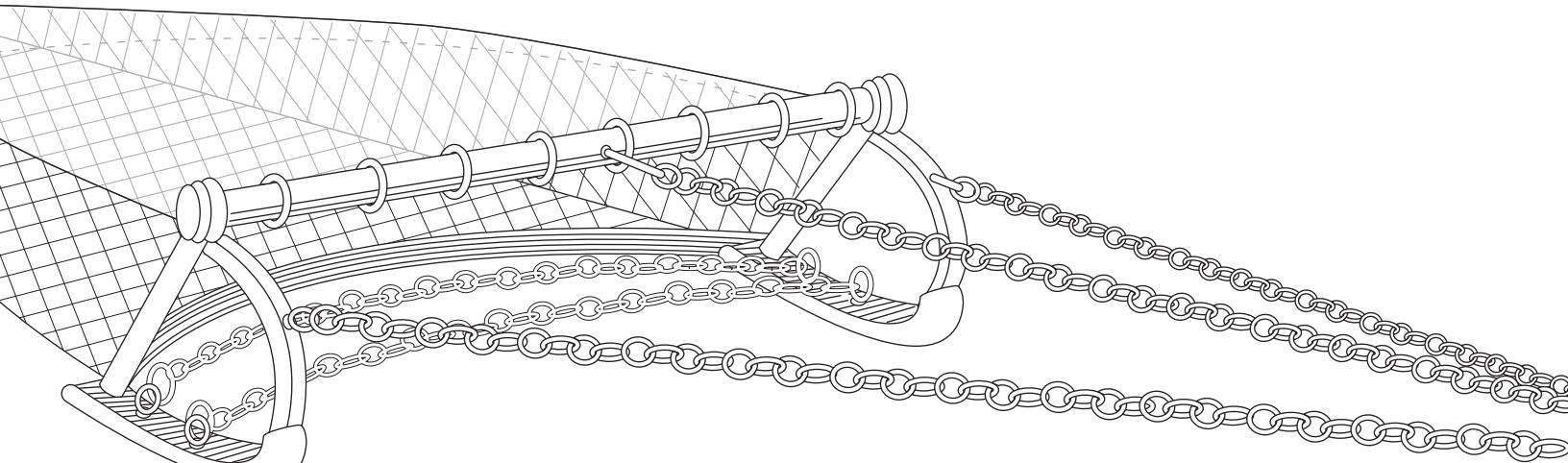


Transferable Effort Shares

A SUPPLEMENT TO THE
CATCH SHARE DESIGN MANUAL

C. Kent Strauss and Michael Harte



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CONTRIBUTORS

Ashley Apel, Kate Bonzon, Rod Fujita, Sarah Poon, Jeremy Prince, Tonya Van Leuvan, Jeff Young

Michael Harte is a Professor at the College of Earth, Ocean and Atmospheric Sciences, Oregon State University.

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Introduction

As fish stocks continue to decline worldwide as a result of overfishing, fishery managers and stakeholders are seeking effective solutions to ensure healthy fish stocks while meeting other economic and social goals. There is growing evidence that fishery management programs are most effective when they provide fishermen with secure, dedicated access to fishery resources and hold them accountable to limits.

A catch share program allocates a secure area or privilege to harvest a share of a fishery's total catch to an individual or group. Programs establish appropriate controls on fishing mortality and hold participants accountable. Catch shares have a strong record of biological, ecological, economic and social performance and should therefore be considered and implemented in fisheries wherever possible. Detailed information on catch share performance and design is available in the following documents:

- **Catch Share Design Manual, Volume 1: A Guide for Managers and Fishermen**
- **Catch Share Design Manual, Volume 2: Cooperative Catch Shares**
- **Catch Share Design Manual, Volume 3: Territorial Use Rights for Fishing**

Transferable effort share programs are not catch shares, but incorporate many of the key attributes of catch share programs, such as security, exclusivity and transferability. They also involve many of the same design decisions. The key difference between these approaches is that transferable effort share programs allocate effort-based privileges, which are based on the use of fishing inputs (such as gear, vessels and days). In contrast, catch share programs allocate quota- or area-based privileges. Transferable effort share programs achieve compliance to an effort cap, but do not directly control catch.

The primary principle of effective fisheries management is to ensure enough fish remain in the population to reproduce and replenish fish stocks at productive levels. The most direct way to achieve this outcome is to establish science-based catch limits that are set at biologically appropriate levels and to ensure compliance with these catch limits. Fisheries should strive to achieve

these hallmarks of fishery management even when they have limited data.

See **Science-Based Management of Data-Limited Fisheries: A Supplement to the Catch Share Design Manual** for a framework for assessing data-limited stocks.

Transferable effort share programs are an important option for fisheries where it is difficult to set an accurate annual catch limit and/or where it is difficult to monitor the catch or landings of fishermen. These programs may also be less costly to administer than catch share programs. There are distinct drawbacks to using a transferable effort share program. First, it may be challenging to effectively predict the appropriate level of effort to ensure stock sustainability. Second, fishermen are often able to change their fishing practices and adopt new technology that allows them to catch more fish while complying with regulations. Fishery managers must periodically assess these changes and modify the program as needed. Due to these challenges, transferable effort share programs are not appropriate for many fisheries. It is important to note, however, that transferable effort share programs have often been used as stepping stones to catch shares, and may be a helpful interim step in certain situations.

The use of transferable effort share programs should be assessed on a fishery-by-fishery basis, taking into account fisheries characteristics and fishery goals. This guide will walk you through key design considerations specific to transferable effort share programs, help you determine whether these programs are appropriate for your fishery and help you develop a design specific to your fishery's goals.

WHAT IS A TRANSFERABLE EFFORT SHARE?

A transferable effort share program is a fishery management approach that sets an effort cap (or limit on the use of fishing inputs), allocates secure shares to individuals and allows trading. The effort cap is adjusted up or down to achieve fishery goals. Fishermen are held accountable to use only the effort shares that they hold and/or acquire.

Rather than directly controlling the amount of catch, transferable effort share programs control the catch as a function of the effort cap and stock size. In theory, an effort cap allows the removal of a stable proportion of the stock being targeted. For a constant level of effort, harvests increase when stock size increases, and harvests decrease when stock size decreases. This can help keep stocks at sustainable levels even when stock size varies unpredictably.

Effort caps rely on a clear relationship between catch and fishing effort. This relationship is based on both fishing mortality and catchability: fishing mortality (the proportion of a stock removed by fishing activity), and catchability (a measure of fishing efficiency). Catchability

is often measured as the proportion of a stock removed by a single unit of effort (Van Oostenbrugge et al., 2008). Effort caps—the total number of effort units available in a fishing season—are set based on estimates of catchability and target fishing mortality rates. See **Step 2.5** for more information on setting effort caps.

Transferable effort share programs allocate individual secure shares of the effort cap and allow trading. This provides greater security and flexibility for individual fishermen while ensuring effort caps are not exceeded. Many terms have been used to describe transferable effort shares programs. Common names include:

- Individual transferable effort quotas
- Transferable effort rights-based management
- Transferable effort units
- Tradable effort permits
- Transferable input share
- Tradable fishing effort
- Tradable gear units

HOW WELL HAVE TRANSFERABLE EFFORT SHARES PERFORMED?

Transferable effort shares have had mixed results in fisheries around the world. These programs commonly manage a single or small set of inputs, such as the amount of gear used and/or fishing days, while allowing other inputs to change. Because transferable effort share programs do not control the level of catch directly, fishermen have incentives to fish harder and more effectively with their share of the effort cap. Fishermen will commonly increase the use of other inputs or develop new technology in order to increase their catch. For example, if fishermen are capped on the specific amount of gear they can use, they may increase the number of times they deploy the gear. By addressing these challenges through program design and establishing programs reviews, many

fisheries have successfully achieved biological goals of stock conservation.

Specific case studies reflect some of the benefits that transferable effort share programs can generate for fisheries:

- Management of fish stocks to sustainable targets (Dichmont et al., 2012)
- Lower enforcement and assessment costs (Grafton and McIlgorm, 2009; Shanks, 2010)
- Fewer conflicts between fishermen of different sectors (Jakupsstovu et al., 2007)
- Greater economic return to countries managing internationally shared fish stocks (Havice, 2013)

Other case studies reflect the inherent challenges of managing effort through fishing inputs and their use. The ability of transferable effort share programs to meet economic goals may be undermined due to incentives to increase the use of non-regulated inputs, program restrictions that limit gear innovation and difficulties in reducing effort to target levels (Townsend, McColl and Young, 2006). Specifically, transferable effort share programs have faced challenges in many fisheries, including:

- Challenges managing for changes in fishing practices and technology that can increase fishing effort and fishing costs (Bradshaw, Williamson and Wood, 2000; Dichmont et al., 2012)
- Challenges managing effort across multiple fishing fleets (Dichmont, Pascoe, Jebreen and Pears, 2013)
- Lack of direct management control on individual species in multi-species fisheries (Jakupsstovu et al., 2007)

Importantly, experiences with transferable effort share programs show that they are a significant improvement

over open access fishing and other input-based regulations that do not define individual transferable shares. The mixed performance of transferable effort share programs should not preclude their use, but rather highlight the importance of assessing fishery characteristics, determining whether an appropriate program can be designed to meet the fishery's goals and frequently reviewing and modifying the program as needed.

Fisheries managed under transferable effort shares commonly transition to a catch share approach over time. Often, fisheries management agencies start off with very limited capacity to set catch limits and monitor catch or landings. Transferable effort share programs establish many elements of a good fishery management system that can be applied to a catch share approach, specifically defining and allocating secure privileges. For example, Australia has moved many fisheries managed with transferable effort shares to catch share approaches over the past two decades. See **Step 7.4** for more detail on using a transferable effort share program to transition to a catch share.

UNDER WHAT CONDITIONS SHOULD TRANSFERABLE EFFORT SHARES BE CONSIDERED?

Transferable effort share programs for fisheries are often considered to improve management performance in the absence of catch limits and catch-monitoring systems (Townsend et al., 2006). Many fisheries implement transferable effort share programs as a step towards evolving more effective management and eventually implement a catch share program. Additionally, transferable effort share programs can be used as an appropriate mortality control within Cooperative catch shares and Territorial Use Rights for Fishing (TURFs). For more information on the design of Cooperative catch shares and TURFs, see **Volumes 2 and 3** of the **Catch Share Design Manual**.

Catch limits can be difficult to set for a number of reasons: biology of the stock (such as unpredictable fluctuations in abundance), number of species included in the program, availability of data and capacity for assessment. Setting an accurate effort cap does not necessarily require less data

or capacity for assessment, but requires different data and different capacities. Setting catch limits generally requires estimating changes in stock size (biomass) over time. In contrast, setting effort caps generally requires estimating and adjusting to changes in the proportion of the stock removed by fishing effort (catchability). Effort caps may be more biologically accurate than catch limits when dealing with biomass changes that are hard to estimate and predict due to uncertainties in growth, recruitment and stock assessments (Baudron et al., 2010). However, effort caps depend on reliable estimates of catchability and therefore may be less appropriate if no clearly established relationship exists between the fishing effort and fishing mortality, or if there are unpredictable changes in fishing practices.

Transferable effort share programs can use a single effort cap, such as the amount of gear permitted, to manage

fishing mortality across many species. Most transferable effort share programs apply a fishery-wide effort cap that includes effort expended on all co-caught species. In these situations, weak stocks—those that have been fished beyond target levels and are not abundant—may be subject to excessive fishing pressure if effort caps are not adjusted appropriately. Furthermore, it may be possible for fishermen to selectively target specific co-caught stocks, increasing the threat of overfishing. While this is not biologically ideal, as it can threaten the sustainability of low-abundance stocks, it may be appropriate as an incremental step towards improved management of all species caught together.

Transferable effort share programs are also frequently considered in fisheries where fishermen's catch is not easy to monitor. Catch can be difficult to track in fisheries that span multiple jurisdictions, have many unmonitored landing locations, or have informal markets for fishery products. In these cases, effort use may be easier to track. For example, the Western Pacific Ocean Purse Seine Vessel Day Scheme uses vessel monitoring systems to track vessel locations and determine how many fishing days a vessel uses (Shanks, 2010).

SNAPSHOT A | Defining Fishing Effort

Fishing effort is often poorly defined and difficult to measure. While definitions vary, fishing effort is generally considered the amount of fishing taking place in a fishery. It is measured by the amount and use of fishing inputs, including size/power of vessels, number of days deployed and type of gear used. Measuring fishing effort is challenging because most fisheries employ a large number of fishing inputs and vessel operators may use them differently. While these challenges can be taken into account, most assessments of fishing effort are based on an approximation, using a single input or small combinations of inputs and their use.

Some management bodies use a specialized definition of fishing effort. For example, the European Union defines fishing effort as a function of vessel tonnage, engine power and days at sea. These definitions should be considered in the context of your fishery.

SNAPSHOT B

How to Use this Supplement to Design an Effective Transferable Effort Share Program

This supplement to the **Catch Share Design Manual** is intended to help you—whether you are a manager, a fisherman, a scientist or another interested party—design successful transferable effort share programs. Specifically, it guides you through the design process step by step, and discusses various design elements in detail, including how they may address biological, economic and social goals. This supplement should be used in conjunction with **Volume 1** of the **Catch Share Design Manual**, as well as additional research, analysis and expert consultation in order to design the most appropriate transferable effort share program for your fishery.

Volume 1 of the **Catch Share Design Manual** outlines a step-by-step approach to designing catch shares. Design of transferable effort share programs also involves many of these decisions, and this supplement follows the same design steps, expanding upon the decisions that are specific to transferable effort share programs. **Steps 2** and **4** differ significantly for transferable effort share programs: these focus on defining an available effort unit, setting effort caps and defining an effort-based privilege.

Step 1 – Define Program Goals

Step 2 – Define and Quantify the Available Effort Unit

Step 3 – Define Eligible Participants

Step 4 – Define the Effort Privilege

Step 5 – Assign the Effort Privilege

Step 6 – Develop Administrative Systems

Step 7 – Assess Performance and Innovate

Each design step has a series of sub-steps. Many of the sub-steps in this volume overlap with **Volume 1**, but some are unique to transferable effort share programs. Design decisions that are common to both are summarized in this supplement, but more detailed information about them is found in **Volume 1**. As such, it is recommended that **Volume 1** be used as a companion to this supplement.



WHAT ARE THE KEY PRINCIPLES OF TRANSFERABLE EFFORT SHARE DESIGN?

Volume 1 of the **Catch Share Design Manual** outlines 13 design principles that reflect lessons learned from around the world and offer basic rules of thumb for a successful catch share program. Transferable effort share programs include many of the same underlying design principles, as well as others that are specific to effort-based programs. The appropriate design principles are summarized here and modified where appropriate. The principles are discussed in further detail in the design steps in this supplement.

Basic Transferable Effort Share Design Principles

- 1 Design the transferable effort share program based on clearly articulated goals with measures of success.
- 2 Consider including in the transferable effort share program species that are commonly caught together. Transferable effort share programs may be more appropriate and successful for single-species fisheries.
- 3 Define the effort unit to ensure a strong relationship with fishing mortality.
- 4 Create effort caps that account for all species, stocks and zones in the fishery.
- 5 Set effort caps at levels that will achieve sustainable stocks, and frequently review and adjust to account for increases in catch efficiency resulting from changes in fishing practices and technology.
- 6 Develop mechanisms for accommodating new entrants during the design of the transferable effort share program and prior to allocation of effort shares.
- 7 Allocate effort shares for sufficient tenure to provide stability for shareholders and associated industries. This can be achieved by allocating for significant periods of time with a strong assumption of renewal, provided rules are adhered to.
- 8 Employ percentage shares, when possible, of the overall cap rather than absolute effort units for long-term shares.
- 9 Allow temporary and/or permanent transferability of effort shares.
- 10 Develop a transparent, independent allocation process that is functionally separate from the rest of the design process. Allocations that retain the relative equity positions of stakeholders are the least contentious.
- 11 Employ an allocation appeals process that allows eligible participants to refute allocated amounts with verifiable data.
- 12 Encourage cost-effective, transparent trading that is easy for all participants.
- 13 Employ transparent effort accounting completed regularly enough to ensure the effort cap is not exceeded.
- 14 Design and implement a fishery information system that keeps costs low and is effective for conducting effort accounting, collecting scientific data and enforcing the law.
- 15 Assess performance against goals and encourage innovation, including a transition to a catch share program, to improve the program over time.

STEP-BY-STEP DESIGN

Checklist

Step 1

Define Program Goals

- Identify the program's biological and ecological goals
- Identify the program's economic goals
- Identify the program's social goals
- Balance trade-offs

Step 2

Define and Quantify the Available Effort Unit

- Determine which species will be included
- Determine which stocks will be included
- Determine the spatial range and identify zones
- Determine the effort unit
- Determine the effort cap for each species and sector

Step 3

Define Eligible Participants

- Decide if the privilege will be allocated to individuals or groups
- Determine who may hold and fish effort shares
- Establish limits on the concentration of effort shares
- Determine how new participants will enter the fishery

Step 4

Define the Effort Privilege

- Determine the tenure length of the effort privilege
- Define the long-term effort share
- Determine the annual allocation unit
- Decide if effort privileges will be permanently and/or temporarily transferable
- Determine any restrictions on trading and use of effort shares

Step 5

Assign the Effort Privilege

- Establish a decision-making body for initial allocation
- Determine when allocation will occur
- Establish an appeals process
- Determine who is eligible to receive effort shares
- Decide whether initial effort shares will be auctioned or granted
- Determine how many effort shares eligible recipients will receive
- Identify and gather available data for allocation decisions

Step 6

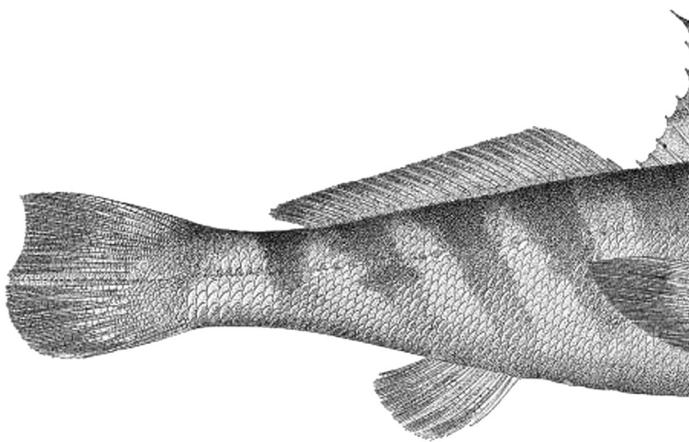
Develop Administrative Systems

- Establish how trading will occur
- Determine how effort accounting will work
- Determine what fishery information is required for science, effort accounting and enforcement
- Determine who covers the program cost

Step 7

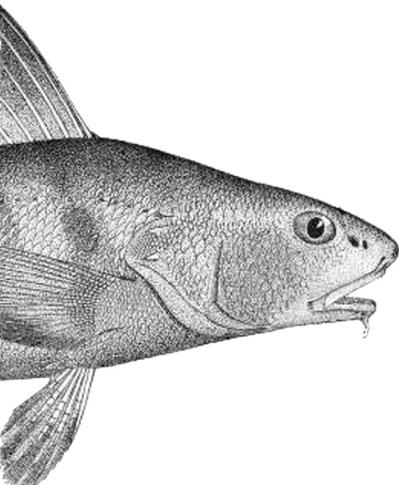
Assess Performance and Innovate

- Conduct regular program reviews
- Assess performance against goals
- Encourage innovation
- Consider transitioning to a catch share program



Step
1

Define Program Goals





At a Glance

Defining goals is perhaps the most important step to ensure a well-designed transferable effort share program. Goals should be clearly articulated prior to transferable effort share design: They will drive design decisions and provide a basis for evaluating success.

KEY PRINCIPLES

Design the transferable effort share program based on clearly articulated goals with measures of success. | [12](#)

SUB-STEPs

- 1.1 What are the program's biological and ecological goals? | [12](#)
- 1.2 What are the program's economic goals? | [12](#)
- 1.3 What are the program's social goals? | [13](#)
- 1.4 Balance trade-offs. | [14](#)

SPECIAL FEATURES

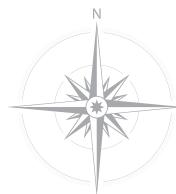
Meeting Biological and Ecological Goals: Australian West Coast Rock Lobster Fishery | [13](#)
Challenges Meeting Economic Goals: United States Florida Spiny Lobster Trap Certificate Program | [14](#)

Define Program Goals

The first and most important step to designing a transferable effort share program is to clearly define program goals. Transferable effort share programs will have many of the same goals as catch shares. In this step, common goals are highlighted, with an emphasis on those that are often identified for transferable effort share programs. Goals may be defined by fishery managers, fishermen and other stakeholders. Defining program goals will inform decisions throughout program design and provide a basis on which to evaluate performance.

DESIGN PRINCIPLE

Design the transferable effort share program based on clearly articulated goals with measures of success.



1.1

WHAT ARE THE PROGRAM'S BIOLOGICAL AND ECOLOGICAL GOALS?

Biological and ecological goals are generally the most important for fisheries management. Common goals include preventing or ending overfishing, rebuilding overfished stocks, reducing non-target catch and reducing habitat impacts due to fishing. Transferable effort share programs have often been designed to reduce fishing

effort with the goal of lowering fishing mortality on target and non-target stocks. Lower levels of fishing effort can also reduce habitat impacts by establishing limits on the amount of fishing inputs and the frequency or duration of their use.

1.2

WHAT ARE THE PROGRAM'S ECONOMIC GOALS?

Economic goals are commonly identified as critical to the design and success of transferable effort shares. Common economic goals include reducing overcapitalization, including fishing effort, increasing catch-per-unit-effort and economic returns from fishing, and cost-effective fisheries management.

Transferable effort share programs are commonly implemented in fisheries where managers and fishermen have identified overcapitalization as a current or future problem. Overcapitalization is present when fishing capacity or fishing effort exceeds the amount required

to harvest sustainably. Overcapitalization increases fishing costs and can lead to overfishing. Transferable effort share programs directly set targets for fishing effort based on effort caps, potentially reducing problems with overcapitalization. However, effort caps are not a guarantee that effort and capacity will actually meet targets. Effort can increase through the use of non-regulated inputs and development of new technology. Program design should account for this potential risk, and changes in fishing practices should be assessed frequently to inform program modifications.

SNAPSHOT 1.1 | Meeting Biological and Ecological Goals**Australian West Coast Rock Lobster Fishery**

The Australian West Coast Rock Lobster Fishery has a long and relatively successfully history of using transferable effort shares to control fishing mortality. The program demonstrates how a well-defined effort unit and frequent review (to inform adjustments of effort caps and program design) can help to achieve biological and ecological goals.

The transferable effort share program was first implemented in the 1960s in response to increasing fishing pressure in the open access fishery. The program defines the effort unit as the use of a pot for the fishing season. The number of pots available and the season length are adjusted to achieve target effort levels. Frequent reviews allowed effort caps to be changed in response to changes in the use of pots, the effectiveness of pots and information about the rock lobster population. A key biological performance indicator, the abundance of the breeding stock, was maintained near target levels from the 1960s to the 2000s. In 2000, the fishery was the first ever to become a Marine Stewardship Council certified fishery.

In the mid-2000s, assessments indicated that stock status was on the verge of declining, as recruitment into the fishery appeared to be low. Following a formal review process examining fishery status, goals and management options, the fishery transitioned to an Individual Transferable Quota (ITQ) program in 2010. An ITQ was selected to better manage catch while also improving economic conditions. It gave fishermen greater flexibility and eliminated the competition to increase shares of the catch that is inherent to effort-based systems (Reid, Caputi, Lestang and Stephenson, 2013).

1.3**WHAT ARE THE PROGRAM'S SOCIAL GOALS?**

Social goals generally reflect the character and makeup of fishing fleets and communities, and are often identified to ensure fairness and equity. These goals can be expressed in a number of ways, including promoting certain fleet structures, limiting consolidation and concentration, promoting domestic fishing industries and more. Social

goals often focus on the importance of fairness and the distribution of benefits from fishing activities. Transferable effort share programs can include many design elements to achieve social goals, including eligibility requirements, trading provisions and concentration limits.

SNAPSHOT 1.2 | Challenges Meeting Economic Goals

United States Florida Spiny Lobster Trap Certificate Program

The United States Florida Spiny Lobster Trap Certificate Program was implemented in 1991 with a primary goal of reducing effort in order to increase the catch per trap used in the fishery, and reduce congestion and conflict on the water. Significant decreases in seasonal catch per trap had occurred leading up to the implementation of the program, declining from 24.1 kilograms in the 1969-70 season to 3.1 kilograms in 1991-92, while total catch remained relatively constant. Over the same time period, fishermen made large investments, increasing the number of traps used each season from 91,000 to 850,000.

The Trap Certificate Program set effort caps in the form of a total number of traps allowed and allocated effort shares to fishermen. The program proposed a steady reduction in the number of traps by a fixed percentage each year (Ehrhardt and Deleveaux, 2009), although these have been delayed due to extensive debate and an unclear effort target (Larkin and Milon, 2000). Although catch efficiency per pot has increased over the lifetime of the Trap Certificate Program (Ehrhardt and Deleveaux, 2009), the program has not achieved the economic benefits that could result from more appropriate effort caps (Larkin and Milon, 2000). If the effort caps had been lowered, as designed, the program might be better meeting economic goals. This program highlights the need to establish a clear science-based target for effort caps and adhere to predefined mechanisms to adjust effort caps as needed.

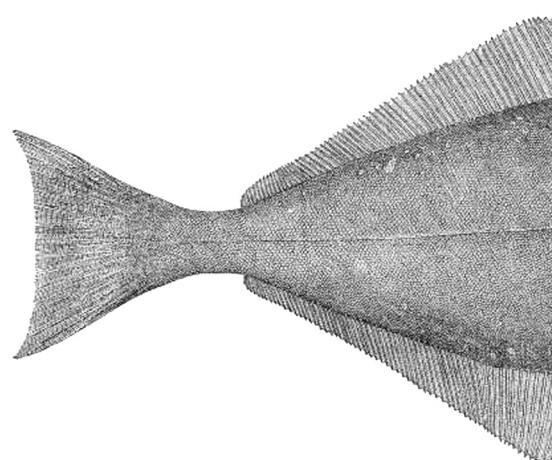
1.4

BALANCE TRADE-OFFS

There may be tension between various identified goals, and managers and stakeholders should be clear about which objectives are most important for program design. Biological goals are paramount, as managers are generally required by law to meet specific biological goals, and well-managed fish stocks are essential to achieving economic and social goals. Achieving some goals may require trade-offs with others. For example, the biological goals of conserving fish stocks often require design features to standardize fishing inputs and their use by fishermen.

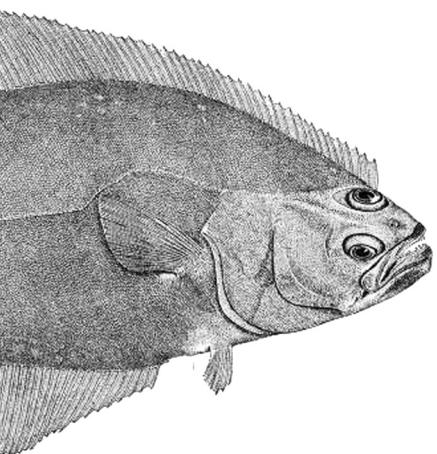
These regulations may be at odds with economic and social goals of promoting innovations in fishing practices and creating a fleet with diverse characteristics.

Design decisions for a transferable effort share program should be made with reference to clear goals, recognizing that trade-offs may be necessary. Ranking goals by importance and revisiting them over time can ensure the program is meeting its objectives.



Step
2

Define and Quantify the Available Effort Unit





At a Glance

Defining and quantifying the available effort unit provides the basis for the transferable effort share program. By carefully completing this step, you will ensure that you have clearly defined the effort unit and set appropriate effort caps.

KEY PRINCIPLES

Consider including in the transferable effort share program species that are commonly caught together. Transferable effort share programs may be more appropriate and successful for single-species fisheries. | [19](#)

Define the effort unit to ensure a strong relationship with fishing mortality. | [21](#)

Create effort caps that account for all species, stocks and zones in the fishery. | [23](#)

Set effort caps at levels that will achieve sustainable stocks, and frequently review and adjust to account for increases in catch efficiency resulting from changes in fishing practices and technology. | [24](#)

SUB-STEPS

2.1 Which species will be included? | [18](#)

2.2 Which stocks will be included? | [19](#)

2.3 What will the spatial range be and will different zones be created? | [19](#)

2.4 What will the effort unit be? | [20](#)

2.5 What will the effort cap be for each species and sector? | [22](#)

SPECIAL FEATURES

Multiple Zones: Eastern Tuna and Billfish Fishery | [20](#)

Examples of Effort Units from a Selection of Transferable Effort Share Programs | [22](#)

Changes in Fishing Practices: Tasmanian Red Rock Lobster Fishery | [24](#)

Define and Quantify the Available Effort Unit

Defining and quantifying the available effort unit is important for determining how the transferable effort share program will be designed to effectively limit fishing mortality. In this step you will determine which species, stocks and zones will be included, clearly define the effort unit and set appropriate effort caps.

2.1

WHICH SPECIES WILL BE INCLUDED?

Transferable effort share programs can be used in single-species or multi-species fisheries. It is important to consider which species are commonly caught together and whether effort can be effectively regulated across multiple species to achieve sustainability. Multi-species fisheries are often more complex to manage. Effort regulations may provide a broad limit on fishing mortality for all species caught together, but it requires careful consideration when setting effort caps, discussed in **Step 2.5**. Species, zone and stock-specific measures can be added to the program to meet biological goals, such as conserving sub-stocks or critical habitat.

Single-species fisheries



Single-species transferable effort shares allow effort units to be used to target a single species caught in the fishery. This approach is common where there is a single target species and little or no non-target catch. If there are significant interactions with non-target species, then it is advisable to consider a multi-species transferable effort share program.

Multi-species fisheries



Multi-species transferable effort share programs allow effort units to be used to target a set of species commonly caught together. Transferable effort share programs can manage multi-species fisheries but require careful consideration and design since the effort unit will likely have varying impacts on all species included in the program.

Including more species introduces clear tradeoffs.

Transferable effort share programs manage mortality on a number of species and can be relatively easy to monitor in

complex, multi-species fisheries. However, species often vary in terms of their stock status, abundance, ability to be selectively targeted, catchability and more. A single effort cap applies a one-size-fits-all approach that may not account for these differences and may lead to under or over harvest of various species. To achieve biological goals and conserve weak, depleted species, it may be necessary to set effort caps that can restrict the catch of more productive and abundant species. Transferable effort shares also limit fishermen's flexibility to adjust fishing inputs and input use to achieve a catch composition that balances harvest and conservation of more than one species.

If using and conserving multiple species are important economic and biological goals, you should consider a catch share that sets and assigns quota-based or area-based privileges for each species or species-group and allows fishermen to innovate to meet goals.

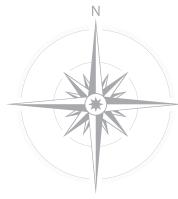
Bycatch

Bycatch refers to any non-target species that are incidentally caught and discarded. Bycatch can be a commercially valuable species that is not allowed to be landed in the fishery or it can be non-marketable or prohibited species that is discarded. Transferable effort share programs can regulate the catch of bycatch in much the same way as target species. By limiting the amount of effort units available, bycatch can be reduced. However, bycatch should be considered when setting appropriate effort caps to ensure these species are not threatened by overfishing.

Additionally, any species that is caught but is not allowed to be kept under the program will become bycatch. This

DESIGN PRINCIPLE

Consider including in the transferable effort share program species that are commonly caught together. Transferable effort share programs may be more appropriate and successful for single-species fisheries.



may work well in instances where discarded species have a high survival rate, but can also be detrimental to economic goals for the fishery if discarded species are

marketable. Information on bycatch should be collected and incorporated into program reviews.

2.2

WHICH STOCKS WILL BE INCLUDED?

Many fisheries encounter multiple, biologically distinct fish stocks. Transferable effort shares can manage different fish stocks in a method similar to managing multiple species. A transferable effort share program should apply to all stocks

caught together, and those with low abundance should be considered during the process of setting effort caps, similar to the treatment of multi-species fisheries. Setting effort caps is discussed in more detail in **Step 2.5**.

2.3

WHAT WILL THE SPATIAL RANGE BE AND WILL DIFFERENT ZONES BE CREATED?

The spatial range of a transferable effort share program can be customized and is largely related to species and stock boundaries. Existing political or socio-cultural boundaries may be important in defining managed areas, while biological and social considerations often determine whether zones are defined within the fishery's boundaries. Transferable effort share programs can make area-specific regulations to prevent local stock depletion or to specify more efficient spatial allocation of effort (Summary Report, 2012). Effort units should be defined with a clear specification for the spatial range in which they can be used.

Biological considerations

Spatial range and zone boundaries of transferable effort shares are usually driven by the species and stock biology. Fishing pressure often has variable impacts on stocks based on the location in which it is applied. For example, fishing pressure applied on spawning grounds or other critical habitats may have large impacts on the fish stocks' ability to replenish. Additionally, fishing effort may be highest in

areas where costs are low and catch rates are high, leading to localized depletion in some areas. Zone boundaries with specific regulations related to the use of effort units can be established to spread effort across the grounds or protect critical areas. However, establishing multiple zones will require administration systems to monitor and enforce spatial management. See **Step 2.5** for information on setting effort caps.

Social considerations

Social goals can also be accommodated through zones. The effort of certain participants or groups of participants can be assigned to different zones based on social consideration and other characteristics. For example, specific zones can be established for participants from historical fishing communities to maintain access and promote the communities' fishing fleet.

For more detail on how to use zones to manage social and biological goals, see **Step 2.3 of Volume 1 of the Catch Share Design Manual**.

SNAPSHOT 2.1 | Multiple Zones

Eastern Tuna and Billfish Fishery

In the Eastern Tuna and Billfish Fishery, a transferable effort share program was used during the 2009 season to reduce fishing mortality on key target species. The program allocated shares of the effort cap to participants, defining the effort unit as the deployment of a hook in the fishery during the season and allowing harvest of five target species. The fishery manages a number of zones, some of which have a significantly higher risk of harvesting bycatch species, including turtles, sharks and seabirds. To discourage the use of effort in these areas, a conversion rate was applied to effort shares based on where they were used. Participants' available effort units were based on both their shares and the location of fishing. For example, in one zone, a participant's shares could result in 100 hooks available for use, whereas the same shares in another zone could result in 90 hooks. This system discouraged the use of available effort from highly sensitive areas by effectively reducing the value of effort units used in these areas (Pascoe, Wilcox, Dowling and Taranto, 2010). The fishery transitioned to an Individual Transferable Quota Program for the 2011-12 fishing season, which allowed for improved control over catch and catch composition in the multi-species fishery.

2.4

WHAT WILL THE EFFORT UNIT BE?

The effort unit is the basis for management in a transferable effort share program and should be well defined to meet fishery goals. Defining an effort unit involves choosing a fishing input and a measure of use, such as duration or frequency. A well-defined effort unit should closely correlate to fishing mortality. It should not be easy to substitute for effort units by using non-regulated inputs.

Selecting a fishing input

Fisheries often employ a large number of fishing inputs including gear, vessel size, vessel power, fuel and more. An ideal effort unit would account for all of these inputs to control for changes in catch efficiency. However, the ability to do so require extensive data, may be prohibited by law and may be costly to monitor and administer. Therefore, a single fishing input such as gear or vessel size is often used to approximate effort. Successful transferable effort share programs select a fishing input that: is used by all participants in the fishery; has a clear, direct relationship to fishing mortality; and, cannot easily be substituted for through the use of other inputs. Input substitution can lead

to greater catches for each effort unit, increase fishing costs and lead to overcapacity.

Effort units are frequently determined by the gear or vessels used in a fishery. Gear-based effort units are often defined as the gear allowed to be used in the fishery, such as traps, pots, trawls and hook and line, and stipulations on the use of that gear. If more than one gear type is used, an effort unit can be defined for each sector of the fishery. However, it may be necessary to account for differences in the impact on fish stocks from each sector's use of effort units and ensure that total effort does not exceed sustainable levels.

Vessel-based effort units allow the use of a vessel for some defined period, often a day. Vessel-based effort units restrict the use of all fishing inputs used, but do not directly control the vessel characteristics, amount of gear and other dimensions of effort. Vessel-based programs have been used in the Faroe Islands, Falkland Islands, Western Pacific and many other locations.

Effort units are almost always based on a single dimension of fishing effort and therefore, regulations may be placed

on fishing inputs to standardize their use or to decrease input substitution. For example, the United States Florida Spiny Lobster Trap Certificate Program limits trap size and construction to maintain a relatively homogenous fleet and limit changes in fishing practices over time that could increase catch efficiency of each pot (Larkin and Milon, 2001). However, these regulations may decrease the economic performance of the fishery as they limit fishermen's flexibility to innovate and lower fishing costs through the use of different mixes of inputs.

Duration or frequency of use

The use of fishing inputs can vary greatly in duration and frequency. Changes and differences in the use of fishing inputs can be a major source of uncertainty in defining fishing effort. Transferable effort share programs often define the terms of use for fishing inputs to address this challenge. Duration refers to the length of time during which the input is used, often a season or a day. Frequency refers to how often an input is used, such as a single pull of a trap or a single trawl tow. It is important to incorporate use restrictions into the definition of the effort unit in order to achieve biological and economic goals, as unchecked use

of a regulated input can lead to unsustainable increases in fishing pressure and higher fishing costs.

Regulating other fishing inputs

Transferable effort shares often limit the use of just one dimension of effort. While the effort unit should be defined with an input that has a direct relationship to fishing mortality and cannot be easily substituted for, it may be necessary to regulate the use of other fishing inputs as well. For example, if the effort unit is defined as the use of a vessel for a day, increasing horsepower of engines and capacity could lead to unsustainable increases in catch. Limitations on vessel characteristics—such as length, capacity and engine power—may be required to ensure larger and more powerful vessels are not used to increase catch to unsustainable levels. Regulating the characteristics of fishing inputs may be important to achieving biological goals.

There are distinct economic drawbacks to regulating fishing inputs. Regulations limit operators' flexibility to adjust to changing fishing conditions and to innovate to fish more effectively and lower costs. However, they may be necessary to achieve biological goals for the fishery.

DESIGN PRINCIPLE	<p>Define the effort unit to ensure a strong relationship with fishing mortality.</p>	
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TABLE 2.1 | EXAMPLES OF EFFORT UNITS FROM A SELECTION OF TRANSFERABLE EFFORT SHARE PROGRAMS

PROGRAM	FISHING INPUT REGULATED	DURATION OR FREQUENCY OF USE
Tasmanian Red Rock Lobster Fishery	Fishing pot	Season
Australian West Coast Rock Lobster Fishery	Fishing pot	Season
U.S. Florida Spiny Lobster Trap Certificate Program	Lobster trap	Season
Australian Eastern Tuna and Billfish Fishery	Hooks	Season
Australian Squid Jig Fishery	Fishing jig (hook and line)	Season
Faroe Islands Demersal	Vessel	Day
Western Pacific Ocean Purse Seine Vessel Day Scheme	Vessel	Day
Australian Queensland East Coast Trawl Fishery	Vessel	Night
Western Australia Demersal Finfish Trap Fisheries	Traps	Season

2.5 WHAT WILL THE EFFORT CAP BE FOR EACH SPECIES AND SECTOR?

Appropriately set effort caps are one of the most important aspects of a transferable effort share program. An effort cap, also known as total allowable effort, determines the number of effort units available to the fishery in a given fishing season. The primary goal in setting the effort cap is to ensure enough fish remain in the population to reproduce and replenish fish stocks at productive levels. There is significant literature and experience regarding how to set appropriate effort caps. This literature and experience continues to evolve and inform new methods to increase the accuracy and range of fisheries in which effort caps can be set. This discussion provides a brief overview of effort caps in the context of designing a transferable effort share program.

The effort cap is generally set by calculating the number of effort units that would achieve the target fishing mortality rate to ensure stocks are not overfished. Common targets included fishing mortality to achieve maximum sustainable yield (MSY), the level at which the fishery would be expected to maximize harvests, or maximum economic

yield (MEY), the level at which the fishery would be expected to maximize profits.

Data requirements for transferable effort share programs can be simple or highly complex depending on the goals of the program, data availability and the funds available for monitoring and assessing the fishery. Formal assessments for effort caps require an estimate of catchability, knowledge of the proportion of a fish stock removed by a unit of effort and a clearly defined target for fishing effort. Effort caps have also often been set in data-limited situations where a formal assessment may not be possible. In these situations, a historical effort level or a reduction from current effort is often specified. These can be developed alongside systems to collect additional data and eventually set more robust effort caps. Independent of the level of data available and capacity for formal assessments, effort caps should be set in consideration of:

- the status of all species that are commonly caught together in the program;

- significant differences in the fishing practices and/or fishing inputs of eligible participants; and,
- short-term and long-term changes in the relationship between effort units, catch and fishing mortality due to changes in fishing practices.

Setting effort caps in multi-species fisheries

While effort caps can be set in multi-species fisheries, they require additional consideration. Different species in a fishery will likely have different levels of abundance and productivity, and fishermen may have the ability to target some more selectively than others. A single effort cap can control mortality on many species, but must take these differences into account to ensure allowable effort does not cause unsustainable levels of fishing pressure on any stock. There are clear trade-offs in using an effort cap in multi-species fisheries. Applying a precautionary effort cap based on any stock or stocks at risk of depletion can ensure biological sustainability but also lead to underuse of species that are more productive and abundant (Baudron et al., 2010). Alternatively, applying a single effort cap based on productive and abundant stocks can allow for greater utilization of them, but will compromise the sustainability of any species that are depleted (Baudron et al., 2010).

Additionally, if species are caught in different areas or in different seasons, spatial and seasonal measures can be included in the effort caps. For example, the transferable effort share program used in the Faroe Plateau mixed demersal fisheries clearly defines spatial regulations and differentiates gears (Baudron et al., 2010), although concerns exist over whether the effort caps are being set consistent with scientific recommendations (Baudron et al., 2010).

Setting effort caps in multi-sector fisheries

Transferable effort share programs are commonly used in fisheries where there is a distinct fishing fleet with similar gear, gear use and vessel characteristics. However, fisheries with multiple distinct fleets or significant differences between fishing vessels have also occasionally used transferable effort share programs. In multi-sector fisheries, it may be necessary to set sector-specific effort caps and assess the impact of fishing mortality from the use of effort units from each. The total use of effort units should not exceed the fishery-wide effort caps. Effort equivalence, or standardization of effort across diverse types of fishermen, may be necessary if sectors differ significantly and/or trading between sectors is allowed.

Changes in fishing practices and technology

While transferable effort share programs restrict the use of one dimension of fishing effort, limitations on the use of one or more fishing inputs will often be countered by long-term changes in the use of other inputs and technological change (Summary Report, 2012). Changes in fishing practices, including the use of new technologies and gear, all change catch efficiency of effort units and can substantially impact the relationship between effort and fishing mortality (Marchal et al., 2007). This requires effort caps to be adjusted in order to keep fishing pressure near target levels, or standardization of fishing inputs to limit changes. Transferable effort share programs must determine how changes in fishing practices and technology will be managed in consideration of trade-offs. Standardizing fishing inputs limits technological innovations and improvements in fishing efficiency that can lower fishing costs and achieve economic goals. Adjusting effort caps in response to changing fishing practices allows for changes, but may require greater monitoring and assessment.

DESIGN PRINCIPLE

Create effort caps that account for all species, stocks and zones in the fishery.



SNAPSHOT 2.2 | Changes in Fishing Practices

Tasmanian Red Rock Lobster Fishery

The Tasmanian Red Rock Lobster Fishery was managed under a transferable effort share program from 1972 to 1998, when an Individual Transferable Quota (ITQ) program was implemented with industry approval. The fishery targets red rock lobster, *Jasus edwardsii*, using pots. The transferable effort share program defined the effort unit as the use of a pot within the fishing season. The management plan limited vessels and pots, but did not effectively adjust effort caps to account for new technologies that increased the effectiveness of each pot and vessel. The use of global positioning technology and fish finders allowed fishermen to place pots more precisely, leading to higher fishing mortality. Changes in the market for red rock lobster and spatial fishing patterns were also not appropriately incorporated into effort caps. By the mid-1990s, it was apparent that the management system was not effectively controlling fishing mortality through the transferable effort share program. At the same time, it was clear that reducing pot numbers to reduce fishing mortality to target levels would be politically infeasible. Building off success of a catch share program for Tasmanian abalone, the red rock lobster fishery transitioned to an ITQ program in 1998. Pot allocations were translated into catch-based quota shares (Bradshaw et al., 2000). A parallel evolution from tradable effort to catch share management has occurred in all rock lobster fisheries in the three other southern Australian states.

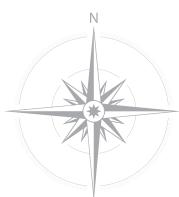
Long-term reductions in effort

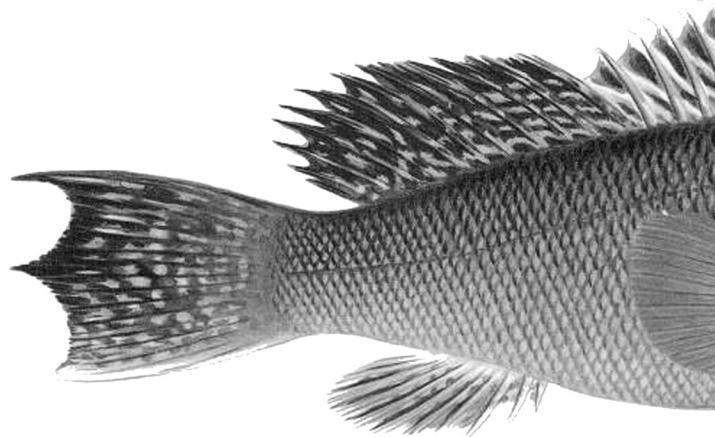
A common goal of transferable effort share programs is to reduce fishing effort to achieve biological and economic goals. However, reducing effort caps can be a politically challenging process. Many transferable effort share programs have had limited biological and economic performance due to resistance to reduce effort caps to sustainable levels (Baudron et al., 2010; Larkin and Milon,

2000). Additionally, the effectiveness of fishing effort is likely to increase over time, requiring future reductions in effort caps. Fishery managers and fishermen should expect that reductions in the effort cap will be necessary to achieve biological and economic goals for the fishery, and they should create clear targets based on available data and assessments.

DESIGN PRINCIPLE

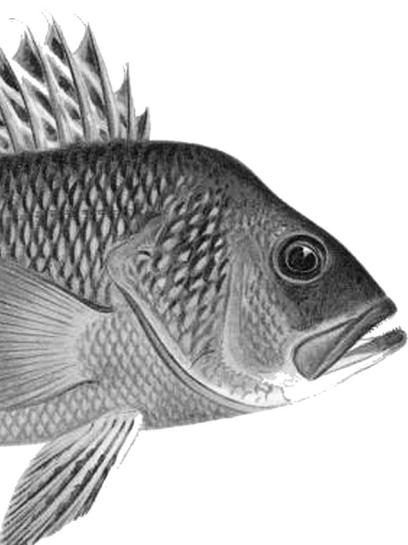
Set effort caps at levels that will achieve sustainable stocks, and frequently review and adjust to account for increases in catch efficiency resulting from changes in fishing practices and technology.





Step
3

Define Eligible Participants





At a Glance

In completing this step, you will identify the parameters for participation in the transferable effort share program. This will govern the ways in which current and future shareholders are permitted to operate within the program.

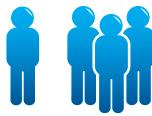
KEY PRINCIPLES	Develop mechanisms for accommodating new entrants during the design of the transferable effort share program and prior to allocation of effort shares. 31
SUB-STEPS	<ul style="list-style-type: none">3.1 Will the effort privilege be allocated to individuals or groups? 283.2 Who is allowed to hold and fish effort shares? 283.3 Will there be limits on the concentration of effort shares? 303.4 How will new participants enter the fishery? 30
SPECIAL FEATURES	Variable Annual Allocation Units: Falkland Islands Vessel Day Scheme 29

Define Eligible Participants

In this step, you will determine who is eligible to participate, whether any restrictions will be placed on participation and how new participants will enter the fishery. Existing management structures and laws may guide these decisions. For example, if limited licensing exists it may determine who the privilege holder will be. If your fishery is not currently managed through limited licensing, it may be incorporated into program design. These decisions are outlined in **Step 3 of Volume 1** of the **Catch Share Design Manual** and expanded upon for transferable effort share programs in this step.

3.1

WILL THE EFFORT PRIVILEGE BE ALLOCATED TO INDIVIDUALS OR GROUPS?



Transferable effort share programs allocate a secure share of the effort cap to individual privilege holders. Individual allocation ensures users have a secure share of the effort cap and can be held accountable for their effort use. An important goal of allocating shares is to eliminate, or minimize, the incentives for fishermen to competitively race for fish. Transferable effort share programs will not eliminate all of the incentives to increase catch, because fishermen will still be incentivized to catch the maximum possible with their share of the effort. However, by individually allocating shares you can reduce some aspects of competition. Catch share programs may allocate privileges to individuals or groups. Consider using a catch share program if you wish to allocate to groups.

Transferable effort share programs can also be used within group-allocated catch shares (Cooperative catch shares) and Territorial Use Rights for Fishing (TURFs) as an appropriate control on fishing mortality, if designed well. For example, the Baja California Regional Federation of Fishing Cooperative Societies (FEDECOOP) in Mexico allocates secure areas, or TURFs, to Cooperatives. In turn, Cooperatives manage the TURFs and typically allocate a set number of traps per boat to be used to harvest spiny lobster, *Panulirus interruptus*. Fishing teams operating each boat are responsible for reporting the number of traps used and the number of lobster caught (Leal, De Alessi and Baker, 2008). **Volume 3** of the **Catch Share Design Manual** provides design guidance for TURFs and **Volume 2** of the **Catch Share Design Manual** provides design guidance for Cooperative catch shares.

3.2

WHO IS ALLOWED TO HOLD AND FISH EFFORT SHARES?

You can identify who is eligible to both hold shares and participate in a transferable effort share program, as well as how those shares will be used throughout time. Establishing criteria and rules for eligible shareholders has often been important to participants and managers. Generally, criteria are identified to accommodate existing fishery participants, encourage fairness and promote a particular characteristic of the fishery in the short and long term, such as an owner-operated fleet. When determining these criteria, major consideration should be given to the relative position of current fishermen and their past participation.

Shareholder eligibility

There are a number of reasons to carefully consider who is allowed to hold transferable privileges and who may participate. Eligibility criteria will determine who receives initial allocations of effort shares as well as the nature of future participants.

Common considerations for determining eligibility include:

- Citizenship
- Participation in fisheries, as indicated by holding a license

- Membership in an identified cooperative
- Reliance on fishing for income
- Connection to the resource
- Investment in the fishery
- Catch history
- Gears employed
- Conservation behavior

Shareholder specifications

When determining eligibility requirements for a transferable effort share program, managers have often specified what gear may be used how it may be used and how it should be constructed. These specifications can standardize the use of the effort unit across eligible participants who may wish to employ different fishing practices.

You may also wish to specify requirements related to the use of effort units. These decisions often relate to who is allowed to fish the shares and whether the shareholder and the fishermen on the water must be one and the same. For example, fisheries often consider the impact of allowing “absentee owners,” or shareholders who do not actively engage in harvesting the resource. An owner-on-board provision is one option available to address this concern. This requires that the shareholder be present on the vessel when effort units are used, ensures that the benefits of fishing accrue to active fishermen and increases the likelihood that shares will be offered for sale, possibly enabling new entrants. However, owner-on-board provisions may also limit the flexibility of the program and create barriers to entry, as purchasing shares for new entrants can be more costly than leasing.

SNAPSHOT 3.1 | Variable Annual Allocation Units

Falkland Islands Vessel Day Scheme

The Falkland Islands government implemented a transferable effort share program for key fish stocks in 2007. The program design is intended to achieve economic goals through greater flexibility and security in the fishing sector. It encourages diversification of Falkland Island businesses, from harvesting to value-added activities such as domestic fish processing, and aims to increase efficiency of fishing fleets accessing fish stocks. The program is intended to maintain local ownership of fishing privileges while balancing the importance of foreign direct investments to the local economy (Harte and Barton, 2007). Additionally, the transferable effort share program was designed to be efficient to administer, given the limited fisheries management capacity of the small island state’s fisheries department.

The program has a number of sophisticated design features. One important feature is variable annual allocations of effort units based on vessel characteristics. Under this system, the effort unit is defined as a vessel-day, allowing operators to use a vessel for one fishing day. Vessels are assigned a catchability coefficient based on vessel characteristics. A shareholder’s annual allocation is based on the effort cap set for the season, the number of shares held and the vessel’s catchability coefficient. For example, vessels with lower coefficients will have a great annual allocation of effort units for every share held, while those with higher coefficients will receive fewer. Distinguishing the ability of vessels to catch fish, and incorporating this into the program design, reduces incentives for operators to make changes that increase their catch and can lead to overcapacity and overfishing.

3.3

WILL THERE BE LIMITS ON THE CONCENTRATION OF EFFORT SHARES?

A hallmark of transferable effort share programs is transferability of shares, which enables greater flexibility in the program and can help meet economic goals. With transferability, some participants may increase the number of effort shares they hold, while others may choose to reduce their effort shares and possibly exit the fishery while receiving payment for doing so. Transfers of shares are based on voluntary agreements and occur when they benefit the participants involved.

While transferability of effort shares creates clear benefits for participants, many transferable effort share programs wish to prevent “excessive” concentration and ensure a minimum number of participants. Concentration limits specify the maximum percentage of effort shares or number of effort units any one participant or entity can hold and/or fish, and are commonly incorporated into the program

design. Concentration limits are usually set at levels that reflect the structure and relative concentration of a fishery prior to implementing a new program. Managers should take the existing nature of the fishery and program goals into account when setting concentration limits.

Trade-offs

Concentration limits should be determined on a fishery-by-fishery basis in order to achieve program goals. There are clear trade-offs to using concentration limits. Concentration limits influence the number of fishery participants as well as the potential profitability of fishermen. Concentration limits are often used to meet certain social goals, such as maintaining a minimum number of shareholders and fishery participants. In these instances, managers may choose to set relatively low limits.

3.4

HOW WILL NEW PARTICIPANTS ENTER THE FISHERY?

New participants are vital to the longevity and continued operation of a fishery. A number of mechanisms exist to allow for new participants to enter over time, and are described below.

Lease or purchase of shares

The most straightforward way for new participants to enter a transferable effort share program is to lease or purchase shares from existing shareholders. New participants may need to satisfy eligibility requirements prior to leasing or purchasing shares.

Share holdbacks

Share holdbacks reserve effort shares at the outset of the program for the purpose of making them available at a later date for new entrants. Share holdbacks can be leased annually to new participants or allocated as long-

term shares at some time after initial allocation. To avoid conflict, the criteria for allocating any shares from a share holdback should be clearly established and transparent.

Share redistribution

Redistributing shares is another option for accommodating new entrants. In general, this involves taking some amount of shares from existing shareholders and redistributing them to new entrants. This approach can have a significant impact on existing participants and should be carefully considered. Requiring participants to return a portion of their shares may undermine the role of secure privileges in achieving biological and economic goals. If shareholders expect to have their shares reduced in the future, they may shift priorities and work to achieve greater catch in the short term rather than make investments to achieve long-term benefits from the fishery.

Financial assistance

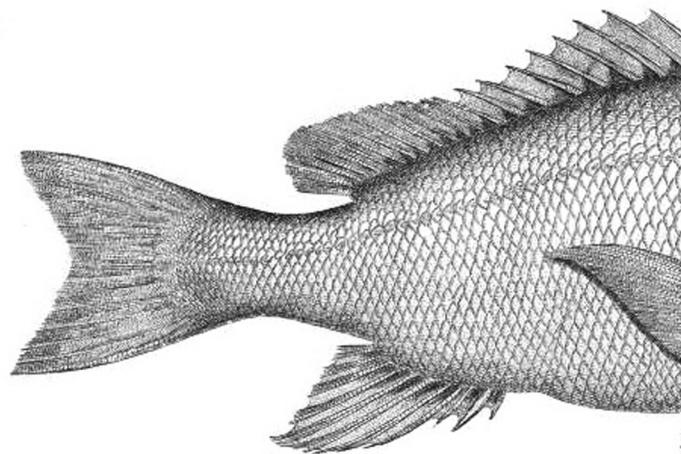
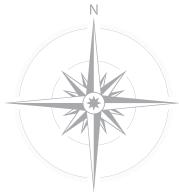
Financial assistance can also be provided to aid entry of new participants. Loans or other sources of capital can help new entrants acquire shares through leasing or purchase from existing participants.

Community-based permit banks

Permit banks can hold permits or shares for use by a set of fishermen, such as those operating out of a specific port. A permit bank holds and leases shares based on a set of criteria, which can include accommodating new entrants.

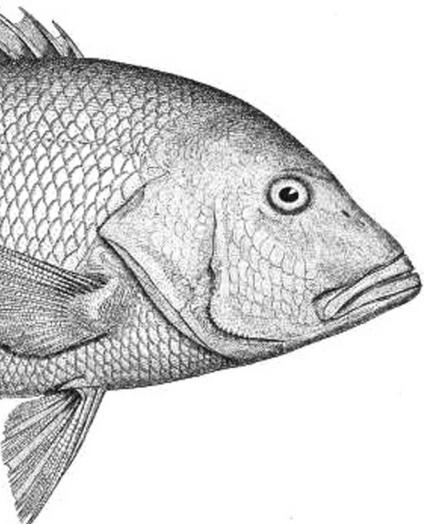
DESIGN
PRINCIPLE

Develop mechanisms for accommodating new entrants during the design of the transferable effort share program and prior to allocation of effort shares.



Step
4

Define the Effort Privilege





At a Glance

This step requires you to define the effort privilege and its main attributes. Many of these decisions will determine ongoing management of the program, as well as the stability and flexibility participants will have under the program.

KEY PRINCIPLES	<p>Allocate effort shares for sufficient tenure to provide stability for shareholders and associated industries. This can be achieved by allocating for significant periods of time with a strong assumption of renewal, provided rules are adhered to. 34</p> <p>Employ percentage shares, when possible, of the overall cap rather than absolute effort units for long-term shares. 34</p> <p>Allow temporary and/or permanent transferability of effort shares. 36</p>
SUB-STEPs	<ol style="list-style-type: none">4.1 For how long will the effort privilege be allocated? 344.2 How is the long-term effort share defined? 344.3 What will the annual allocation unit be? 354.4 Will the effort privilege be permanently and/or temporarily transferable? 354.5 Will there be restrictions on trading and use of shares? 36

Define the Effort Privilege

The next step in designing a transferable effort share program is to define the effort-based privilege and its main attributes. Effort-based privileges confer secure privileges (in the form of effort units) to participants to harvest species included in the program. Attributes are largely determined by program goals and help define use of the privilege. These decisions are outlined in **Step 4** of **Volume 1** of the **Catch Share Design Manual** and expanded upon for transferable effort share programs in this step.

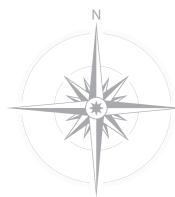
4.1 FOR HOW LONG WILL THE EFFORT PRIVILEGE BE ALLOCATED?

Adequate tenure of shares is important for providing stability and security to participants in the transferable effort share program and for encouraging stewardship. The tenure of shares should be long enough to provide stability in the program, allow fishermen to adapt and plan their businesses under the program and realize gains from

conservation activities, such as reduced effort and catch. Fishery managers have often allocated privileges for a set period of time with a strong assumption of renewal and the ability to revoke shares for violating program rules.

DESIGN PRINCIPLE

Allocate effort shares for sufficient tenure to provide stability for shareholders and associated industries. This can be achieved by allocating for significant periods of time with a strong assumption of renewal, provided rules are adhered to.



4.2 HOW IS THE LONG-TERM EFFORT SHARE DEFINED?

Since transferable effort shares are commonly allocated for more than one year, managers must determine the long-term share, or the privilege that is held from year to year. The long-term share is generally based upon either a percentage of the overall effort cap, or an absolute number of effort units. These approaches have a key difference. Under a percentage-based system, the number of effort units shareholders can use from year to year will vary based on changes in the effort cap. Under an absolute effort unit

approach, the number of effort units will stay constant from year to year.

Percentage-based systems may be preferable as they provide greater flexibility to change effort caps as needed to maintain target fishing mortality rates and conserve fish stocks. Adjusting the effort cap when shares are defined as an absolute number of effort units can be costly, as shares may need to be revoked or purchased from shareholders.

DESIGN PRINCIPLE

Employ percentage shares, when possible, of the overall cap rather than absolute effort units for long-term shares.



4.3

WHAT WILL THE ANNUAL ALLOCATION UNIT BE?

Most transferable effort share programs differentiate between the long-term share and annual allocation. While long-term shares provide participants secure access over multiple seasons, the annual allocation determines the extent of fishing allowed within each season. In transferable effort share programs, the annual allocation is the effort unit defined in **Step 2.4**. A participant's annual allocation, or number of effort units, is calculated based on long-term shares held and the effort cap for that year.

An annual allocation unit is clearly needed with a percentage-based approach so that shareholders know exactly how many effort units can use that season based on their long-term share. Separating the long-term share from the annual allocation facilitates trading, as participants can permanently buy and sell long-term shares or transfer an annual allocation of effort units for a single season.

4.4

WILL THE EFFORT PRIVILEGE BE PERMANENTLY AND/OR TEMPORARILY TRANSFERABLE?

Transferability is a required attribute of a transferable effort share program. Transferability increases flexibility in the program and can increase the fishery's value. Transferability allows participants to increase or decrease their holding to adjust for short- or long-term needs, and provides a mechanism by which new entrants can participate. Privileges may be either permanently or temporarily transferable.

Permanent transferability

Permanent transferability refers to purchase and sale of the long-term share (see **Step 4.2**). Permanent transfers offer the opportunity for shareholders to make business decisions about whether to stay in the fishery or sell their shares and exit. Permanent trading is also a mechanism for accommodating new entrants who may purchase shares from an exiting shareholder, and existing participants who want to grow their business by purchasing additional shares.

Temporary transferability

Temporary transferability, also referred to as leasing, is a transfer of shareholders' annual allocations (see **Step 4.3**). Transfer of the annual allocation is common and occurs on

an annual basis once each participant's annual share has been calculated. Participants generally transfer a certain number of effort units, such as pot entitlements, allowing the recipient to use those effort units during the season. Purchase or lease of annual allocation is commonly used as the first level of access for new entrants.

It is possible to allow one type of transferability but not the other. Most transferable effort share programs allow both permanent and temporary transferability, but you should consider program goals and available administrative systems when making that determination.

Trade-offs

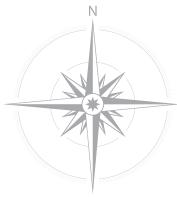
Transferability is an important component of a transferable effort share program because it provides fishermen with the flexibility to adjust their shares according to their business plan, and allows a mechanism by which new entrants can enter a fishery, opening up participation to a wider group. At the same time, transfers may change the catch efficiency of effort units because some fishermen may be skilled enough to catch more fish with the same effort unit. Increased catch rates and catch efficiency are a common economic goal; however, rising catch efficiency also increases fishing pressure. If efficiency changes

are not detected and incorporated into management decisions (for example, by changing the effort cap), the result may be unsustainable increases in fishing pressure over time. Transfers should be tracked and incorporated

into the process for setting effort caps in order to prevent undesirable increases in fishing pressure and possibly overfishing.

**DESIGN
PRINCIPLE**

Allow temporary and/or permanent transferability of effort shares.



4.5 WILL THERE BE RESTRICTIONS ON TRADING AND USE OF SHARES?

Transferable effort share programs allow trading of shares to increase flexibility of the program and help participants to better meet economic goals. However, to also meet other important fishery goals, such as maintaining robust stocks, restrictions can be placed on the trading and use of shares using the methods described below.

Geographically based limitations

Geographic trading and use limitations are important when there are specific goals regarding fish stocks and populations, such as preventing localized depletion or protecting critical habitats. In this case, zones may be created to distribute the use of effort units and fishing pressure (see **Step 2.5**). If different zones are used, it may be desirable to specify effort caps for each zone and restrict the transfer of shares from one area to another to avoid excessive fishing pressure in particular areas. Alternatively, some programs have set a fishery-wide effort cap and used variable effort accounting based on the zone in which effort is applied. For example, an effort share may allow the use of more effort units in some areas and less in others. This encourages the use of effort units in areas less sensitive to fishing pressure.

Fleet-based limitations

Limiting transfers based on fleet characteristics may be useful in ensuring fishing pressure does not increase. Transferable effort share programs should account for

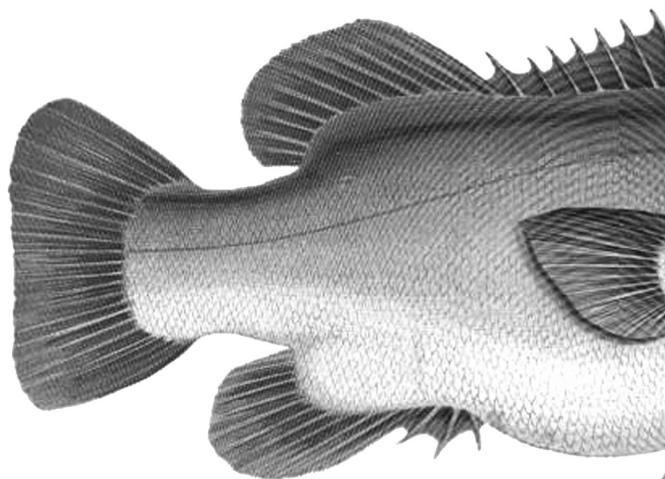
large differences in the catch efficiency of effort units used by different participants. Fleet characteristics, such as gear type and vessel size, may be different across fleets. In this case, trading between fleets should be prohibited or accounted for through standardization of effort units when a trade occurs. Standardization of effort units accounts for differences in the catch rate for different participants of fleets to ensure that transfers do not result in unsustainable catch increases. For example, in the Falkland Islands transferable effort share program, each vessel is assigned a catchability coefficient based on vessel and gear characteristics. Vessels that are able to apply more fishing pressure receive fewer effort units per effort share held in the fishery.

Additional considerations

Transferability of shares provides shareholders flexibility to manage their effort use and is a hallmark of transferable effort share programs. At the same time, transfers may increase the catch efficiency of effort units because some fishermen may be skilled enough to catch more fish with the same effort unit. Increased catch rates and catch efficiency are common economic goals, yet improved catch efficiency also increases fishing pressure. If efficiency changes are not detected and incorporated into management decisions (for example, by changing the effort cap), they may result in unsustainable increases in fishing pressure over time.

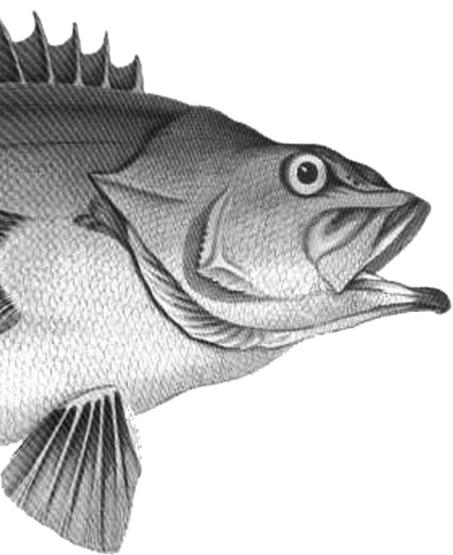
Some transferable effort share programs place restrictions on transfers to account for the potential catch increases that result from transfers. For example, the United States Florida Spiny Lobster Trap Certificate Program applies a 25% reduction to any shares that are transferred. Under this design, if 100 shares are transferred, 25 must be relinquished and retired. While this program may limit

unsustainable increases in catch due to transfers, it also has economic drawbacks, imposing a higher cost on transfers and thereby limiting trading. The economic and biological impacts of transfers should be tracked and incorporated into the program design to prevent undesirable increases in fishing pressure and possibly overfishing.



Step
5

Assign the Effort Privilege





At a Glance

Assigning the privilege has often been the most difficult and controversial step of implementing a transferable effort share program. Participants feel that much is at stake in the distribution of effort privileges and initial allocation sets up the starting point for the program.

KEY PRINCIPLES	<p>Develop a transparent, independent allocation process that is functionally separate from the rest of the design process. Allocations that retain the relative equity positions of stakeholders are the least contentious. 40</p> <p>Employ an allocation appeals process that allows eligible participants to refute allocated amounts with verifiable data. 41</p>
SUB-STEPS	<ul style="list-style-type: none">5.1 What decision-making body will determine initial allocation? 405.2 When will allocation occur? 415.3 Will there be an appeals process? 415.4 Who is eligible to receive effort shares? 425.5 Will initial effort shares be auctioned or granted? 425.6 How many effort shares will eligible recipients receive? 425.7 What data are available for allocation decisions? 43

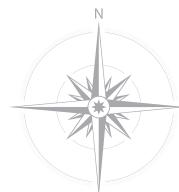
Assign the Effort Privilege

Initial allocation is a key step in transitioning to a transferable effort share program. Allocation will determine who receives initial effort shares and in what quantity. The number of shares that can be allocated in any fishery is limited and therefore valuable. Transferable effort shares have often been introduced in fisheries that are overcapitalized with a specific goal of reducing fishing effort. Therefore effort caps may be set below current effort levels creating additional concerns in the initial allocation. These decisions are outlined in **Step 5 of Volume 1** of the **Catch Share Design Manual** and expanded upon for transferable effort share programs in this step.

Effort shares within a transferable effort share program may be allocated across fleets as well as to individuals within fleets. Fleet allocations should be considered where multiple sectors exist and will likely be determined by decisions made in **Step 3-Define Eligible Participants**. Functionally, allocating and accounting for effort levels across differing fleets and gear types is very difficult and can introduce weaknesses into the program if proper effort conversion and accounting are not used to ensure fishery-wide effort stays within effort caps. If allocation across fleets is used, individual allocation is still necessary for a transferable effort share program to meet fishery goals.

DESIGN PRINCIPLE

Develop a transparent, independent allocation process that is functionally separate from the rest of the design process. Allocations that retain the relative equity positions of stakeholders are the least contentious.



5.1

WHAT DECISION-MAKING BODY WILL DETERMINE INITIAL ALLOCATION?

Different countries have used various decision-making bodies to determine allocations in fisheries, including fishery managers, fishery stakeholders and independent third parties. Countries may have existing legal requirements or legal precedents regarding allocation of any privilege in fisheries, and these should be considered in determining the decision-making body.

Managers are generally responsible for developing policy, analyzing options and implementing decisions. They therefore usually hold the ultimate responsibility for developing and implementing the catch share program, including allocation decisions.

Stakeholders, particularly fishermen, also usually participate in the allocation process. Their participation is expected and advisable because of their knowledge of the fishery. However, allocation decisions directly impact stakeholders' businesses and livelihoods, so it may be challenging for fishermen to remain neutral in the process.

Independent panels have also been used to make allocation decisions. In Australia, for example, independent panels have been used almost exclusively. These panels have generally included a retired judge, a fishermen with no direct stake in the fishery and an economist or policy maker (Shotton, 2001). Panels receive guidance about fishery goals and solicit input from a variety of sources to make allocation decisions (Shotton, 2001).

5.2

WHEN WILL ALLOCATION OCCUR?

Initial allocation can occur at any point in the transferable effort share program design process. In reality, decisions impacting allocation will occur at multiple stages of the process. It may be advisable to focus on allocation upfront to reduce uncertainty and bolster support for the program. Calculating different allocation scenarios early in the process can shed light on the appropriateness of different

design options. However, some fisheries have found it beneficial to wait until the end of the design process to make allocation decisions. Knowing the design features of a transferable effort share program—such as how the effort unit will be defined—may prove important during the allocation process.

5.3

WILL THERE BE AN APPEALS PROCESS?

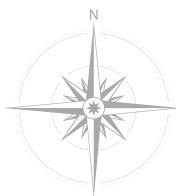
An appeals process can help ensure fairness in allocation. While it is not and should not be used as a substitute for transparent allocation decisions, an appeals process provides stakeholders with a mechanism to address factual issues such as accounting errors. For example, appeals processes often hear cases in which fishermen claim data used in allocation were inaccurate or incomplete. If fishermen can make a compelling case by showing corroborating data, appeals processes are likely to result

in changes to their initial allocations. Appeals processes should not result in changes to other design features of a program or in allocating effort units that exceed sustainable effort caps.

While an appeals process is important for fairness, it should not be used as an excuse to delay decisions about allocation. Rather, those issues should be worked out through the identified initial allocation process and appeals should be reserved for extreme or unordinary cases.

DESIGN PRINCIPLE

Employ an allocation appeals process that allows eligible participants to refute allocated amounts with verifiable data.



5.4

WHO IS ELIGIBLE TO RECEIVE EFFORT SHARES?

Determining eligibility for initial allocation is an important step in your fishery's transferable effort share program. Decisions made in previous steps will influence this determination. Identifying which participants are eligible in **Step 3 – Define Eligible Participants** will influence who can receive effort shares. Eligibility to receive effort shares determines who will be able to receive granted shares and/or participate in auctions, depending on the method of allocation.

Eligibility for initial allocation of effort shares is often based on fishery characteristics related to the definition of the effort unit. Historical participation in the fishery demonstrated through the use of gear or other fishing inputs that comprise the effort unit is often considered. Your fishery may have existing license structures that should also be considered when determining eligibility for initial allocation.

5.5

WILL INITIAL EFFORT SHARES BE AUCTIONED OR GRANTED?

There are two main forms of initial share distribution: auctioning and granting. Auctioning requires participants to pay for the shares, whereas granting gives the effort shares free of charge to an identified set of participants. Shares can also be allocated for a set fee. The amount of shares that can be granted or allocated for a set fee is

determined by an allocation formula. Allocation formulas are discussed in **Step 5.6**. In fisheries, granting of shares has been more common, but both auctioning and granting are flexible in how they are structured and can be designed to achieve biological, economic and social goals.

5.6

HOW MANY EFFORT SHARES WILL ELIGIBLE RECIPIENTS RECEIVE?

If your fishery decides to grant transferable effort shares, then you must develop a protocol for distributing them. Fisheries that have opted to grant effort shares have used a variety of formulas to determine initial share holdings. Formulas often reflect effort use, catch history and/or level of investment, or use equal sharing to divide effort shares. Within a formula, it is also possible to include multiple variables and give them different weights.

Historical use of fishing inputs is a commonly used a factor in determining how many effort shares eligible recipients receive. Historical use can include quantity of gear used, vessel characteristics and more. However, any number of factors may be considered and weighted according to fishery goals. Historical landings and level of investment have also commonly been used. Additionally, shares can be equally granted among all eligible participants. Administratively, this is very simple to determine and carry out.

5.7

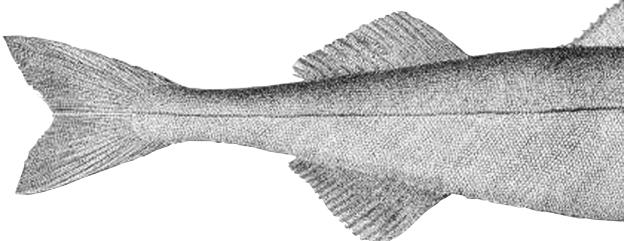
WHAT DATA ARE AVAILABLE FOR ALLOCATION DECISIONS?

The quality and availability of data will impact your fishery's initial allocation method. If data are robust and available on many dimensions, then it will be possible to develop an allocation system that depends heavily on existing, retrievable information. However, if there are few data or the data are inaccurate, alternative methods should be developed.

Many fisheries that have transitioned to a transferable effort share program had previously been under some form of permitting or licensing. If this is true of your fishery, historical use records on past participants in the fishery and their characteristics may be available. These include:

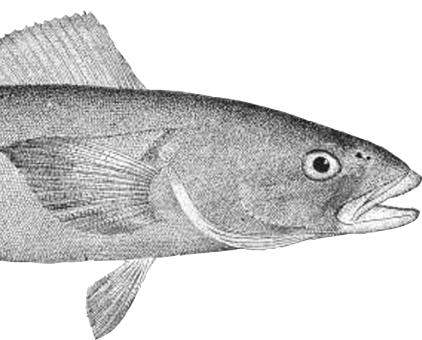
- License holder characteristics (e.g., length of tenure, number of licenses held, gear permitted)
- Vessel characteristics (e.g., length or type of vessel)
- Participation characteristics (e.g., number of years with catch history and effort use)

These can be important factors for determining how many effort shares participants should receive, as they represent both who has participated and at what level. This information also allows participants to examine past use against proposed allocations. Many fisheries track the gear and/or effort used in the fishery, and this information can also be used in allocation decisions.



Step
6

Develop Administrative Systems





At a Glance

Administrative systems are an important component of a transferable effort share program. By developing and implementing effective administrative systems, you will ensure that participants can successfully participate in the program and are held accountable for their effort privileges.

KEY PRINCIPLES

Encourage cost-effective, transparent trading that is easy for all participants. | [46](#)

Employ transparent effort accounting completed regularly enough to ensure the effort cap is not exceeded. | [47](#)

Design and implement a fishery information system that keeps costs low and is effective for conducting effort accounting, collecting scientific data and enforcing the law. | [47](#)

SUB-STEPs

6.1 How will effort trading occur? | [46](#)

6.2 How will effort accounting work? | [46](#)

6.3 How will fishery information required for science, effort accounting and enforcement be collected? | [47](#)

6.4 Who covers the program cost? | [48](#)

SPECIAL FEATURES

Collecting Resource Rent: Western and Central Pacific Ocean Tuna Purse Seine Vessel Day Scheme | [49](#)

Develop Administrative Systems

As with any fishery management system, transferable effort share programs must be implemented and administered. Management systems should establish how trading will occur, track participants' shares, monitor and enforce fishing activity, conduct scientific assessments and more. Managers should determine how the program will work within existing systems and what administrative changes may be necessary.

This step will highlight some of the necessary administrative systems for transferable effort share programs and some of the key issues that arise during program development. The four components outlined here are integral to the design of the program and should be considered during the design phase and prior to system implementation. Performance of the transferable effort share program will depend upon good information, compliance and the ability for the program to be cost-effective. Tracking the program's performance over time will help improve systems. Additional information on developing administrative systems is available in **Step 6 of Volume 1** of the **Catch Share Design Manual**.

6.1

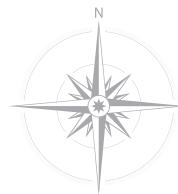
HOW WILL EFFORT TRADING OCCUR?

Trading of effort shares is a hallmark of transferable effort share programs, and most programs allow individuals to conduct both temporary and/or permanent transfers. An effective mechanism must be in place to facilitate trades to allow participants to adjust holdings. Trading can occur via

a number of avenues, including self-identification, brokerage firms and trading platforms. All three may be appropriate for your fishery. These systems can be implemented by fishery managers or by independent third parties and should comply with and be supported by the law.

DESIGN
PRINCIPLE

Encourage cost-effective, transparent trading that is easy for all participants.



6.2

HOW WILL EFFORT ACCOUNTING WORK?

Accountability of shareholders to their allocated effort share is one of the most important aspects of a transferable effort share program. "Effort accounting" tracks fishermen's use of effort units against their share holdings and is one of the keys to effective management. Effort accounting is accomplished by tracking the effort units held and used by a participant over the course of a fishing season.

Effort accounting systems must track the shareholder's balance based on the annual allocation, transfers that

increase or decrease shares holdings and use of effort units. Generally, effort accounting is completed through self-reporting, reporting by buyers or processors and/or by independent third parties. Effort accounting systems should be linked to fishery information and monitoring systems used for other management purposes, such as setting effort caps and assessing fish populations.

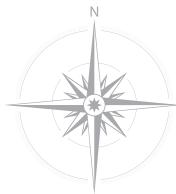
Effort accounting can occur at various points in the season. The duration or frequency of use defined for the effort unit

will influence this decision. For example, some effort units can only be used once in the season, such as vessel-days or a trawl tow. In these systems, effort accounting must occur at regular points throughout the season to track and deduct fishermen's use of effort units against their share holdings. Other effort units allow the use of a specified amount of gear for the entire season, such as the number of pots or

traps. In these systems, effort accounting must ensure a participant's use of effort units stays within their share holding throughout the season. In either case, the method of effort accounting should be stated clearly in the program design to allow participants to plan their use of available effort units and ensure the fleet does not exceed the total effort cap.

DESIGN PRINCIPLE

Employ transparent effort accounting completed regularly enough to ensure the effort cap is not exceeded.



6.3

HOW WILL FISHERY INFORMATION REQUIRED FOR SCIENCE, EFFORT ACCOUNTING AND ENFORCEMENT BE COLLECTED?

The keys to sustainability in a transferable effort share program are to ensure the use of effort units does not exceed the appropriate effort cap and to ensure the effort cap is set at an appropriate level. As with all fisheries management, transferable effort share programs also require good information to function well. Information systems should be designed and used to conduct effort accounting, set effort caps and enforce laws. Strong information systems improve science and knowledge of the stocks, and can lead to a higher level of compliance in transferable effort share programs.

Fishery information can be collected through a broad array of methods, including at-sea and dockside data collection and through self-reporting. The fishery's resource, fleet, operation and market characteristics are important in determining the appropriate method for gathering and verifying information. Some programs will require

spatial or temporal information, while others may require information on bycatch. In general, the least expensive, most effective approach should be used when possible.

Many fisheries rely on self-reported information systems, such as fishermen logbooks and dealer reports. Self-reported systems are low in cost but may have lower-quality, inconsistent data. Therefore, accuracy and authenticity are often of paramount concern and additional incentives, such as random checks and strong penalties for misreporting data, will help improve data. Independent monitoring systems, such as at-sea observer coverage, tamper-proof camera systems or vessel monitoring systems, tend to be more objective and better trusted. They generally have higher data quality and are deemed more credible, especially when the data collection is independent from the business operations of the fishery and data collectors are specifically trained for their role.

DESIGN PRINCIPLE

Design and implement a fishery information system that keeps costs low and is effective for conducting effort accounting, collecting scientific data and enforcing the law.



Any management system will carry with it certain management costs, and transferable effort share programs are no different. Often, governments have underwritten the costs of management, essentially providing a subsidy to fishing fleets. Governments are increasingly interested in limiting subsidies and shifting the cost of management to the participants who benefit. When participants and government share management costs, there is an incentive for the industry to work to improve management and lower costs (Yandle, 2003).

There are two general cost-related issues to consider: how the transition will be paid for and who will fund the ongoing program costs. In addition, you should consider whether to collect rents from industry for their use of fish stocks, considered a public resource by many countries.

Cost recovery

Cost recovery refers to a variety of mechanisms by which fishing participants pay for some or all of the costs of management. Costs may be incurred for setting science-based effort caps, monitoring the fishery, administration and more. Cost recovery fees can be collected in a variety of different ways including direct payment to the government through a fee or tax on landings and/or effort units held, or shareholders may directly contract with companies providing these services.

Resource rents

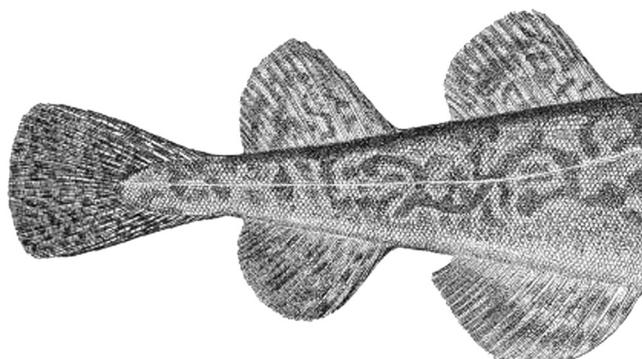
Resource rent is the value of extracting the resource in excess of the costs of extraction (including management costs). Resource rent is a fee charged to shareholders for the benefits of accessing fish stocks.

It is possible to collect resource rents from a fishery by auctioning the allocation or charging royalties. In some countries, rent recovery is an important fishery goal. For example, collection of resource rents and cost recovery is a primary goal of the Falkland Islands transferable effort share program. Resource rental fees and auctioning are used to collect 10% to 20% of the value of the catch depending on the fishery and is a principal source of revenue for the government (Harte and Barton, 2007). These payments for the use of effort shares covers administrative, enforcement and monitoring costs and ensures the public benefit from the use of fish resources. It is important to consider the level at which resource rent is set. If it is set too high, it may limit interest in participating in the program and participants' ability to run profitable businesses. If set too low, it may not return as much value to the government and public. Analysis will help determine the appropriate level.

SNAPSHOT 6.1 | Collecting Resource Rent**Western and Central Pacific Ocean Tuna Purse Seine Vessel Day Scheme**

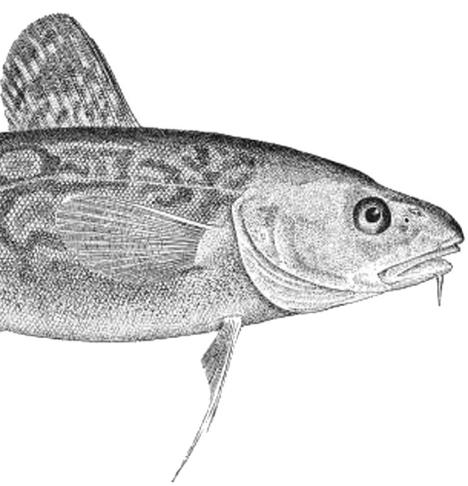
In 2007, eight Pacific Island nations formed an agreement to use a transferable effort share program to manage shared tuna resources within their 200-mile exclusive economic zone (EEZ). The countries collectively known as Parties to the Nauru Agreement (PNA), include the Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, the Solomon Islands and Tuvalu. The PNA countries began coordinating management in the 1980s under the Nauru Agreement, which was created to conserve fish stocks, constrain fishing effort and provide economic returns to PNA countries from the use of their tuna resource. This resource includes three main stocks: skipjack, bigeye and yellowfin tuna (Havice, 2013).

The transferable effort share program, commonly called the Vessel Day Scheme, was implemented following growing concerns about the sustainability of tuna harvest and the relatively low payments foreign fleets were making to access PNA fisheries. The Vessel Day Scheme restricts the total number of days that tuna purse seine vessels can fish within PNA countries' waters and allocates PNA countries a share based on EEZ productivity and effort and catch history. Once allocated, fishing days are transferable between PNA countries. To access PNA waters, foreign fleets must purchase vessel days equal to the amount of fishing they wish to conduct. They must also carry a vessel monitoring system to track their activity. Payments for a single day typically exceed \$5,000 and have significantly increased the revenues generated to PNA countries (Havice, 2013). While the program has significantly increased the strength of rights and economic returns for PNA countries, concerns about the stocks' status persist. Changes in fishing practices have increased catch per day, and the countries have faced challenges in setting the correct effort cap to manage multiple species. However, the program continues to be assessed and refined to better achieve fishery goals.



Step
7

Assess Performance and Innovate





At a Glance

The final step of transferable effort share design is to ensure the program is functioning well and achieving the identified program goals. You should conduct regular assessments and modify the program as necessary to meet existing and new goals. In addition, a future transition to a catch share program should be considered in program design.

KEY PRINCIPLES

Assess performance against goals and encourage innovation, including a transition to a catch share program, to improve the program over time. | [52](#)

SUB-STEPS

- 7.1 Conduct regular program reviews. | [52](#)
- 7.2 Assess performance against goals. | [53](#)
- 7.3 Encourage innovation. | [53](#)
- 7.4 Consider transitioning to a catch share program. | [54](#)

SPECIAL FEATURES

Innovations in Program Design: Australian Northern Prawn Fishery | [53](#)

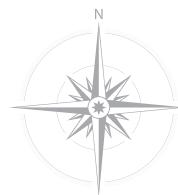
Assess Performance and Innovate

The final step in designing a transferable effort share program is to assess performance and innovate to address emerging opportunities and challenges. A well-designed program will regularly assess performance and make modifications to meet program goals. Transferable effort share programs must be dynamic in order to meet the changing needs and conditions of the fishery. This is especially important in transferable effort share programs because the effort unit and fishing mortality are not inextricably linked. Fishermen may innovate and increase the efficiency of the effort unit, so managers must regularly assess and adjust.

Transferable effort share programs have often transitioned into catch share programs over time. They rely on many of the same design decisions and introduce administrative systems that can act as building blocks for a catch share program. Fishermen and managers have often transitioned to a catch share program in order to more effectively meet their goals. Transferable effort share programs can incorporate elements into the design process to support catch share programs. A clearly defined plan can ensure that the process is transparent and reduce delays.

DESIGN PRINCIPLE

Assess performance against goals and encourage innovation, including a transition to a catch share program, to improve the program over time.



7.1

CONDUCT REGULAR PROGRAM REVIEWS

As with any fishery management program, it is important to regularly review a transferable effort share program. Regular review will provide important information on program performance. It may be helpful during the design process to identify a review schedule and opportunities to modify the program design if needed. Processes for program modification should be transparent and take into account the impacts of changes in program design on the fishery.

Transferable effort share programs can be affected by a number of factors. Changes in environmental conditions and fishing practices may have a direct effect on the ability of the program to meet fishery goals. Reviews should include an assessment of biological and environmental conditions and fishing practices to determine the health of fish stocks and whether effort and catch are sustainable. Changes in environmental conditions and fishing practices can occur rapidly; however, it is also possible that the full effects of the program will not be evident for several years.

7.2

ASSESS PERFORMANCE AGAINST GOALS

It is important to regularly assess performance against program goals defined in **Step 1**. Assessing the performance of a transferable effort share program will inform modification and innovations to the design.

Over time, fishing practices commonly change and new technology is developed as fishermen innovate to increase catch efficiency. These changes and their impact

on biological and economic goals should be assessed. Increases in efficiency can often lead to greater catches in the short term with the same allocated effort, but may limit the ability of the program to meet future biological and economic goals if stocks are depleted below target levels. Careful assessment of changes in fishing practices and technology can lead to adjustments in the effort cap and modification of the effort unit.

7.3

ENCOURAGE INNOVATION

Innovations allow programs to meet new and/or changing demands and should be encouraged. Many transferable effort share programs have made changes following initial implementation, such as modifications to the effort unit, fishing season and more. Programs have often been modified as a result of fishermen innovations, such as development of new technologies to increase the ability to

target and catch species included in the program. Changes in fishing practices should be expected and modifications to the program—including the effort unit and effort caps—should be made as necessary. Additionally, many fishery managers have used transferable effort share programs until a point at which a catch share program can be implemented.

SNAPSHOT 7.1 | Innovations in Program Design**Australian Northern Prawn Fishery**

The Australian Northern Prawn Fishery has undergone a number of program innovations since a transferable effort share program was first implemented in 1984. The Northern Prawn Fishery is one of Australia's most valuable fisheries, with nine species of prawn harvested during two distinct fishing seasons. A transferable effort share program was initially chosen to address overexploitation of the prawn stocks and overcapacity in the fishing industry (Jarret, 2001).

From 1984 to 2000, the effort unit was defined based on engine and vessel capacity. As fishermen modified fishing practices over time, they altered the mix and application of fishing units, increasing the use of unregulated inputs in order to increase catch. In 2000, managers re-defined the unit of effort as head rope length to better meet biological and economic goals. Under effort units as defined by engine and vessel capacity, fishing mortality was above target levels and assessments showed an inefficiency in the proportion of inputs being used (Kompas, Che and Grafton, 2004). Redefining the effort unit as a length of head rope created a clearer link between the fishing input regulated and fishing mortality, while also allowing fishermen to make adjustments and operate with a more efficient mix of inputs.

Designing a transferable effort share program establishes many elements common to catch share programs, and can be directly applied in a transition to a catch share. Design steps—including defining goals, defining eligible participants, assigning privileges and developing administration systems—are all fundamental elements of a well-designed catch share program. The primary difference between these two approaches is in how the privilege is defined. Transferable effort share programs define the privilege as a share of effort cap whereas ITQ programs define it as a share of the catch limit.

Some fisheries have implemented a transferable effort share program as a transitional strategy to implementing a

catch share program. The transferable effort share program can provide foundational administrative elements while also improving science and data, which can then be used to effectively set a science-based catch limit and transition to a catch share. In other instances, fishermen and managers have recognized limitations in the transferable effort share program to achieving goals, and determined that a catch share program would be more effective. In either case, it may be important and appropriate for fishermen and managers to design the transferable effort share program with a possible transition to catch shares in mind. Following the design steps outlined in this guide can aid in that process.

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Glossary

Allocation – Distribution of a secure share of the catch to individuals or groups.

Annual allocation unit (*syn.*: Quota pounds) – The measure used to determine the annual amount of fish each participant is allowed to catch, usually defined as total weight. It is often calculated as a percentage of the catch limit based on a participant's holdings. In the case of area-based programs, the unit is a specified area.

Area-based catch share – See Territorial Use Rights for Fishing.

At-sea monitoring – The collection of information on fishing activities taking place at sea, including harvesting, catch handling, biological sampling, fishing methods and interactions with protected species. At-sea monitoring is conducted with onboard observers or an electronic monitoring system.

Bycatch (*syns.*: Incidental catch, Non-target catch/species) – Fish other than the primary target species that are caught incidental to the harvest of those species. Bycatch may be retained or discarded. Discards may occur for regulatory or economic reasons (NRC, 1999).

Catch (*syn.*: Harvest) – The total number (or weight) of fish caught by fishing operations. Catch includes all fish killed by the act of fishing, not just those landed (FAO, n.d.).

Catchability (*syn.*: Vulnerability) – 1. The extent to which a stock is susceptible to fishing. Catchability changes depending upon fish behavior and abundance and the type and deployment of fishing gear (Blackhart et al., 2006). 2. The fraction of a fish stock which is caught by a defined unit of the fishing effort (FAO, n.d.).

Catch accounting – The tracking of fishermen's catch, including landings and discards, against their share holdings.

Catch limit (*syn.*: Total allowable catch) – The scientifically determined, acceptable level of fishing mortality.

Catch-per-unit-effort (CPUE) – The weight or number of fish caught with a specific unit of fishing effort (e.g., time and/or gear used).

Catch share (*syn.*: Catch share program) – A fishery management system that allocates a secure area or privilege to harvest a share of a fishery's total catch to an individual or group. Programs establish appropriate controls on fishing mortality and hold participants accountable.

Concentration – A measurement of the percent of privileges held by one entity.

Concentration cap (*syn.*: Accumulation limit) – The limit on the percentage of shares that any one participant or entity can hold and/or fish.

Consolidation – The accumulation of shares by a relatively small number of shareholders.

Controls on fishing mortality – Management measures such as catch limits, gear restrictions and seasonal and spatial closures that limit the total amount harvested each year. When set at appropriate levels, they ensure long-term sustainability of stocks.

Cooperative – 1. A group of fishery participants that is allocated a secure share of the catch limit or a secure area, and collectively manages its allocation. 2. A group of people who come together to coordinate activities in some way.

Cooperative catch share – A type of catch share in which one or more groups of fishery participants are allocated a secure share of the catch limit or a secure area, and accept certain fishery management responsibilities, including ensuring compliance with controls on fishing mortality.

Cost recovery – Partial or full recovery, by the government or management authority, of the costs of management, monitoring and/or enforcement of a fishery.

Derby-style fishing (*syns.*: Olympic-style fishing, Race for fish) – Fishing conditions characterized by short seasons and severe competition for fish, often resulting in low profits and harvests that exceed sustainable levels.

Discard (*syns.*: Regulatory discard, Economic discard) – To release or return a portion of the catch, dead or alive, before offloading, often due to regulatory constraints or a lack of economic value (FAO, n.d.).

Dockside monitoring – The monitoring of activities taking place upon a vessel's landing, including weighing or counting offloaded catch, biological sampling and identifying species composition.

Effort (*syn.*: Fishing effort) – The amount of time and fishing power used to harvest fish; effort units include gear size, boat size and horsepower (Blackhart et al., 2006).

Effort accounting – The tracking of fishermen's use of effort units against their share holdings.

Effort-based – Fishing privileges based on a percentage or absolute number of the total effort units available, often allocated as days, pots or trawl tows. Effort-based programs do not qualify as a catch share.

Effort cap (*syn.*: Total allowable effort) – The scientifically determined acceptable level of fishing effort, defined as the number of effort units allowed in a given fishery. Effort caps are often based on target levels of fishing mortality.

Effort unit – A unit of fishing effort. In reference to designing transferable effort share programs, a unit defined by a fishing input or set of inputs and the frequency or duration of their use; for example, the use of a trap for a season, the length of a trawl tow or the use of a vessel for a fishing day.

Electronic monitoring – A technique employed to monitor at-sea fishing activities, often consisting of cameras, sensors and Global Positioning System (GPS) units that record vessel and fishing location, fishing activity, catch (retained and discarded) and compliance with fishing rules.

Eligibility – Standards or guidelines that qualify individuals or entities for allocation of catch shares.

Enforcement – Measures to ensure compliance with fishery regulations, including catch limits, gear use and fishing behavior.

Fish – Used as a collective term that includes finfish, molluscs, crustaceans and any aquatic plant or animal that is harvested.

Fish stock – The living resources in the community or population from which catches are taken in a fishery. Use of the term fish stock usually implies that the particular population is more or less isolated from other stocks of the same species and hence self-sustaining. In a particular fishery, the fish stock may be one or several species of fish but here is also intended to include commercial invertebrates and plants (FAO, n.d.).

Fishery – The combination of fish and fishermen in a region, the latter fishing for similar or the same species with similar or the same gear types (Blackhart et al., 2006).

Fishery information – The information needed in a fishery for science and compliance, which can be collected through various forms of monitoring and self-reporting.

Fishing effort (*syn.*: Effort) – The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time (e.g., hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day) (FAO, n.d.).

Fishing inputs – The resources used to catch a species or group of species, often including fishing vessels, vessel type and power, gears used, fuel and more.

Fishing mortality (*syn.*: Mortality) – A measurement of the rate of fish removal from a population by fishing. Fishing mortality can be reported as either annual or instantaneous. Annual mortality is the percentage of fish dying in one year. Instantaneous mortality is the percentage of fish dying at any given point in time (Blackhart et al., 2006).

Group-allocated – A catch share program in which privileges are allocated to a clearly defined group of people, often a community or fishing association.

Harvest – The total number or poundage of fish caught and kept from an area over a period of time (Blackhart et al., 2006).

Individual Fishing Quota (IFQ) – A type of catch share program in which shares are allocated to individuals or individual entities. Recipients are generally fishermen and shares may or may not be transferable.

Individual Quota (IQ) – A type of catch share program in which shares are allocated to individuals or individual entities. Recipients are generally fishermen and shares are not transferable.

Individual Transferable Effort Quota (ITEQ) (*syns.*: Effort-based, Transferable effort share) – A percentage of the total allowable effort allocated to individuals, often in the form of days-at-sea or a set amount of gear. ITEQ is tradable between eligible participants.

Individual Transferable Quota (ITQ) – A type of catch share program in which shares are allocated to individuals or individual entities. Recipients are generally fishermen and shares are transferable.

Individual Vessel Quota (IVQ) – A type of catch share in which shares are allocated to an individual vessel. Shares are attached to the vessel rather than the vessel owner and shares may or may not be transferable. This has been used most commonly in Canada.

Individually-allocated – A catch share in which privileges are allocated to individuals or individual entities.

Input controls (*syns.*: Input regulations, Input-based regulations, Input-based controls, Input measures) – Management instruments used to control the time and place, as well as type and/or amount, of fishing in order to limit yields and fishing mortality; for example, restrictions on type and quantity of gear, effort and capacity and closed seasons (FAO, n.d.).

Landings – The number or weight of fish offloaded at a dock by fishermen. Landings are reported at the locations where fish are brought to shore (Blackhart et al., 2006).

Limited access (*syns.*: Controlled access, License limitation, Limited entry) – A fishery management approach that limits the number of fishermen participating in a fishery, usually by issuing a limited number of licenses.

Logbook (*syn.*: Logsheet) – A detailed, usually official, record of a vessel's fishing activity registered systematically onboard the fishing vessel. It usually includes information on catch and species composition, the corresponding fishing effort and location (FAO, n.d.).

Maximum Economic Yield (MEY) – The catch level that corresponds to the highest amount of profit that could be earned from a fishery (Blackhart et al., 2006).

Maximum Sustainable Yield (MSY) – The largest average catch that can be taken continuously (sustained) from a stock under average environmental conditions. This is often used as a management goal (Blackhart et al., 2006).

Monitoring (*syn.*: Catch control) – The collection of fishery information for the purposes of science, including setting catch limits and assessing stocks, and ensuring accountability, including catch accounting and enforcing fishery regulations.

Mortality – A measurement of the rate of death of fish, resulting from several factors but mainly predation and fishing.

Multi-species fishery – A fishery in which more than one species is caught at the same time. Because of the imperfect selectivity of most fishing gear, most fisheries are “multi-species.” The term is often used to refer to fisheries where more than one species is intentionally sought and retained (NRC, 1999).

Non-target species (*syns.*: Bycatch, Incidental catch) – Species not specifically targeted as a component of the catch but which may be incidentally captured (Blackhart et al., 2006).

Onboard observers (*syn.*: Observers) – A certified person onboard fishing vessels who collects scientific and technical information on the fishing operations and the catch. Observer programs can be used for monitoring fishing operations (e.g., areas fished, fishing effort deployed, gear characteristics, catches and species caught, discards, collecting tag returns, etc.) (FAO, n.d.).

Open access – Condition in which access to a fishery is not restricted (i.e., no license limitation, quotas or other measures that would limit the amount of fish that an individual fisherman can harvest) (NRC, 1999).

Overcapacity – A level of fishing pressure that threatens to reduce a stock or group of stocks below the abundance necessary to support Maximum Sustainable Yield and allow an economically sustainable fishing industry (Blackhart et al., 2006).

Overcapitalization (*syn.*: Excess capacity) – In the short term, fishing capacity that exceeds the level required to capture and handle the allowable catch. In the long term, fishing capacity that exceeds the level required to ensure the sustainability of the stock and the fishery at the desired level (FAO, n.d.).

Overfished – A state in which a fish stock is below a scientifically determined target biomass (e.g., one half of the biomass that produces Maximum Sustainable Yield).

Overfishing – A rate of fishing mortality that, unchanged, will result in an overfished state.

Permit bank (*syns.*: Quota bank, Community license bank) – Collection of harvesting privileges in which certain rules and stipulations govern the use of the privileges and the distribution of benefits.

Public resource (*syns.*: Public good, Common resource) – A resource that is held collectively by all people and often managed by the government on their behalf.

Quota – The maximum number of fish that can be legally landed in a time period. Quota can apply to the total fishery or an individual fisherman’s share under a catch share program (Blackhart et al., 2006).

Quota-based catch share – A catch share program in which secure shares of the catch limit are allocated to individuals or groups and participants are held accountable to their share. Shares are based on the number or weight of fish.

Race for fish (*syns.*: Derby-style fishing, Olympic fishing) – A pattern of fishing characterized by an increasing number of highly efficient vessels fishing at an increasing pace, with season length becoming shorter and shorter (FAO, n.d.).

Sector – 1. A specific division of a fishery with unique characteristics including management regulations, gear types, fishing locations, purpose of activity or vessel size. 2. A type of group-allocated catch share program, most commonly used in New England.

Shareholder (*syn.*: Privilege holder) – An individual or entity holding a secure share in a catch share fishery.

Single-species fishery – A type of fishery in which fishermen target only one species of fish, although it is usually impossible not to catch others incidentally (Blackhart et al., 2006).

Stewardship – Responsible management of resources for future generations, such as maintaining populations of target and non-target species, protecting wildlife, conserving key habitats and strengthening ecosystem resilience.

Stock – A part of a fish population usually with a particular migration pattern, specific spawning grounds and subject to a distinct fishery. A fish stock may be treated as a total or a spawning stock. Total stock refers to both juveniles and adults, either in numbers or by weight, while spawning stock refers to the numbers or weight of individuals that are old enough to reproduce (Blackhart et al., 2006).

Sustainable fishing – Fishing activities that do not cause or lead to undesirable changes in the biological and economic productivity, biological diversity, or ecosystem structure and functioning from one human generation to the next (FAO, n.d.).

Sustainable harvest (*syns.*: Sustainable catch, Sustainable yield) – The biomass or number of fish that can be harvested

ed without reducing the stock biomass from year to year, assuming that environmental conditions remain the same (Blackhart et al., 2006).

Target species (*syn.*: Directed fishery) – Those species primarily sought by fishermen in a particular fishery. There may be primary as well as secondary target species (FAO, n.d.).

Tenure length of shares – The duration for which an individual's or group's share is allocated.

Territorial Use Rights for Fishing (TURF) (*syn.*: Area-based catch share) – An area-based management program that assigns a specific area to an individual, group or community. To meet the definition laid out in the Design Manual, one or more species in the area must have a scientifically based catch limit or other appropriate controls on fishing mortality.

Total allowable catch (TAC) (*syn.*: Catch limit) – The annual recommended or specified regulated catch for a species or species group (Blackhart et al., 2006).

Total allowable effort (TAE) (*syn.*: Effort cap) – The annual recommended or specified effort level applied to catch a species or group of species.

Total catch – The landed catch plus discard mortality (Blackhart et al., 2006).

Transferable (*syns.*: Transferability, Tradable) – In reference to the attributes of a catch share program, shareholders can buy, sell and/or lease shares. See SEASALT.

Transferable effort share (*syn.*: Transferable effort share program) – A fishery management system that sets an effort cap based on fishery inputs and their use, allocates shares to individuals and allows trading.

Vessel Monitoring System (VMS) – A satellite communications system used to monitor fishing activities; for example, to ensure that vessels stay out of prohibited areas. The system is based on electronic devices, which are installed onboard vessels. These devices automatically send data to a shore-based satellite monitoring system (Blackhart et al., 2006).



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Sacramento / 1107 9th Street, Suite 540 / Sacramento, CA 95814 / **T** 916.492.7070

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