Share Market Information

As the catch share privilege is tied to the LLP license and based on catch history, there are no data on QS transfers for this fishery, and the CQ transfers (leases) are not reported with price information. However, there are data on the LLP transfers of the included LLP licenses. There have been a total of 31 voluntary LLP license transactions since 2007 (the start of the Rockfish Pilot Program) for the 57 LLP licenses that received QS. Of the 57 LLP transactions, prices were recorded for 17 transactions; however, one of the reported prices was below \$10 and is unlikely to have been accurately reported. The mean price for the remaining 16 usable transactions was \$1.66 million (in \$2005 using the CPI personal consumption expenditures deflator). With so few trades it is unclear whether these are representative prices.

Pacific Coast Groundfish Trawl Rationalization Program

The Pacific coast groundfish fishery management plan (FMP) covers over 90 different species including 64 rockfish species, 12 flatfish species, 12 roundfish species, and six species of sharks and skates managed by the Pacific Fishery Management Council (PFMC). The fishery extends from the Mexican

border with California to the Canadian border with Washington. It takes place on a relatively narrow continental shelf, but over a wide range of depths from a few fathoms to over 1,000 fathoms. The fishery is prosecuted with a variety of gear types. The FMP includes Pacific whiting which is a distinct fishery that catches other FMP species only in relatively small amounts as bycatch. The non-whiting fishery is divided into separately managed sectors including a limited entry trawl sector, a fixed gear (primarily traps and longlines) sector, an open access sector, a recreational sector, and a tribal sector.

In 2011, the Pacific Fishery Management Council implemented an IFQ system in the Pacific Coast Groundfish Limited Entry Trawl fishery including the shore-based component of the Pacific whiting fishery. The at-sea delivery components of the Pacific whiting fishery (mothership and catcher-processor sectors) operate under cooperatives – one for catcher-processors and one for motherships and associated catcher vessels. The limited entry fixed gear sector of the groundfish fishery continues to operate under separate management arrangements including a permit stacking catch share system for sablefish which is described separately in this report. For the IFQ program, individuals were allocated catch privileges for 28 groundfish stocks and stock complexes as well as individual bycatch quotas for Pacific halibut. Several of the IFQ stock complexes include multiple species (e.g., other rockfish, minor slope rockfish and minor shelf rockfish). A number of the quota species/complexes are divided into separate northern and southern stocks. Numerous species caught and landed in this fishery, such as dogfish, skates, and some less common groundfish species, are not included in the IFQ program at this time.

The IFQ sector of the fishery has two forms of catch privileges, QS and QP. QS is a revocable privilege that entitles the holder to a share of the total QP allocated each year indefinitely. At the beginning of each calendar year, QP are allocated to QS permit account owners by multiplying their QS by the total shore-based sector allocation for each IFQ species/stock complex. QP are valid only for one calendar year, but there are provisions that allow vessel account holders to carry forward up to 10

percent of the unused amount of QP to the next year subject to NMFS approval. For most species, QS were initially allocated based on catch history. However, for Pacific halibut and seven overfished rockfish species, initial QS allocations were based on bycatch rates applied to allocations of associated target species.

QS were initially non-transferable, but transfers were allowed beginning in 2014. By contrast, QP have been transferable since the beginning of the program. In order to use the QP to balance catch (landings and discards) of IFQ stocks, the QP must be transferred from the QS account to a vessel account. Once in a vessel account, it can be used to balance catch or it can be transferred to another vessel account. There are accumulation limits for both QS and QP. A few entities initially received QS allocations that exceeded these limits and are required to divest some holdings and abide by accumulation limits by the end of 2015.

Catch Share Market Information

QP and QS transfers are initiated through a web-based interface. The transferor indicates the amount of QP or QS for each species/stock to be transferred and the account to which it will be transferred. The transferor is required to indicate the type of transfer. Choices include “self-trade”, “cash sale”, “barter”, “barter and cash”, and “other”. The transferor may also indicate the price per pound of the species being transferred. This is not required information since there may be many species in a transfer and no per-species price, the transfer may be an internal transfer, or there may be some other form of compensation. The transferor is required to enter the total value of the transfer though a price of zero may be entered. Transferors are also asked to report details about the transfer such as a description of what was received in exchange for a barter transaction or description of a payment mechanism, but this information is not required, and it is generally not provided or is not very specific. Since the transfer identifies all parties to the transfer, the details of those individuals/companies can be associated with the transfer and thus it is possible to track how QP is

moving in the fishery (e.g., geographically based on owner addresses or where fishing takes place). QS became transferable in 2014 and similar information, including the value of the transfer, is required when making transfers.

The majority of QP transfers are “self trades” (i.e., internal company transfers). Only about 14% of transfers (292 transfers in 2011 and 340 in 2012) were single-species cash sales that can provide directly usable price information. Of the single species cash-sales of QP through 2012, 90% and 85% had a total value listed greater than \$1 in 2011 and 2012 respectively. This is roughly the percentage with usable data, although there are a few transactions that should be eliminated from an analysis on an ad-hoc basis (e.g., prices look unrealistic or the value given appears to be a price per pound rather than total value). Total transfer value information was provided for 75% and 78% of multispecies cash sale transfers in 2011 and 2012 respectively.

For many species there are only a few cash sales of QP. The data appear to be sufficient to calculate meaningful QP prices for a number of the more frequently traded species, but not for most species. For this reason, it is not possible to use this information to estimate the net value of the overall fishery, although available price data for some individual species may provide useful information. However, even in these cases, the number of trades with reported prices is a small proportion of total QP allocated. This means that it is difficult to determine whether or not they represent the true value of QP. There was also not enough activity to describe how prices change during the year. Even for more frequently traded species, average QP prices must be viewed with caution since price dispersion is high, and prices are not necessarily normally distributed. Price dispersion (C.V.) by IFQ stock ranged from 9% to 57% in 2012, dropping substantially from 2011 for several more frequently traded primary target stocks, but remaining high for most other stocks.

Permit holders in the mothership and catcher-processor sectors of the groundfish fishery (which solely targets Pacific whiting) do not receive QS or QP. For the mothership cooperative program,

mothership catcher vessel endorsed limited entry trawl permits have a “catch history assignment.” The catch history assignment is a percentage of the overall mothership fishery catch limit. Mothership cooperatives get an annual allocation of whiting based on the catch history assignments of the enrolled catcher vessels. Since there has only been a single mothership cooperative since the program began, it receives the entire mothership fishery catch limit. Mothership fishery catcher vessel endorsements and the associated catch history assignment became transferable in 2013; however, no price data are collected or has been reported on transfers. No partial transfers of catch history assignment for vessels are allowed.

For the Pacific whiting catcher-processor cooperative, the catch limit is allocated in pounds to the cooperative (a single, voluntary cooperative of all catcher/processor endorsed limited entry permits). For the catcher-processor cooperative, the catcher processor-endorsed limited entry trawl permits are transferable. Reporting of prices of transfers is voluntary, but there are no usable data on transfer prices to date. For both mothership and catcher-processor cooperatives there may be internal allocations of catch privileges to members of the cooperative that are done by contract. Internal transfers of these allocations may occur, but they are not reported and no price information on them is collected.

Pacific Sablefish Permit Stacking

As noted in the prior section, Pacific sablefish is managed under the Pacific coast groundfish FMP by the Pacific Fishery Management Council . While the FMP covers a number of species and gears, the sablefish permit stacking program covers only one species, sablefish, and only a subcomponent of total sablefish catch along the West coast. The fishery (also referred to as the “primary sablefish fishery”) is limited to longline and trap (fish pot) gear and regulates catch north of 36^o latitude to the Canadian border by vessels with limited access fixed-gear sablefish endorsements. Sablefish is a relatively high value, deep

water species, mostly found at depths between 200 and 700 fathoms. As mentioned in the prior section, sablefish are also targeted in the separately managed trawl fishery. Vessels in the permit stacking program can also land sablefish up to daily trip limits when the primary fishery is not open and after they have harvested all sablefish allocated to the primary fishery during the primary sablefish season (April-October).

The program evolved through several forms of management before arriving at its current state. The primary fishery began as an open access fishery, became a limited entry groundfish program in 1994, and in 2006, regulations were implemented to establish the program as it is today. Groundfish limited entry permits were initially issued in 1994 and then sablefish endorsements were assigned to the permits in 1997, both based on historical participation. In the same year, equal cumulative limits were imposed on the fleet. In 1998, the present “three-tier” system was implemented assigning a different cumulative catch limit to each of the three tiers, again based on catch history. The tiers determine the amount of sablefish that may be harvested with each permit in a particular year's primary sablefish fishery with tier 1 having the highest catch limits and tier 3 the lowest. The permit stacking program (primary sablefish fishery) was implemented in stages. In 2001, the first stage allowed for stacking of up to three permits (of any tier) and the extension of the fishing season from a period of 6-9 days to a season beginning on August 15 and ending on October 31. In a second stage, the season was further extended in 2002 to April 1 – October 31.

Catch privileges, in pounds of sablefish, are allocated annually to the tier permits. The total amount is determined by a set ratio where a Tier 2 permit is allocated 1.75 times the weight allocated to the Tier 3 permit and a Tier 1 permit is allocated 3.85 times the weight allocated to the Tier 3 permit. Permits may be sold or leased. Up to three permits can be stacked onto one vessel, allowing the vessel to catch the sum of the allocation to each permit. The catch privileges associated with each permit are not divisible.

There is a prohibition on the ownership of permits by corporations or other business entities, a permit owner-on-board requirement, a limit on the number of permits any individual or entity (individually and collectively) can own or hold, and a prohibition on at-sea processing. Currently there are 164 sablefish tier permits, composed of 28 Tier 1 permits, 42 Tier 2 permits, and 94 Tier 3 permits. These permits were associated with 86 vessels in 2012.

Catch Share Market Information

There is limited information available about sablefish permit sales and leases. There are two sources of data, the permit transfer form that is submitted to initiate a sale of a permit, and the cost-earnings data collection from the fleet (e.g., Lian 2012). In both cases, it is voluntary to provide the information. Cost or revenue from sale or lease of sablefish permits reported on the cost-earnings survey or permit transfer forms account for less than 10% of all transfers of permits. Some data are also collected through the mandatory Economic Data Collection Program (EDC) for those vessels participating in the West Coast groundfish trawl fishery and the primary sablefish fishery. In many cases, the cost of a permit sale might be combined with the sale of an entire operation which often includes the vessel and additional permits.

Gulf of Mexico Red Snapper IFQ Program

Red snapper is a demersal reef fish species that occurs in the Gulf of Mexico and the southeastern Atlantic coast of the U.S. Red Snapper are most abundant on the Campeche Banks of the Yucatan Peninsula and in the northern Gulf of Mexico (GMFMC 2004). However, they are making a comeback along the west Florida shelf, where they were abundant prior to the 1980's. The U.S. Gulf of Mexico red snapper fishery is managed by the Gulf of Mexico Fishery Management Council under the Reef Fish FMP which also includes a number of other reef fish species now managed under a separate IFQ program which is discussed in the next section. The red snapper stock is shared between commercial (51%) and

recreational (49%) interests. The commercial sector is multispecies in nature. Permits for the commercial reef fish fishery, which includes red snapper, are issued under a limited entry program. Permits are transferable, and all vessels must have an operational vessel monitoring system (VMS) installed. Vertical line vessels are responsible for most of the commercial landings. These vessels also jointly catch vermilion snapper, red grouper, and other shallow water groupers. A few longline vessels that mainly target red grouper also land small amounts of red and vermilion snappers and other shallow water groupers.

On January 1, 2007, the red snapper individual fishing quota (IFQ) program was implemented to reduce overcapacity and to eliminate, to the extent possible, the problems associated with derby fishing (Agar et al. 2014). Prior to the IFQ program, the commercial fishery was mainly managed with license limitations, trip limits, size limits, and seasonal quotas which were unsuccessful at protecting and rebuilding this over-exploited stock and encouraged excessive capital investments and derby fishing conditions that resulted in market gluts, depressed prices, higher harvesting costs, and unsafe fishing conditions (Waters 2001).

The IFQ program defines IFQ shares (analogous to QS) as a percentage of the red snapper commercial quota held by an IFQ shareholder and IFQ allocation (analogous to QP) as the poundage of fish that an IFQ participant may possess, land, or sell within a given fishing year. The IFQ program has a built-in flexibility measure to allow a once-per-year allocation overage for any IFQ account that owns shares. For these accounts, a vessel can, once during the year, land 10% more than their remaining allocation on the vessel for their last trip. NMFS deducts this overage from the shareholder's allocation in the following fishing year (SERO, 2013). IFQ allocation may be obtained by an IFQ participant without the need to own shares. Both IFQ shares and IFQ allocation are revocable privileges; hence, holders have no right to compensation if these privileges are withdrawn or limited. Initial distribution of IFQ shares

was based on historical catches. There is a cost recovery fee of 3% of the ex-vessel value of the landed fish.

During the first five years of the program (2007-2011), only persons who possessed a valid Gulf of Mexico commercial reef fish permit or commercial reef fish dealer permit were eligible to participate in the program. On January 1, 2012, all U.S. citizens and permanent resident aliens became eligible to purchase IFQ shares and allocation. Only accounts with allocation and a valid Gulf reef fish permit can legally harvest red snapper commercially (SERO 2013). There are no trading restrictions other than a 6.0203% accumulation cap on IFQ shares. There is no cap on the amount of allocation that may be held during the calendar year. The transfer of IFQ shares and IFQ allocation between the commercial and recreational sectors is not allowed. Banking or carry-over of unused allocation is not allowed.

Catch Share Market Information

All transfer and landing transactions must take place through an online website system. For each share or allocation transfer, the system records the name of the transferee and transferor, amount of allocation or share transferred, transaction prices, and date/time. Share transfer prices were not required from 2007-2009, but since 2010 shareholders have been required to enter a share or allocation transfer price.

While a price field is required for share and allocation transfers, often participants have reported values of \$0.01. In late 2012, an additional field was added to the online system to record the reasons for transferring shares and/or allocation to clarify the reasons behind unusual transaction prices and identify arm's-length transfer prices. The new field included the following options: sale to another shareholder, transfer to a related account, barter (swaps) for share or allocation (including those for share or allocation in the Grouper-Tilefish IFQ program), gift, package deal (e.g., purchased with vessel and/or permit), and no comment. In addition to recording share and allocation transfers, the IFQ program requires landing transactions to be completed by an IFQ dealer and validated by the fisherman.

The date, time, location of transaction, weight and ex-vessel value of the fish landed and sold, and shareholder account, vessel, and dealer names are collected on the landing transaction.

Because the existing database cannot confidently determine arm's-length transactions and misreported/underreported prices, only between 19 and 52% (depending on the year) of the IFQ share transactions during the first 5 years of the program are thought to report "reasonable" (believable) prices. Similarly, only between 20 and 35% (depending on the year) of the IFQ allocation transactions during the first 5-years of the programs are believed to have provided reasonable values. Also, there has been misreporting of dockside prices. In June 2011, to address the presence of unrealistically low dockside prices, regulations were put in place prohibiting participants from making any deductions (e.g., costs of allocation, goods, and/or services) from the actual dockside price for reporting purposes. Finally, in late 2013, fishermen were asked to validate previously reported share prices and provide reasons for share transfers.

Gulf of Mexico Grouper-Tilefish Individual Fishing Quota (GT-IFQ) Program

The Gulf of Mexico Reef Fish (GOMRF) FMP, managed by the Gulf of Mexico Fishery Management Council, currently covers 31 species in the Gulf of Mexico, including 11 snappers, 11 groupers, four jacks, three tilefishes, one triggerfish, and one wrasse. The grouper-tilefish (GT) sector is a component of the reef fish fishery in the Gulf of Mexico. The GOMRF fishery extends westward from state and federal waters off the Florida Keys to those off Texas. GT species are heavily concentrated along the west Florida shelf. However, a significant deep water grouper and golden tilefish sector exists off Texas. Shallow-water groupers may be caught at depths less than 20 fathoms, whereas deep-water groupers and tilefishes are commonly caught at depths greater than 100 fathoms. The GT sector is prosecuted mainly by vertical lines (VL), including bandit gear which uses electric or hydraulic reels, and bottom longlines (BLL). Vessels employing VL primarily target gag grouper, whereas vessels using BLL primarily

target red grouper, deep-water grouper, and tilefishes. Both gears are relatively indiscriminate, often resulting in secondary catch of other GT and reef fish species. The gag grouper stock is considered overfished with overfishing still occurring; whereas the red grouper, yellowedge grouper, and golden tilefish stocks are not overfished and are not undergoing overfishing. The stock status of other species managed under the IFQ program is unknown.

Permits for the commercial GOMRF fishery are issued under a limited entry program. Permits are transferable, and all vessels must have a vessel monitoring system (VMS) installed and operational. In 2010, the Gulf of Mexico Fishery Management Council implemented a multispecies IFQ Program for the GT sector, which also eliminated trip limits and season closures for these species. Commercially harvested GT species are quota managed in combination with size limits. Additional regulations affecting the GT sector include marine reserves, time-area closures, and gear restrictions (including a BLL endorsement).

For the GT-IFQ Program, distribution of initial IFQ shares (analogous to QS) was based on historical catches. Five share categories were established: gag , red grouper, shallow-water grouper (i.e., scamp, red hind, rock hind, black grouper, yellowfin grouper, and yellowmouth grouper), deep-water grouper (i.e., speckled hind, misty grouper, snowy grouper, Warsaw grouper, and yellowedge grouper), and tilefishes (i.e., anchor, blackline, blueline (grey), golden, and goldface tilefishes). In 2012, the following species were removed from the program and the Reef Fish FMP: red hind, rock hind, misty grouper, anchor tilefish, and blackline tilefish. IFQ shares are a percentage of the commercial quota within each of the five GT-IFQ species categories.

The GT IFQ program defines IFQ shares (analogous to QS) as a percentage of the commercial quota for each species or species aggregate held by an IFQ shareholder. IFQ allocation (analogous to QP) is the pounds of fish that an IFQ participant may possess, land, or sell within a given fishing year. IFQ shares are revocable privileges that entitle the holder to a share of the total allocation distributed each

year. IFQ allocations are distributed at the beginning of the calendar year or at any time within the year that the quota is increased. Allocations expire at the end of the calendar year. Shareholders may land 10% more than the remaining allocation in their IFQ account once per year per share category if they own shares in that share category. This overage is then deducted from their allocation at the start of the following fishing year. Caps on the accumulation of IFQ shares and IFQ allocation are monitored. A cost-recovery fee of 3% of the ex-vessel value of the landed fish is collected for administration and enforcement of the program.

IFQ shares and IFQ allocation are transferable to anyone holding a GOMRF permit. In addition to the original shareholders, any entity owning a commercial GOMRF harvest permit may join the program. Therefore, allocation may be obtained by any IFQ account holder without the need to own shares. Any dealer with a GOMRF dealer permit may also join the program. After January 1, 2015, all U.S. citizens and permanent resident aliens will be eligible to purchase GT-IFQ shares and allocation, although a valid GOMRF permit will still be required to harvest, possess, and land any allocation.

Two IFQ share categories, gag and red grouper, have a multi-use option that allows a portion of the red grouper allocation to be harvested under the gag allocation, or vice versa. Presently, due to the overfished status of gag, only the multi-use gag allocation may be fished for red grouper. Other flexibility measures allow certain species found in varying depths to be landed with either shallow-water grouper allocation or deep-water grouper allocation after allocation of their primary share category has been entirely used.

Catch Share Market Information

All transactions related to the GT IFQ Program must be conducted through an online system. While a price field is required for all IFQ shares and allocation transfers, there is no minimum price threshold, and therefore values of \$0.01 may be reported. Misreported or under-reported prices for IFQ share transfers, IFQ allocation transfers, and some ex-vessel prices are common. The main reasons for

misreporting or under-reporting of prices are due to: privacy concerns, trading to a related account, barter trades (swaps), combined package deals (e.g., vessel, permit and shares bought for a single price), and misunderstanding of which price should be entered (total vs. price per pound).

A landing transactions report must be completed by the IFQ dealer and validated by the fisherman. The information on the landing transaction includes the date, time, location of transaction, weight, and ex-vessel value of the fish landed and sold, as well as shareholder account, vessel, and dealer. The definition of actual ex-vessel price was changed through regulations in June 2011, and prohibits the costs of allocation transfers, goods, and/or services from being deducted from ex-vessel prices. Ex-vessel price reporting has improved since 2010, with 84% of ex-vessel prices considered “reasonable” in 2012, but a small number of dealers continue to under-report prices through the GT-IFQ online system.

For each IFQ share and allocation transfer, the transferee and transferor are recorded, along with the amount transferred, price (total price for share transfers, price per pound for allocation), and date/time. Starting in late 2012, an additional field was added to record the reason for the transfer. Reasons for transfers include: sale to another shareholder, transfer to a related account, bartered trade for IFQ share/allocation, gift, package deal (e.g., purchased with vessel), and no comment. Transfer reasons were added to aid in the understanding of price data, particularly unusually high or low values. In late-2013, fishermen were surveyed to validate previously reported IFQ share prices and provide reasons for share transfers.

In 2012, 66% of the 5,700 allocation transfers had no usable price information. Due to the high volume of allocation transfers, there are a substantial number with usable prices for each share category/year. Audited allocation price data are believed to offer representative annual estimates of the value of the harvesting privilege. The representativeness of the prices of allocation transfers at a finer temporal scale (e.g., monthly) has yet to be determined, and may be influenced by regional differences.

While the number of IFQ share transfers with no usable price information has decreased each year, there may be greater uncertainty about the representativeness of these prices because of the smaller number of total transactions.

South Atlantic Wreckfish Individual Transferable Quota (ITQ) Program

The South Atlantic Wreckfish ITQ is a single species program managed by the South Atlantic Fishery Management Council (SAFMC) as part of the Snapper-Grouper FMP. Wreckfish are caught with mechanized reels along the edge of the continental shelf and are not commonly encountered with other species. Fishery participants have concentrated their effort in the Charleston-to-Northeast Florida region on the Charleston Bump, which lies between 1,200 and 2,000 feet, and also in the Florida Keys. There is evidence that these wreckfish are part of a trans-Atlantic stock, as juvenile wreckfish (which dwell along the ocean's surface) are very rarely encountered, and fishermen have encountered European-style fishing hooks in harvested adults.

The wreckfish ITQ program is the oldest finfish catch share program in the U.S. The presence of large, adult wreckfish along the South Atlantic coast was unknown until the late 1980s. The fishery quickly grew to harvest the virgin stock, from two vessels in 1987 to 70 vessels in 1990. In response, NMFS implemented the ITQ program in February 1992, at which point 49 shareholders qualified for QS allocations. These shareholders demonstrated at least 5,000 lbs. of wreckfish landings in either 1989 or 1990, and received QS based equally on landings (50% of the allocation was in proportion to each recipients' shares of landings from 1987-1990) and an equal split of shares (50% of the allocation was equally distributed to all who qualified for the program) (Gauvin et al. 1994). No shareholder was allowed to receive more than 10% of the initial allocation.

Shareholders in the program are issued QP in the form of paper coupons in 100 and 500 pound denominations at the beginning of each fishing year, currently in April. Each shareholder receives these

coupons equivalent to his/her owned share percentage multiplied by the commercial Annual Catch Limit (ACL). Shareholders are not required to be holders of wreckfish permits, but a wreckfish permit and a limited-access snapper/grouper permit is required to land wreckfish. Coupons expire at the end of the fishing year, which is currently in mid-January. Coupon holders must redeem coupons equal to or greater than their wreckfish catch at the time of landing.

There are no sunset provisions that limits the duration of the ITQ program and QS privileges, although Congress and the SAFMC have the authority to alter it. The SAFMC has done this recently with Amendment 20A to the Snapper/Grouper FMP, which reallocated unused QS. Initially, there was no cap on the accumulation of QS, but this also changed with the passage of Amendment 20A in March 2012. There is now a 49% cap on QS ownership of the overall quota.

Coupons can only be bought by current shareholders. The selling party lists the sale in his/her logbook, and the buying party signs the back of the coupons and presents them to the dealer at the time of actual use. NMFS receives this information at the time that the coupons are redeemed or logbooks are reported. Other than the QS cap, QS and coupons can be freely traded and used by various commercial gear types; however, they cannot be transferred to the recreational sector (e.g., for hire, private anglers, etc.). There are no geographic restrictions on the use of QS and coupons other than the South Atlantic region. Banking or carryover of unused coupons is not allowed.

Catch Share Market Information

The market for QS transfers is sporadic and inconsistent, and has largely preceded or followed regulatory changes to the ITQ program. No QS were transferred between 1999 and 2008, as most shareholders did not use all of their own coupons due to diminished markets for wreckfish, better opportunities in other fisheries, a collapsed stock, or some combination of these factors. All QS transfers must be approved by Regional Office staff to ensure that ownership caps are not exceeded, and all QS transfer information has been recorded since the ITQ program began. Both QS transferee and transferor

are requested to provide price information, but compliance is voluntary. There are also price data from the transfer of annual coupons (leasing) on the wreckfish logbook forms, but coupon transfers are infrequent.

The transfers of QS in the fishery occurred in two distinct time periods: from 1992-1998, and again from 2009-2013. Both time periods have usable price data. Twenty-nine QS transfers occurred between 1992 and 1998, and nearly all of them list plausible prices of between \$4,800 and \$11,700 per 1% share. Thirty-eight QS transfers from 2009-2013 were valued between \$1,000 and \$7,500 per 1% share in anticipation of the SAFMC's reallocation of unused QS as part of Amendment 20A. The sharp drop in sales price between the two periods is believed to be driven by factors that would have made the latter time period a buyer's market: the Council's announced intention to revoke and reallocate unused QS, and a drastic reduction in the fleet quota from two million pounds to 235,000 pounds (plus the first set-aside for a small recreational wreckfish fishery).

Further QS transfers are less likely because the number of shareholders has dwindled to six, and one of those shareholders is capped at the 49% maximum stake in the fishery. The current small size of the ACL also makes the sale of QS by current, active fishermen unlikely.

Mid-Atlantic Surfclam and Ocean Quahog ITQ Program

Surfclams and ocean quahogs are both bivalve mollusks with partially overlapping distributions, but have different life histories and product markets. Ocean quahogs are distributed on both sides of the North Atlantic. In U.S. waters ocean quahogs occur from Maine to North Carolina although the majority of the resource is found exclusively within the Exclusive Economic Zone (EEZ) at depths from 20 to 80 meters. Ocean quahogs are slow growing long-lived organisms that do not start to reproduce until age 6 and do not reach a commercially harvestable size until around age 20. Ocean Quahogs can live for at least 200 years. Surfclams are found in Northwest Atlantic waters from the Gulf of St. Lawrence to Cape

Hatteras, North Carolina⁷. The surfclam is distributed in both state waters and the EEZ at depths ranging from intertidal beach zones to 160 feet. The majority of the resource is found in the EEZ off New Jersey, the Delmarva Peninsula, and on Georges Bank. Like ocean quahogs, surfclams are harvested in coarse grained sandy bottom using a hydraulic dredge that uses jets of water to remove sand and sediment from clam beds dislodging the clams that are retained in the dredge. The spacing of the bars in the dredge allows smaller clams to pass through while retaining larger clams. Surfclams are harvested at larger sizes than ocean quahogs and are not consumed live, but are processed as clam strips, minced clams sold fresh or frozen, and used in soups and chowders.

The surfclam and ocean quahog fisheries, which are managed by the Mid-Atlantic Fishery Management Council, were the Nation's first fisheries to adopt an Individual Transferable Quota (ITQ) management system beginning in 1990. In the several years prior to ITQ program implementation, surfclams had been the more intensively exploited species and were subject to limited access, whereas ocean quahogs remained an open access fishery. Relative to surfclams, ocean quahogs are distributed farther offshore and the fishery was prosecuted by only the larger vessels. Like the surfclam fishery, ocean quahogs were subject to quarterly quotas, but the effort limits imposed on surfclam fishing time were not needed in the ocean quahog fishery. Economic problems in the surfclam fishery associated with inefficient use of fishing vessels that were idled much of the year were not evident in the ocean quahog fishery. Nevertheless, when the Mid-Atlantic Surfclam ITQ Program was being considered, the ocean quahog fishery was approaching the limit of its specified optimum yield and there was concern over the transfer of effort from surfclams to ocean quahogs if the former became an ITQ system and the latter did not. Thus, identical ITQ programs were established for both species at the same time.

In establishing the ITQ programs the Mid-Atlantic Fishery Management Council sought to: 1) conserve the ocean quahog resource and stabilize harvest rates, 2) minimize public and private costs of

⁷ For more information see http://www.fishwatch.gov/seafood_profiles/species/clams/species_pages/atlantic_surfclam.htm

managing the resource, 3) bring harvest capacity in line with processing and biological capacity to allow industry participants to achieve economic efficiency, and 4) create a management approach that is flexible and adaptive to short term events or circumstances.

Initial shares for the Mid-Atlantic Surfclam and Ocean Quahog ITQ Program were primarily based on historical participation in the fishery in terms of landings measured in bushels. This meant that initial QS were allocated to owners of fishing vessels. However, the ITQ Program permits the transfer of QS to any individual or entity provided they would be eligible to own a U.S. Coast Guard documented vessel. QS may be transferred on a permanent basis or transferred (leased) on an annual basis to industry participants (processors or vessel owners) or other entities. Processors may purchase ocean quahogs or surfclams from a vessel owner that own QS or they may operate their own fleet of vessels, which may lease additional QS from others. Processors may also contract for harvesting services to a fishing vessel owner. An open access vessel permit, which must be renewed annually, is required to harvest either surfclams or ocean quahogs, but QS are issued indefinitely. There are no sunset provisions for QS ownership in the fishery management plan.

Each year, the harvest privilege for both surfclams and ocean quahogs is allocated in units of cage tags equal to 32 bushels of clams per tag. The number of allocated cage tags to each QS owner is determined by multiplying the total allowable harvest in bushels by the individual QS then dividing by 32. Cage tags expire at the end of the fishing year. Both QS and cage tags are freely transferrable. The unit of exchange for permanent transfers is in percentage terms while the unit of exchange for temporary transfers is in cage tags. To date, no accumulation caps on either QS or cage tags have been implemented.

Catch Share Market Information

All transfers must be approved by the NMFS to verify eligibility and track ownership of quota and cage tags. Required information at the time of transfer includes the transferor's name, allocation

number, the amount of QS to be transferred, transferee name, and allocation number⁸. If the transferee does not have a current allocation number then the transferee's name, vessel (if applicable), mailing address, and telephone number must be provided. The application must be signed and dated by both seller and buyer. If just cage tags are being transferred the serial numbers for the tags and the number of tags to be transferred must be provided. Neither the price paid for QS nor the price paid for cage tags is required to be reported. This means that economic analysis of market performance, efficiency, or profitability cannot be supported.

The information collected on QS and cage tag transfers may be used to evaluate spatial distribution of catch privileges and may be used to evaluate trading networks. Assessment of trading networks may be limited to cage tag transfers since QS trades are relatively infrequent. The number of QS transfers in the ocean quahog IFQ ranged from 2 to 11 trades from 2009 to 2013 while transfers of QS in the surfclam IFQ program ranged from 7 to 29 transfers over the same time period. By contrast, from 2009 to 2013 cage tag transfers averaged 118 and 286 transfers in the ocean quahog and surfclam IFQ programs, respectively. Even so, evaluation of trading networks is complicated by a number of factors. First, what constitutes a transaction for purposes of analysis needs to be defined. The number of transfers previously reported was based on a simple count of the number of transfer records in the data base where a record was composed of both, the transferor and transferee name, allocation numbers, and the beginning and ending serial numbers of the set of cage tags that are subject to transfer. In cases where more than one set of cage tags is transferred between the same two trading partners multiple records are created. Thus, what may appear to be multiple transfers is, in fact, a single transaction. Fortunately the number of occasions in which this occurs in the data is relatively small. Second, cage tags are issued to holders of QS many of which are not vessel owners. This means that a substantial number of transfers occur solely for the purpose of enabling the harvesting of clams. Last, cage tags may

⁸ A quota allocation number is assigned to each individual entity that may be eligible to receive cage tags which includes both holders of QS and entities that may temporarily receive cage tags during the fishing year.

be transferred more than once in a fishing year. In some cases, this is the result of a permanent transfer that is then immediately leased to another entity, while in other cases it may be an intra-company transfer. In either case, the sum of all cage tag transfers can exceed the total number of cage tags that have actually been issued.

Mid-Atlantic Golden Tilefish IFQ Program

Golden tilefish are found along the outer continental shelf and upper continental slope of the entire U.S. East Coast and in the Gulf of Mexico. They are most abundant from Nantucket Island, Massachusetts, south to Cape May, New Jersey. Tilefish live in water from 250 to 1,500 feet deep where bottom temperatures range from 49 to 58 degrees Fahrenheit. Individual tilefish are found in and around submarine canyons, where they burrow in mud or sand sediment. The majority of golden tilefish are caught using bottom long-line gear with little or no incidental catch of other species.

The Mid-Atlantic Golden Tilefish IFQ program is managed by the MAFMC and was implemented in 2009 as Amendment 1 to the Mid-Atlantic Golden Tilefish FMP. Prior to 2009 the fishery was managed with an annual quota on total allowable landings that was sub-divided among each of three limited access permit categories; Full-Time Tier 1, Full-Time Tier 2, and Part-Time. The FMP included an open access permit category subject to a low trip limit to accommodate incidental quantities of golden tilefish that are occasionally landed while fishing for other species. Five percent of the total quota is set aside for the incidental permit category and 95% is allocated to the limited access fishery with 66% of the limited access allocation going to Full-Time Tier 1, 15% to Full-Time Tier 2, and 19% to Part-Time permit categories.

Prior to the IFQ program, fishermen in the Full-Time Tier 1 permit category were able to come to internal agreements between themselves to manage the quota allocated to the permit category in such a way that harvesting could be timed to market conditions (Kitts et al. 2007). This cooperative

agreement allowed individuals in the Tier 1 permit category to stay within their collective quota while avoiding market gluts and spreading landings throughout the year. Fishermen in the other permit categories were unable to come to agreement on any similar cooperative arrangements resulting in an early closure of the Full-Time Tier 2 fishery in 2005 and 2006 and the part-time quota was closed early in 2002, 2004, 2005, and 2006. The IFQ program was established to address the fishing derbies that were an on-going problem in the Full-Time Tier 2 and Part-Time permit categories and to codify the internal arrangements reached by the Full-Time Tier 1 permit category participants into the FMP.

The IFQ program converted all limited access permit categories to open access permits that are assigned to a vessel and created an IFQ share allocation permit issued to individuals. To fish IFQ pounds a vessel must hold both a commercial and an IFQ allocation permit and the IFQ permit holder must declare in writing the permit numbers of any vessel that will be used to fish IFQ. Mid-Atlantic Golden Tilefish IFQ allocation permits must be renewed annually. The associated IFQ share allocation for any IFQ allocation permit which is not renewed is distributed among the remaining permit holders. Subject to annual renewal and with MSA provisions, the IFQ allocation permit may be issued indefinitely.

Both IFQ shares and pounds are fully transferable subject to an accumulation limit and the requirement that trading partners be permanent U.S. citizens or permanent resident aliens or corporations eligible to own a Coast Guard documented vessel. The accumulation limit is set at 49% of the Total Allowable Landings (TAL) assigned to the IFQ fishery. This means that any single entity may not own more than 49% of IFQ shares, but would allow any single entity with less than 49% to lease IFQ pounds up to 49% of the TAL. The accumulation limit applies to any single entity with an interest in TAL where having an interest includes an IFQ allocation permit holder's name, as a shareholder, officer or partner, by an immediate family member, or as owner or part owner of a company.

Catch Share Market Information

Permanent or temporary transfers of IFQ shares must be approved by NMFS. Transfer requests must include the signatures of the parties to the transfer, the price of the transfer, the amount of quota to be transferred, and the list of Federal permit numbers of the vessels that will fish golden tilefish IFQ. Temporary transfers are for the duration of the remainder of the fishing year and may not be sub-leased to any other entity.

Since its implementation in 2010 through 2013 (the most recent complete fishing year), there have only been 20 IFQ pound transactions executed in the fishery and price information was reported on 10 of these transactions. More recently, reporting of prices has improved as prices were reported on 5 of the 6 IFQ pound trades that occurred during 2013. Given the small number of IFQ pound transactions and much fewer IFQ share transactions, the data are not sufficient to estimate the market value of either IFQ shares or IFQ pounds.

Owner information is collected for both parties to a transfer, so it is possible to evaluate trading networks and whether IFQ shares are moving in the fishery in terms of geographic distribution. The Mid-Atlantic golden tilefish fishery has relatively few participants (both before and after IFQ program implementation).

Northeast Multispecies Sector Program

The Northeast multispecies fishery is managed by the New England Fishery Management Council (NEFMC) under the Northeast Multispecies FMP. The fishery is prosecuted using both trawl gear and fixed gears (gillnet and hook gears including bottom longline, tub trawls and rod and reel). The groundfish stocks are distributed throughout waters of the Gulf of Maine and Georges Bank and to a lesser extent Southern New England and the Mid-Atlantic bight. In all, a total of 19 stocks are managed

under the FMP including Georges Bank stocks of cod, haddock, and yellowtail flounder that are jointly managed between the U.S. and Canada under a trans-boundary resource sharing arrangement.

The Groundfish Plan was first implemented in 1986 with a combination of minimum fish sizes and area-based controls intended to reduce effort and provide spawning protection for haddock and yellowtail flounder. These measures were not sufficient to meet biological objectives, which led to implementation of a series of additional management measures including large closed areas, individual limits on days at sea (DAS), and trip limits. This set of measures became increasingly restrictive and complex over time, but still failed to eliminate overfishing on some groundfish stocks.

In 2004 Amendment 13 introduced a new program called “Sector Allocation” that provided fishermen with the ability to voluntarily form a Sector (effectively a cooperative) that would be bound by a quota and could be exempted from DAS and trip limits. At the time Amendment 13 was implemented only one Sector (the Georges Bank Cod Hook Sector) had been submitted to the Council for approval. A second Sector (the Georges Bank Cod Fixed Gear Sector) was approved in 2006. The transition from effort controls to Sector allocation was largely completed with Amendment 16, which was implemented in 2010. Although Amendment 16 retained the underlying principle that Sectors remain voluntary, the great majority of the more active vessels joined Sectors and over 95% of the commercial groundfish TACs were allocated to Sectors in 2010 and thereafter. Under Amendment 16, Sectors were allocated annual catch entitlements (ACE) for 14 of the 19 regulated groundfish stocks including Acadian redfish, pollock, white hake, witch flounder, American plaice, winter flounder (Georges Bank and Gulf of Maine), yellowtail flounder (Georges Bank, Cape Cod/Gulf of Maine, and Southern New England/Mid-Atlantic), cod (Gulf of Maine and Georges Bank) and haddock (Gulf of Maine and Georges Bank). In 2013 allocations of ACE for a 15th stock, Southern New England winter flounder, were added.

Under Amendment 16, every limited access permit in the Northeast Multispecies Fishery was allocated Potential Sector Contributions (PSC) for each allocated stock. Permit holders may elect to fish in the Sector Program, or in the “common pool.” The common pool fishery (for those who did not join a Sector) is regulated by input controls such as trip limits, minimum fish and mesh sizes and closed areas/seasons, layered on top of seasonal hard TACs. The Sector Program fishery is still subject to some input controls such as closed areas/seasons and minimum fish and mesh sizes, but Sectors may be granted exemptions from many of the specific requirements governing the common pool fishery including trip limits and DAS limits. Sector enrollment is done each year and once approved the PSC associated with each permit must remain with the Sector for the entire year. There is no limit on the number of Sectors that may form, but each Sector must have at least three unique ownership entities. There are no ownership caps in this program, nor are there regional, gear, or vessel type caps that must be maintained. The NEFMC is exploring ownership and consolidation issues in an FMP Amendment (18) currently underway.

PSC is calculated as a percentage of each stock’s Sector sub-ACL based on catch history during the qualification years (1996-2006 for most permits) and does not get re-calculated. The PSC stays with the permit whether the permit holder fishes or not, and PSC are tied to the permit. This means that PSC for individual stocks cannot be separately transferred and transfer of PSC takes place through a transfer of vessel/permit ownership. As such, PSC transfer does not require approval through the Sector program and there are no reporting requirements other than that required to record the vessel transfer.

PSC is the potential catch privilege that a permit may bring to a Sector, but it does not get converted into a usable catch privilege until it is pooled at the Sector level. Once a permit holder elects to join a Sector, the PSC held by that permit is pooled with the PSC of all other Sector members. At this point, the access right becomes known as a Sectors’ Annual Catch Entitlement (ACE). Sectors ‘own’ the ACE, not individual permit holders, though they may allocate ACE to individuals contractually. Sectors

are largely autonomous in how they choose to allocate catch privileges internally, though all Sectors have so far maintained internal catch accounting consistent with the PSC brought in by each permit holder— essentially an internal IFQ with initial allocations based on PSC.

Once the PSC is brought into a Sector and generates ACE for the Sector, this ACE may be transferred between Sectors (similar to QP in other catch share systems). Typically ACE is transferred between permits within a Sector on the basis of informal (binding only at the Sector level) leases.

Catch Share Market Information

Inter-Sector leases of ACE (between sectors) are recorded in a database maintained by the Greater Atlantic Regional Office. Date, volume in pounds, compensation, and Sector name of lessee and lessor data are all collected. The primary use of the Sector leasing data is to track transfers of ACE. For this reason, the Sector names and pounds are reported whereas compensation information may or may not be reliably reported. Some transfers are reported in a manner that complicates estimation of trading prices for specific stocks. These include swaps of ACE of different species, gifts, and block trades where multiple species are transferred for a lump sum. Intra-Sector leases of ACE (between Sector members) are recorded by Sector managers and, starting in Fishing Year (FY) 2012, have been reported to NMFS at the end of the fishing year.

Although intra-Sector trades probably account for the majority of ACE transfers among vessels, in FY2011, approximately one third of the permit-level lease market was traceable. The number of ACE transfers reported grew from 947 to 1,239 between 2010 and 2011, falling to 979 in 2012. In 2010, only 28% of those had usable price information, but in 2011 the proportion with usable price data rose to 70%. This fell back slightly to 63% in 2012. Transfer data was sufficient to calculate reportable average prices for 102 out of 164 stocks (including separate allocations for cod and haddock in the U.S./Canada shared resource area) in 2010, and 13 of 16 stocks in 2011 and 2012.. There are a number of challenges and caveats with use of ACE market data. ACE prices for some species vary substantially during the year,

but data are generally insufficient to estimate intra-annual prices, though it may be possible to do so for some species. Many of the transfers are swaps or are for packages with multiple species so species-level prices are not directly observable for these transfers. Thus, a hedonic modeling approach is required to estimate implied values (Murphy et al. 2012; Holland 2013). Most Sectors maintain rights of first refusal when a Sector member wishes to lease ACE out of the Sector, and the Northeast (Seafood Coalition) Fishery Sectors maintain an additional second-refusal right for all members of their affiliated Sectors. These structures place frictions in the market by concentrating liquidity into small pools before opening the market to all participants. The impact of these internal arrangements among Seafood Coalition sectors on lease prices is uncertain, but within-Sector markets may clear at lower prices than between-Sector markets and therefore estimates based solely on inter-Sector transactions could be biased upwards.

General Category Scallop IFQ Program

Atlantic sea scallops are distributed throughout the Northeast continental shelf from Newfoundland to North Carolina primarily at depths from 100 to 300 feet. Atlantic sea scallops inhabit sandy or gravel bottom in groups of individuals or “beds.” In the U.S. EEZ Atlantic, sea scallops are found primarily on Georges Bank and in the Mid-Atlantic. Although there are a few vessels that use net gear to harvest scallops, the overwhelming majority of scallops are harvested with a scallop dredge.

The general category scallop IFQ fishery is a segment of the larger limited access fishery for Atlantic sea scallops which is managed jointly by the New England Fishery Management Council (NEFMC) and Mid Atlantic Fishery Management Council (MAFMC) under the Atlantic Sea Scallop FMP. Compared to the limited access scallop fleet, vessels that participate in the general category scallop IFQ fishery tend to be smaller, carry fewer crew, work closer to shore, and take shorter trips. The general

category fishery exclusively targets Atlantic sea scallops, although a small amount of revenue (3%) is derived from species other than scallops.

In 1994, the New England Fishery Management Council implemented Amendment 4 to the Atlantic sea scallop FMP, which created a limited access effort control program for the scallop fishery. Amendment 4 also created an open access permit to accommodate a small boat fleet that had traditionally harvested scallops on day trips. The so-called “general category” fishery was subject to a trip limit of 400 pounds of scallop meats. Over time as measures in other fisheries became more restrictive, the general category scallop fishery was an increasingly attractive source of fishing revenue. Growth in the share of total sea scallop landings by the general category fleet led to concerns that if left unchecked may have required days at sea reductions for the limited access fleet. To address this concern, the NEFMC developed a limited access program for the general category fishery coupled with an IFQ program for qualifying vessels. The general category IFQ fishery was implemented in 2008 with a scheduled allocation of 10% of the total scallop quota in 2008 and 2009 that would be reduced to 5% of the scallop quota in all subsequent years.

General Category (GC) IFQ is issued to qualified limited access general category scallop permit holders which may include holders of limited access DAS permits. The FMP contains no sunset or provisions for program expiration. This means that the GC IFQ may be issued indefinitely subject to provisions of the MSA and annual renewal of the GC limited access permit.

GC IFQ may be transferred, only under certain conditions. Any vessel issued GC IFQ that has also been issued a limited access DAS permit is not allowed to transfer IFQ. For all other vessels, GC IFQ pounds or shares may be transferred. Initially, temporary transfers could only be done once each fishing year and even then only if the lessor had not landed any IFQ scallops. These provisions were recently relaxed so that today, temporary transfers may be executed more than once during the year and IFQ

owners that have used some of their allocated IFQ pounds may now lease any of the unused IFQ pounds to another IFQ owner. Also, it is now possible to re-transfer unused IFQ pounds during the year. . The permanent transfer of GC IFQ share is treated as a vessel transfer requiring that all other Federal permits be included in the transfer. The transfer of quota or share is also subject to accumulation caps that limit the allocation of quota to any one vessel to no more than 2% of the total quota allocated to the GC fishery and no one individual may have an ownership interest in more than 5% of the quota allocated to the fleet. The FMP grandfathered vessels that exceeded the 2% cap and/or individuals that exceeded the 5% cap based on initial allocations, but does not allow these vessels/individuals to acquire additional quota until they are below the cap.

All temporary or permanent transfers of IFQ (IFQ share of IFQ pounds) must be approved by the NMFS. An application for transfer must include the name of both parties to the transfer and the price paid for IFQ. Additionally vessel name, permit number, and hull number of the vessel from which IFQ is transferred are required. The same information is required of the vessel that will receive the IFQ. If the IFQ transfer is a permanent transfer, then the transferor must verify in writing that all other limited access permits are to be canceled or transferred to a replacement vessel.

Catch Share Market Information

Since its implementation in 2010 through 2013 there have been a total of 96 permanent transfers and 1,093 temporary transfers of scallop IFQ. The total value of the permanent transfer was reported on about two-thirds of occasions, whereas total values were reported for about 73% of all IFQ leases. For permanent trades that reported a non-zero value, the average price per IFQ pound has nearly tripled in nominal dollars since 2010 from \$12.65 to \$35.58 per pound in 2013 with very few instances of reported prices that would be considered either extraordinarily high or low. The average lease price for scallop IFQ pounds has about doubled since 2010 from \$1.59 per pound in 2010 to \$3.19 per pound in 2013. Overall, less than 3% of all leases with non-zero prices have reported prices that may

be considered to be unusually high or low. Thus, the available trading data may be adequate to analyze the economic value of QS and QP in the General Category IFQ program.

V. Conclusions

All of the catch share systems we reviewed allow transferability of catch privileges in some form, creating the potential for a market for QP and/or QS. However, restrictions on transfers and use of catch privileges, and the information that must be reported to regulators on transfers varies widely across programs (Table 2). Five of the fourteen programs reviewed allocate all or part of catch privileges to groups that have formed cooperatives and one, BSAI King and Tanner Crab, enables individuals to form a cooperative. These cooperatives distribute catch privileges internally, much like an internally managed IFQ. Cooperatives typically allow transfers of part or all of an individuals' annual catch privileges (effectively QP transfers) to other members of the cooperative, but these transfers are governed by private contracts and are not directly regulated or monitored by the government. In some cases, where multiple cooperatives exist, transfers of QP are allowed between cooperatives, and these generally are regulated and must be reported. The long-term catch privileges (the analog of QS) in these cooperative-based systems are typically tied to a vessel or permit and can only be transferred in their entirety, i.e. they are not divisible.

Table 2: Characteristics of Catch Share Privileges and Markets

Fishery	QP/QS Allocated to Individual or Group		QP/QS Separable, Divisible and Transferable		Transferability or Use Restrictions/Flexibilities
	QS	QP	QS	QP	
North Pacific Halibut & Sablefish	Individual	Individual	Yes	Yes	The quota for each species is unique according to the area, the vessel class than can use it, whether it is fishdownable (which means that it can be harvested by smaller vessels, but not larger vessels), and whether it is unblocked or blocked, which limits aggregation.
Bering Sea AFA Pollock Catcher/Processor Sector Mothership Sector Inshore Sector	Group	Group	n.a.	n.a.	QS and QP are not transferable across sectors. Only named vessels can harvest fish in co-ops. For inshore a maximum of 10% of a co-op's QP can be fished by vessels outside a co-op. Inshore vessels can switch co-ops only after year in common pool.
	Group	Group	n.a.	n.a.	
	Individual	Group	no	yes	
BSAI King & Tanner Crab	Individual but can form co-op	Individual but can form co-op	Yes	Yes	Separate QS for owners and crew of catcher vessels and catcher processors and for processor owners. Separate QP for harvest and processing that must be matched. Species and area specific QS and QP with regional delivery requirements.
BSAI Non-pollock Groundfish Trawl CP (Amendment 80)	Individual	Group	No	Yes	Only receive QS and QP while member of a co-op and allocation is tied to the vessel. QP can be transferred within and between co-ops.
Central Gulf of Alaska Rockfish	Individual	Group	No	Yes	Only receive QS and QP while member of a co-op and allocation is tied to the LLP license. Catcher-processor co-ops can sell QP to catcher vessel co-ops but cannot buy QP from them.
	Individual	Individual	No ⁹	No	
Pacific Coast Fixed Gear Sablefish					There is an owner-on-board requirement. QS and QP transfers limited to transfers of stackable permits with associated allocations.
Pacific Coast Groundfish Trawl Inshore Catcher Vessel Catcher Processor & Mothership	Individual	Individual	Yes	Yes	Some species have separate QS and QP by area. There is no transferability of QS or QP between inshore and at-sea sectors. Aggregation limits that vary by species limit individual accumulation and catch as a percent of the species total.
	Individual	Group	n.a.	n.a.	

⁹ QS and QP are fixed amounts associated with permits but permits can be traded and up to three permits can be stacked on a vessel

Gulf of Mexico Red Snapper	Individual	Individual	Yes	Yes	
Gulf of Mexico Grouper and Tilefish	Individual	Individual	Yes	Yes	Multi-use options allows a portion of red grouper to be harvested with gag QP. Other flexibility measures allow certain species found in varying depths to be landed with either shallow-water grouper allocation or deep-water grouper allocation after allocation if their primary share category has been entirely used.
South Atlantic Wreckfish	Individual	Individual	Yes	Yes	QP are in the form of paper coupons in 100 and 500 pound denominations which are not further divisible. Coupons can only be bought by current shareholders.
Surfclam & Ocean Quahog	Individual	Individual	Yes	Yes	QP is in the form of cage tags in units of 32 bushels per tag. A cage tag is required to harvest clams, but QP and QS may be freely transferred to any entity eligible to own a Coast Guard registered fishing vessel.
Mid Atlantic Golden Tilefish	Individual	Individual	Yes	Yes	QS and QP are freely transferrable subject to an accumulation limit of 49% and eligibility to own a Coast Guard registered fishing vessel.
Northeast Multispecies Groundfish	Individual	Group	No	Yes	QP for several species is stock-area specific. QP is allocated to each sector based on the combined QS of all sector members.
General Category Atlantic Scallops	Individual	Individual	No	No	Transfers of QS must include all other limited access permits and QP transfers must be for the entire allocated pounds. No one permitted vessel may control more than 2% of QP and no one individual may have an ownership interest in more than 5% of the QP.

Nine of the fourteen catch share systems allocate all catch privileges to individuals as IFQs, and another, the Pacific Groundfish Trawl Program, allocates IFQs for the bottom trawl sector of the fishery and makes group allocations to cooperatives in the whiting sector of the fishery. Of the nine programs that allocate catch privileges to individuals, QS and QP are fully divisible and transferable allowing transfers of all or part of an individual's holdings for five out of the nine. For South Atlantic Wreckfish, divisibility is limited to transfers of coupons with denominations of 100 and 500 pounds, but individuals can sell part of their overall allocation of coupons. Similarly, for the Surf Clam and Ocean Quahog IFQ divisibility is limited to cage tags that allow harvest of 32 bushels each. For the Pacific Coast Fixed Gear Sablefish program there are effectively blocks of QS and QP associated with permits. An individual can own multiple permits and buy and sell individual permits, but must transfer all of the QS or QP associated with each permit (though if the QP has been partially used during the year then the transfer may be for less than the full allocation to the permit). For the General Category Atlantic Scallops program, QS or QP transfers are allowed and but must be for the full quantity allocated to the permit. One owner can acquire QP of multiple permits subject to a limit of 2% of all QP.

Many of these programs have other limitations on transfers and use. Aggregation limits are common (Table 2). They may vary by species (e.g. Pacific groundfish) or by quota type and area (e.g. North Pacific Halibut). Some aggregation limits are quite small, e.g., one or two percent of total QS or QP, while others such as Mid Atlantic Golden Tilefish allow consolidation to as few as three owners in total. A few programs require the quota owner to be on board the vessel when the fish is harvested. This is required for North Pacific Halibut, with exceptions for some classes of quota, and for Pacific Coast Fixed Gear Sablefish. One program, BSAI King & Tanner Crab, allocates separate types of QS and QP for processors and harvesters and these must be matched (the so-called "two pie" system).

These restrictions on transfers, use and aggregation of ownership are often designed to achieve social and political objectives, though sometimes they are meant to limit market power. In any case,

they constrain and sometimes segment trading of QS or QP. When, as for North Pacific Halibut, they segment QS and QP into different quota classes, they effectively create separate commodities and markets for which we would expect prices to vary. Thus, attributing values based on priced transfers in one market segment to another is likely to be problematic.

Markets for QS and QP have the potential to provide valuable information to fishery participants, managers, and other stakeholders. However, for many U.S. catch share programs, very little information on QS and QP transfers and markets is collected. Only a few catch share systems yield sufficient data to estimate reliable prices of QS and QP on an annual basis (Table 3). Catch share systems for which reliable QS and/or QP prices are available for at least some species include North Pacific Halibut and Sablefish, BSAI King & Tanner Crab, Pacific Coast Groundfish Trawl, Gulf of Mexico Red Snapper, Gulf of Mexico Grouper-Tilefish, South Atlantic wreckfish, New England groundfish, and General Category Atlantic Scallops. Due to the low volume of transfers with price information, it appears that none of the catch share systems currently have sufficient data to evaluate how prices change within a season or to provide real-time price information to the public, and data for annual prices may not be available for less frequently traded species in multispecies catch share systems. Some programs do not require price information on transfers (e.g., Surf Clam and Ocean Quahog, and transfers of catch privileges within Alaskan cooperatives). While some information may be provided voluntarily, getting comprehensive and reliable priced data is unlikely unless reporting is mandatory.

Table 3: Availability and Quality of Price Information on QS and QP Transfers for U.S. Catch Share Programs

Fishery	QS and QP Price Availability¹⁰
North Pacific Halibut & Sablefish	Prices for both QS and QP
Bering Sea AFA Pollock	No price information collected
BSAI King & Tanner Crab	QS prices available for more frequently traded species. Some limited prices available for QP and PQS.
BSAI Non-pollock Groundfish Trawl Catch Processor (Amendment 80)	No price information collected
Central Gulf of Alaska Rockfish	No price information collected
Pacific Coast Fixed Gear Sablefish	No price information collected
Pacific Coast Groundfish Trawl	QP prices available for some more frequently traded species. No QS transfers allowed until 2014. No prices on permit transfers in at-sea whiting Co-ops.
Gulf of Mexico Red Snapper	Prices for both QS and QP transactions
Gulf of Mexico Grouper and Tilefish	Prices for both QS and QP transactions for more frequently traded species.
South Atlantic Wreckfish	Prices for QS and QP but not transfer in many years
Surfclam & Ocean Quahog	No price information collected
Mid Atlantic Golden Tilefish	Price information collected but priced transfers insufficient to estimate QS or QP values
Northeast Multispecies Groundfish	QS not tradable but QP prices from inter-Sector trades for most species
General Category Atlantic Scallops	Prices for both QS and QP transactions

¹⁰ We use the term quota pounds (QP) as a generic term to refer to the annual form of quota in a catch share system and quota shares (QS) as a generic term to refer to the long-term catch privileges though different terms are actually used for these quota instruments in some fisheries.

Several U.S. catch share programs mandate that the transferor indicate the type of transfer (e.g., transfer to a related account or self-trade, barter, cash sale, etc.), but it is difficult to validate this information. It is not always possible to distinguish arms-length transfers from transfers between related business entities. Data collection on ownership and control is being improved in most catch share fisheries and this will facilitate differentiation of arm's-length vs. internal transfers in the future. Including information on ownership linkages between vessel and quota account owners in quota transfer databases would make this easier. However, ownership structures can sometimes be complex with multiple parties owning parts of vessels and quota accounts.

In some fisheries, processors may act as QP brokers or may provide QP to vessels that deliver fish to them. Processors are well positioned to act as brokers given their interactions with multiple fishermen. However, if compensation for QP takes the form of a reduction in the ex-vessel price, or if the processor sells the QP to vessels at a reduced price on the condition that the vessel delivers the fish to them which may result in lower reported prices for QP. This practice could create downward bias in average observed ex-vessel prices and QP prices, if the practice is widespread, and could undermine the usefulness of ex-vessel and quota price information. Among other concerns, downward bias in ex-vessel prices could also have tax implications for local communities and states that levy landing taxes, and it could have implications for federal cost recovery programs for catch share systems (particularly for programs where the limit that cost recovery not exceed 3% of total ex-vessel value is binding)¹¹.

Collecting and evaluating information on catch share markets is generally more problematic when catch privileges are assigned to cooperatives as opposed to individuals because information on intra-cooperative transfers is generally not collected. It is, however, possible to get price information on

¹¹ Cost recovery is generally based on the "ex-vessel" value of the catch because the cost recovery fee cannot exceed 3% of the total "ex-vessel" value of the fishery. The Alaska region posts the fee in the federal register (primarily for halibut and sablefish but more are coming now that we have cost recovery in other fisheries) using standardized prices (individual owners can appeal based on their fish ticket records) about how they calculate cost recovery. See: <http://alaskafisheries.noaa.gov/ram/ifgfees.htm> and the FR notice for 2013 at: <http://alaskafisheries.noaa.gov/notice/78fr72869.pdf>

intra-cooperative transfers as has been demonstrated in New England where such information has been voluntarily provided. When multiple cooperatives exist in a fishery (e.g., the groundfish Sectors in New England), and transfers between cooperatives are allowed, information on these transfers is generally collected and can provide useful price data. For example, there have been enough transfers of QP with price information between Sectors in the New England groundfish fishery to estimate what are believed to be credible annual QP prices for most species/stocks. However, prices on transfers between cooperatives could diverge from prices on internal transfers (e.g., requirements to first offer QP internally could result in systematically higher prices for external vs. internal transfers). Thus, care should be taken using prices from external transfers as indicators of average value or profitability.

Multispecies fisheries present a number of problems for collecting and interpreting quota market data. Transfers of multiple species in a package with a single price for the package are common in multispecies catch share systems. Hedonic pricing methods can be used to derive implicit prices at the species level from these transactions provided there are sufficient transactions and variability in their make-up (Holland 2013). Quota swaps are also common. In principle, hedonic methods can be used to generate implicit prices from these trades as well (Holland 2013); however, it is unclear that sufficient data currently exist for this type of analysis in any U.S. catch share market. While quota swaps appear to make up a significant proportion of transfers in the Pacific Coast groundfish IFQ and the Gulf Red Snapper and Grouper-Tilefish IFQs, there is generally no easy way to link up both sides of a quota swap or be certain that it included no other compensation. When there are area restrictions or other quota use restrictions on QS or QP, the markets may be much thinner than they first appear. Value and prices are likely to vary by area and with the restrictions. This is a particular issue with Alaska Pacific Halibut which has large numbers of trades, but relatively few in some market segments. With sufficient data, it is possible to generate price information for market segments and even to evaluate how restrictions

impact quota value. This is the case for many market segments, but the number of transactions in some market segments is insufficient to allow this.

QS and QP transfers are sometimes facilitated by brokers, and, for Pacific Coast groundfish by online auctions. If it is possible to acquire data from brokers or auctions, it may provide useful supplementary market information and a way to validate the price information gathered by regulators.

Whether or not price information is collected, transfers of QS and QP can reveal geographic and sectoral shifts of catch share ownership and fishery participation that may be useful for evaluating economic impacts on fishing communities as mandated by National Standard 8 and potentially for evaluating optimal yield under National Standard 1 of the MSA. Information on trading networks may also provide insights into how markets are developing or where they are failing to develop. However, for catch share systems based on cooperatives it may be difficult to quantify internal transfers since cooperatives are generally not required to report internal member allocations and reallocations.

VI. Recommendations

Based on our review of U.S. catch share systems we offer the following recommendations for improving the collection, communication, and use of information from markets for catch privileges:

- 1.** Information on sale price and/or other compensation received should be collected on all arm's-length QP and QS transfers, and systems should be implemented to validate and correct the data. In addition to price information when applicable, other characteristics of transfers should be collected including: whether the transfer is internal to a company; whether there is in-kind compensation for the transfer and what that compensation is (e.g., if it involves swap for quota of another species

what is being received in exchange); if there is some contractual form of compensation and what it is (e.g., a proportion of the landed value of the fish once it is sold¹²).

2. Information on ownership ties between different quota account owners should be collected so that arm's-length transactions can be differentiated from transfers between related business entities.
3. If processors/buyers provide QP to fishermen, care should be taken to ensure that ex-vessel prices and QP prices reported do not reflect discounts associated with an agreement to deliver fish to that processor/buyer.
4. For catch share systems that allocate catch entitlements to cooperatives, both external (inter-cooperative) and internal (intra-cooperative) transfers of catch entitlements should be documented and price information collected where possible.
5. QP and QS prices should be evaluated to determine whether they appear to reflect reasonable QP and QS values and are useful for informing policymaking (e.g., allocation decisions, mandated 5 year-reviews of catch share programs, etc.). Care should be taken when calculating average QP or QS price to exclude transactions with prices that appear to be misreported or errors.
6. Councils, stakeholders and fishery managers should be made aware of the potential value of catch share market information, particularly QS and QP prices, and Councils should be asked to consider making provision of QP and QS price information mandatory when transfers are made.
7. To the extent sufficient non-confidential information about prices and volume of activity in quota markets is available, it should be made readily accessible to the public, preferably online and updated regularly. Information should be provided in as disaggregate form as possible without compromising confidentiality of individuals' transactions (e.g., monthly average prices rather than annual and prices by Sector and/or area if applicable), and information should be as rich as possible (e.g., median prices and price dispersion might be published along with average prices).

¹² Some contracts may be quite complex and getting contract details may be infeasible, but it may be possible to get some basic information describing the type of contract.

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Appendix 1: Terms Used for Long-term and Annual Catch Privileges in Different Catch Share Systems

Fishery	Long Term Catch Privilege	Annual Catch Privilege
North Pacific Halibut & Sablefish	Quota Share (QS)	Individual Fishing Quota (IFQ)
Bering Sea AFA Pollock	Catcher Vessel (CV): Inshore Cooperative Allocation Catcher Processor (CP): Sector Allocation Mothership (MS): Sector Allocation	CV: Annual TAC allocation CP: Annual TAC Allocation MS: Annual TAC Allocation
BSAI King & Tanner Crab	Catcher Vessel Owner Shares (CVO) Catcher Vessel Crew Shares (CVC) Catcher-processor Owner Shares (CPO) Catcher-processor Crew Shares (CPC) Processor Quota Share (PQS)	Individual Fishing Quota (IFQ) Individual Fishing Quota (IFQ) Individual Fishing Quota (IFQ) Individual Fishing Quota (IFQ) Individual Processor Quota (IPQ)
BSAI Non-pollock Groundfish Trawl CP (Amendment 80)	Quota Share (QS)	Cooperative Quota (CQ)
Central Gulf of Alaska Rockfish	Quota Share (QS)	Cooperative Quota (CQ)
Pacific Coast Fixed Gear Sablefish	Permits (stackable)	Allocation
Pacific Coast Groundfish Trawl	Quota Shares (QS)	Quota Pounds (QP)
Gulf of Mexico Red Snapper	IFQ Shares (QS)	IFQ Allocation (allocation)
Gulf of Mexico Grouper and Tilefish	IFQ Shares (QS)	IFQ Allocation (allocation)
South Atlantic Wreckfish	Quota Share (QS)	Quota Pound Coupons (QP)
Surfclam & Ocean Quahog	Quota Share (QS)	Cage Tags
Mid Atlantic Golden Tilefish	IFQ Share (QS)	IFQ Pounds (QP)
Northeast Multispecies Groundfish	Potential Sector Contributions (PSC)	Annual Catch Entitlements (ACE)
General Category Atlantic Scallops	IFQ Share (QS)	IFQ Pounds (QP)