Options for Development of an Individual Quota System in Japan

Based on the Experience of Iceland, New Zealand, Norway, and the United States

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Abstract

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Under the New Fisheries Act, the government of Japan plans to introduce Individual Quota (IQ) management for all Total Allowable Catch management fish species when the fisheries for these species are ready. However, there are no concrete official guidelines for IQ in Japan. In order to provide a list of elements and options that Japan should consider when introducing IQ for major fisheries resources, this study conducts a literature review and analysis of IQ programs in Iceland, New Zealand, Norway, and the United States, as well as a review of Japan's fisheries resource management system.

This study suggests ten elements that Japan should consider in the design of its IQ program: 1) prerequisites, 2) goals of the IQ program, 3) eligibility to participate in the IQ program,4) definition of IQ, 5) IQ allocation, 6) IQ administration, 7) administrative cost and payers, 8) monitoring and enforcement, 9) avoidance of excessive concentrations of IQs and negative social impacts, and 10) review of performance.

Based on the experience of other countries, this study also suggests that: (1) developing the IQ system for all national fisheries in Japan is a very large task. It should be done in an orderly manner and cannot be done quickly; (2) the IQ system needs some flexibility to fit characteristics of each fishery and community and should take advantage of Japan's previous fisheries resource management experience; and (3) careful thought must go into how quota transfers and trade limitations can be used to achieve the economic and social goals of the IQ program, and dialogues with fishers are important.

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GLOSSARY OF ABBREVIATIONS

ABC: Allowable Biological Catch

AFCC: Area Fisheries Coordinating Committee

BSAI: Bering Sea and Aleutian Island

CQE: Community Quota Entity

CDQ: Community Development Quota

EM: Electronic Monitoring

ER: Electronic Reporting

FAJ: Fisheries Agency of Japan

FCA: Fisheries Cooperative Association

FMO: Fisheries Management Organization

FMP: Fishery Management Plan

FRA: Japan Fisheries Research and Education Agency

IFQ: Individual Fishing Quota

ITQ: Individual Transferable Quota

IQ: Individual Quota

IVQ: Individual Vessel Quota

LRP: Limit Reference Point

MSA: Magnuson-Stevens Fishery Convention and Management Act of 1976

NMFS: National Marine Fisheries Service

QF: Quota Factor

QES: Quota Exchange System

QMS: Quota Management System

RQ: Recruitment Quota

SQS: Structural Quota System

TAC: Total Allowable Catch

TRP: Target Reference Point

UQS: Unit Quota System

WAFCC: Wide-Area Fisheries Coordinating Committee

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Chapter 1. Introduction

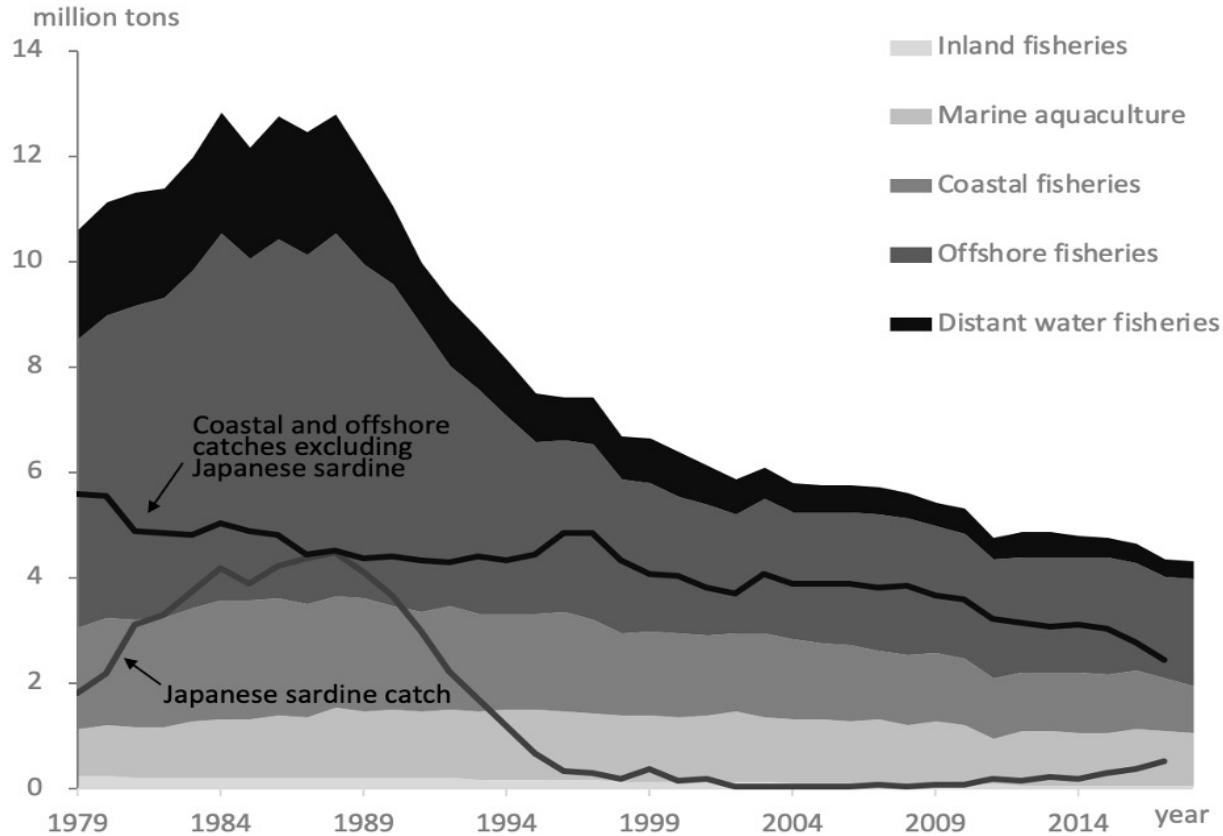
1.1 Overview of fisheries and contemporary issues in Japan

Japan is one of the most important fishing countries and biggest consumers of seafood in the world. Japan is surrounded by very productive oceans formed by warm and cold currents (Fisheries Agency of Japan, 2019a; Yabana, 2018). The oceans provide a wide variety of fisheries products and make the fisheries one of the essential industries in Japan, especially in coastal areas. Fisheries products are primary source of animal protein for Japanese people. According to Fisheries Agency of Japan (2019a), fish supplies for domestic consumption in Japan were 7,374,000 tons in 2017.

Based on the first large review in 70 years, Japan faces three main issues in the fisheries sector (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a).

The first issue is a decline in fisheries production. Previously, Japan's total fisheries production from all sources, including aquaculture production, was over 10 million tons, peaking at 12,820,000 tons in 1984 (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). However, fisheries production has been declining in volume since 1988 (Ministry of Agriculture, Forestry and Fisheries of Japan, 2020). As of 2017, the total fisheries production was 4,310,000 tons, which was lower by 50,000 tons than in 2016 (Fisheries Agency of Japan, 2019a). Fisheries Agency of Japan (2019a) shows that the main reason for the rapid decline after 1984 was the decline of landings of Japanese sardine (*Sardinops melanostictus*) by offshore purse seine vessels, which decreased due to the changes in the marine environment. However, coastal and offshore catches, excluding Japanese sardine, also declined (Figure1) (Fisheries Agency of Japan, 2019a; Ministry of Agriculture, Forestry and Fisheries of Japan, 2020).

Figure 1 Trends in the production volume of Japan's capture fisheries and aquaculture



(Source: Ministry of Agriculture, Forestry and Fisheries of Japan 2020)

The second issue is that the biomass of many fisheries resources has been low. Scientific fish stock assessments in Japanese waters have been conducted annually by the Japan Fisheries Research and Education Agency (FRA) with various sources of information, including fishery-independent data collected by research boats and fishery-dependent data on catches (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). Prefectural governments, universities, and researchers cooperate and provide advice for conducting the stock assessments (Ad-hoc Task Force on Fisheries Resource Management, 2014). Currently, stock assessments are conducted for 50 important species and 84 stocks (Fisheries Agency of Japan, 2019a). The results of the annual assessments from 1996 to 2018 show that the ratio of the fisheries resources assessed at "low abundance level" remained around 50% (Fisheries Agency of Japan, 2019a). The results of stock assessments in 2018 in the waters around Japan show that 41 out of 84 stocks are at low biomass levels (Fisheries Agency of Japan, 2019a).

The third issue is the decline in the number of fishers. It is vital to secure the number of fishers not only for supplying stable fisheries products in Japan but for revitalizing local communities in coastal areas. However, the number of fishers in Japan has been on a consistent downward trend. The number of fishers in Japan was 790,000 in 1953, while the number was 153,000 in 2017 (Fisheries Agency of Japan, 2019a). In the five years from 2013 to 2017, the number of fishers decreased by roughly 7,000 every year, while the annual increase in the number of new fishers stayed the same at around 2,000 yearly (Fisheries Agency of Japan, 2019a). Most of the fishers in Japan are small-scale fishers who mainly engage in fishing with their families (Fisheries Agency of Japan, 2019a). Traditionally, successors to these small-scale fishers are mostly family members who grew up in coastal communities (Fisheries Agency of Japan, 2019a). However, in recent years, fishers' children do not always become their successors (Fisheries Agency of Japan, 2019a). According to forecasts made by the Fisheries Agency of Japan (FAJ), the number of fishers is expected to be 103,000 in 2028, 73,000 in 2048, and 70,000 in 2068 (Fisheries Agency of Japan, 2019a).

Therefore, for the future of Japan's fisheries industries, it is necessary to rebuild fish stocks, enhance capture fisheries production, and make fishing a more attractive job. It is perhaps obvious that the fisheries policies and its related laws in Japan should be overhauled to solve these issues.

1.2 Overview of the reform of fisheries policy

Under these circumstances, the Basic Plan for Fisheries was formulated by the Cabinet meeting in 2017 (Fisheries Agency of Japan, 2019a; Yabana, 2018). The Plan indicates the need to review current policies, laws, and regulations for the dynamic reform of fisheries resource management and the transformation of Japan's fisheries into a growth industry (Fisheries Agency of Japan, 2019a). In 2018, an official document entitled "Reform of Fisheries Policy" was released by the Agriculture, Forestry, and Fisheries Industry and Regional Vitality Creation Headquarters (Fisheries Agency of Japan, 2019a; Yabana, 2018). The document specifies the contents of the reform (Fisheries Agency of Japan, 2019a). The primary purpose of the reform was to establish appropriate fisheries resource management and transform Japan's fisheries into a growth industry (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). The main contents of the reform are as follows:

I. Construction of a new fisheries resource management system;

II. Reform of distribution structures that contribute to improving fisher's income;

III. Review of the fishing license system for improving productivity;

IV. Review of the system for the use of the sea for the development of coastal fisheries and aquaculture;

V. Review of the fisheries cooperative system in accordance with the direction of the reform;

VI. Revitalizing fishing communities and allowing them to demonstrate their multifunctional roles, including the role of a border patrol (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2019a).

In December 2018, the Act Partially Amending the Fisheries Act (the New Fisheries Act) was promulgated to revise core systems of fisheries policy, including fisheries resource management measures, the fishing right and license systems, and the fisheries cooperative system (Fisheries Agency of Japan, 2019a). The date of implementation is to be within two years from the date of promulgation (Fisheries Agency of Japan, 2019a).

There are two main points of the construction of a new fisheries resource management system in Japan.

First, Japan will manage its main fisheries resources using the Total Allowable Catch (TAC) system based on the stock assessments and the best available science (Fisheries Agency of Japan, 2019a). There are many types of tools for fisheries resource management, including the restriction on the number of fishing boats, the capacity of fishing vessels, the size of fish, the fishing gear types, and the quantity of catch (Fisheries Agency of Japan, 2019a). Japan has traditionally managed fisheries resources by limiting the capacity and the number of fishing vessels through the fishing right and license systems (Fisheries Agency of Japan, 2019a). However, Article 8 of the New Fisheries Act clearly states that fisheries resources are to be managed on the basis of TAC (Fisheries Agency of Japan, 2019a). The reform of fisheries policy aims gradually to expand the TAC system from 60%, the current coverage, to 80% for the fish species with the largest harvests (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a; Yabana, 2018).

Second, the TAC system is to allocate harvests on the basis of Individual Quotas (IQ) (Article 8) (Fisheries Agency of Japan, 2019a). IQ will be applied for licensed vessels or fishers[1] to manage all TAC species if the fisheries are ready to be introduced (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). If it is not ready to apply IQ, TAC is to be managed on the basis of the total catch quantities in management categories in the same manner as before (Article 8) (Fisheries Agency of Japan, 2019a). The Minister of Agriculture, Forestry, and Fisheries (Minister) or a prefectural governor determine IQ for each

[1] In practice, IQ will be assigned for licensed vessels. Hereafter, this paper refers only to licensed vessels for the allocation of IQ.

fishing vessel based on the historical landings and/or other factors (Article 17) (Fisheries Agency of Japan, 2019a). Transfers of IQ are only permitted in specific cases, including upon a vessel transfer (Article 22) (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a).

As the two main points of the construction of the new fisheries resource management system show above, the Japanese government will expand TAC to cover 80% of all the catch amount in Japan and introduce IQ for fishing vessels to manage TAC species when they are ready. Thus, many major stocks are to be managed by IQ.

However, official IQ has been introduced only to distant water longline vessels that catch southern bluefin tuna (*Thunnus maccoyii*) and Atlantic bluefin tuna (*Thunnus thynnus*), and red snow crab pot fisheries that catch red snow crab (C*hionoecetes japonicus*) in Japan (Fisheries Agency of Japan, 2019a). In addition, a trial IQ program has been applied only to purse seine vessels that catch Pacific stock of chub mackerel (*Scomber japonicus*) since 2014 (Fisheries Agency of Japan, 2017b, 2019a). Nevertheless, there are no official guidelines for implementing IQ management as of 2020.

The small number of TAC species and the few IQ managed fisheries show that the current status is the transformational nature of the new fisheries resource management scheme. These situations also point to the challenge to FAJ to simultaneously expand the TAC system for major fish stocks and to design IQ programs. FAJ also needs sequenced implementation for both expanding the TAC system and introducing IQ programs because the IQ program design requires a TAC presumably based on a stock assessment.

1.3 Research design and the goal of this study

The goal of this study is to outline elements and options for introducing IQ in Japan for major fisheries resources, based on the experience of Iceland, New Zealand, Norway, and the United States and Japan's previous experience in fisheries resource management. The list will be helpful for Japan to make a guideline for introducing IQ programs.

It is helpful to review how other countries dealt with issues of these elements when introducing and implementing IQ. This study selects Iceland, New Zealand, Norway, and the United States as case studies of IQ. The lessons from these countries will provide Japan with insight to develop IQ programs that are suitable for the characteristics of Japanese fisheries.

This paper takes the following steps to provide a list of elements and options for Japan to consider when introducing its IQ program. Chapter 2 describes the research design of this paper. Chapter 3 presents the general fisheries resource management systems in Japan and the results of recent high-level meetings in Japan about fisheries resource management. Chapter 4 introduces the overview of the quota-based management systems in Iceland, New Zealand, Norway, and the United States. Chapter 5 discusses ten elements that Japan should consider in the design of its IQ program and options for Japan to consider. Finally, Chapter 6 discusses broader issues of IQ implementation that Japan will likely face and options to tackle the issues.

Chapter 2. Methods

The goal of the study is to provide a list of elements and options that Japan should consider when introducing IQ for major fisheries resources, based on the experience of Iceland, New Zealand, Norway, and the United States, taking into account Japan's previous experience and practice in fisheries resource management. There are five steps to achieve the goal in this paper.

The first step in my approach is to perform a literature review of IQ programs, guidelines, and implementation. I used multiple data sources to analyze how Iceland, New Zealand, Norway, and the United States developed quota-based management systems and market-based approaches to managing fisheries resources. I chose these countries as case studies because they introduced IQ at the early stage of the modern fisheries regime, and they have a long history of the quota-based management systems. I searched literature about the quota-based management in these countries and guidelines for the use of IQ programs through the website of the University of Washington Libraries and Google. Some of the papers were recommended by advisors and researchers in these countries. Since I reviewed literature written in English, some of the literature review, in particular about Iceland and Norway, might be out of date or not necessarily reflect current practice.

The second step is to perform informational interviews with fisheries managers, fishery participants, and researchers in fishing communities. The informational interviews were used to clarify my understanding of the IQ programs from the literature review. I visited Dutch Harbor in the United States in March 2019, Bergen and Tromsø in Norway in August 2019, and Reykjavík and Vestmannaeyjar in Iceland in August 2019. The purpose of my visits was to conduct interviews and visit fishing communities, landing areas, and fish processing facilities. Information from interviews is not cited in this thesis.

The third step is to provide elements that Japan should consider in the design of its IQ program. Elements are developed based on a useful approach toward an IQ program that I found from the literature review, the lessons from the four countries, and Japan's previous fisheries resource management experience. The most useful approach that I found from the literature review is the "cookbook" guidelines from IQ advocates. The guidelines provide a roadmap of catch share design (Bonzon, Mcilwain, Strauss, & Van Leuvan, 2013). Bonzon et al. (2013) discuss many design points and outline the Catch Share Design Manual in a seven-step process as follows:

Step 1 – Define program goals

Step 2 – Define and quantify the available resource

Step 3 – Define eligible participants

Step 4 – Define the privilege

Step 5 – Assign the privilege

Step 6 – Develop administrative systems

Step 7 – Assess performance and innovate (Bonzon et al., 2013).

These steps will work to identify gaps, unique features, etc. to consider in the design of IQ systems commonly. However, for Japan, it is necessary to modify the Bonzon et al. (2013) approach to focus on the introduction of IQ, that fits the characteristics of Japan's fisheries and current Japan's fisheries resource management system. The Bonzon et al. (2013) approach is also modified to reflect the understanding of the design of IQ programs in the four countries based on the literature review.

In order to achieve this end, I performed a literature review of Japan's fisheries resource management system and reviewed documents from recent high-level meetings about fisheries resource management in Japan. I also reviewed Japan's new IQ policy on the reform of fisheries policy, through the White Paper on Fisheries published by the government of Japan, and documents regarding the reform of fisheries policy released on the website of FAJ and the Cabinet Office of Japan, and some academic articles (Sections 1.2 and 3.3.3).

Based on Bonzon et al. (2013), Japan's previous fisheries resource management experience, and the lessons from the four countries, I suggest ten elements that Japan should consider in the design of its IQ program: 1) prerequisites, 2) goals of the IQ program, 3) eligibility to participate in the IQ program, 4) definition of IQ, 5) IQ allocation, 6) IQ administration, 7) administrative cost and payers, 8) monitoring and enforcement, 9) avoidance of excessive concentrations of IQs and negative social impacts, and 10) review of performance.

The comparison between Bonzan et al. (2013) and this paper, and rationales for modifications are described in Appendix. Some elements, such as setting of clear goals, determining eligibility, defining IQ, assigning IQ, and developing administrative systems remain consistent with the Bonzon et al. (2013) approach. However, I made three major changes from Bonzan et al. (2013) in this paper.

The first modification regards concentration limits of IQ and restrictions on trading IQs. The lessons from other countries made me realize that concentration limits of quotas described in Step 3 of Bonzon et al. (2013), as well as restrictions and trading and use of IQs in Step 4 of Bonzon et al. (2013) are essential to achieve social goals. Each country has unique systems that fit its characteristics to achieve social goals. Thus, the concentration limits and restrictions on trading and use of IQs are discussed as an independent element simultaneously with the ninth element of this paper.

The second point is prerequisites. It is not apparent that Step 2 of Bonzon et al. (2013) is necessary for a nation with a functioning fisheries resource management system. Because Japan already has the stock assessment program and the TAC system, the stock assessment and TAC setting are discussed as prerequisites in the first element of this paper.

The third modification is monitoring and enforcement. The lessons from Iceland, New Zealand, Norway, and the United States made me realize that monitoring and enforcement described in Step 6 of Bonzon et al. (2013) is a crucial point to control each IQ. Each country has unique systems to collect data and monitor and enforce fishing activities. Thus, the monitoring and enforcement system is discussed independently in the eighth element. See Appendix for more details and other descriptions of the modifications and their rationales.

The fourth step is to identify options for Japan to consider when introducing its IQ program based on the experience of these four countries. These options are derived from the design, design process, and lessons from quota-based management systems in these four countries and Bonzon et al. (2013). These options for each element in the third step are listed and discussed in Chapter 5.

The last step is to discuss broader issues of IQ implementation that Japan will likely face (Chapter 6). Options for Japan to consider in tackling the issues are also indicated based on the information of these four countries in Chapter 6.

Chapter 3. Fisheries Resource Management System in Japan

In this chapter, Japan's fisheries resource management system is described (Sections 3.1 and 3.2). In addition, the results of high-level meetings about Japan's fisheries resource management are introduced, focusing on quota management systems (Section 3.3).

3.1 Overview of the fisheries resource management system in Japan

In Japan, many marine species have been used as food sources for thousands of years (Makino & Matsuda, 2005). People living in coastal areas have invented various types of fishing methods to catch many types of fish (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). Many types of operational customs and orders have been formed by people who work in fisheries, based on mutual understandings and cooperation (Ad-hoc Task Force on the TAC System, 2008). Since the Meiji era (1868-1912), Japan's fisheries have gradually expanded their fishing grounds from inshore to offshore with advanced technology and mechanization (Fisheries Agency of Japan, 2019a). Thus, fishers use a wide variety of fishing gear and methods to catch various types of fish species in fishing grounds from coastal to offshore areas (Cabinet Office, 2017).

In order to achieve the coexistence with coastal fisheries and offshore fisheries, fishers have established local rules on fishing operations, such as a restriction for a particular fishing area and a maximum catch amount of a particular fish (Cabinet Office, 2017). FAJ may join the discussion as a mediator, but the basic concept for fisheries management is "local fishers themselves controlling and managing fishing operations" (Cabinet Office, 2017; Makino & Matsuda, 2005).

With this background, the current legal framework, including the Fisheries Act, has been established to manage fisheries resources around Japan, to achieve the coexistence with many types of fisheries, and to make comprehensive use of the seas (Ad-hoc Task Force on the TAC System, 2008).

Tools for fisheries resource management in Japan are classified into three types: input control, output control, and technical management measures (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a; Pope, 2002). Input controls are limits on the intensity of use of fishing gears, such as the restrictions on the number and size of fishing vessels, and the amount of time that fishers are permitted to fish (Pope, 2002). Output controls are restrictions on the amount of fish harvest over a certain period of time, including TAC and IQ (Pope, 2002). Technical management measures, such as the closed season, are controls on a fishing activity to protect young fish, spawning fish, or other fish (Pope, 2002).

Taking into account the characteristics of Japan's fisheries, which have many types of fishing gears to catch many target species, various management measures are used in combination to properly manage fisheries resources (Fisheries Agency of Japan, 2019a). The core laws for fisheries management are the Fisheries Act, the Fisheries Resource Conservation Act, and the Law Concerning Conservation and Management of Marine Living Resources (TAC Law).

The Fisheries Act was enacted in 1949. The aim of the Fisheries Act is to promote the development of the fisheries and the democratization of fishers (Koya, 1993). In order to achieve this object, the Fisheries Act supplies a system for fishers to resolve their issues by themselves (Koya, 1993). It also provides the legal bases for the fishing right and license systems (Cabinet Office, 2017).

The Fisheries Resource Convention Act was enacted in 1951. The Act was designed to contribute to the development of fisheries through the conservation of fisheries resources (Cabinet Office, 2017).

The TAC Law came into force in 1996 to bring Japan into compliance with its obligations under the United Nations Convention on the Law of the Sea, which the government of Japan ratified in the same year (Ad-hoc Task Force on the TAC System, 2008; Cabinet Office, 2017). It provides the legal basis for the TAC system (Cabinet Office, 2017). The TAC Law will be merged with the Fisheries Act by December 2020 according to the timeline specified in the New Fisheries Act promulgated in December 2018 (Fisheries Agency of Japan, 2019a).

3.2 Fisheries resource management system in Japan

3.2.1 Fishing right system

The fishing right system applies only to coastal fisheries. Fishing rights are categorized into three types: common fishing right, large-scale set-net fishing right, and demarcated fishing right (Makino & Matsuda, 2005).

The common fishing rights cover fisheries targeting coastal species attached to certain sea bottoms, such as shellfish, algae and crustaceans, and small set-net fisheries at depths of less than 27 meters (Cabinet Office, 2017). The duration of the common fishing rights is ten years (Cabinet Office, 2017). The large-scale set-net fishing right is a right to deploy a set-net at depths of more than 27 meters (Cabinet Office, 2017). The duration of the large-scale set-net fishing right is five years (Cabinet Office, 2017). The demarcated right is a right to run an aquaculture farm in a specific area (Cabinet Office, 2017). The duration of the demarcated rights is five or ten years, depending on the type and size of aquaculture farms (Cabinet Office, 2017).

These fishing rights are primarily granted to a local Fisheries Cooperative Association[2] (FCAs) by a prefectural governor (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). A local FCA establishes operational regulations tailored to the circumstance and situation of its fishing grounds (Makino & Matsuda, 2005). Operational regulations may include input controls, such as a limitation of the number of fishers, and technical management measures, such as a gear restriction and closure of fishing grounds (Fisheries Agency of Japan, 2019a; Makino & Matsuda, 2005).

Under the New Fisheries Act, the fishing right system will be maintained from the viewpoint of appropriate fisheries resource management (Cabinet Public Relations Office of Japan, 2018).

3.2.2 Fishing license system

The fishing license system applies to offshore and distant water fisheries which demonstrate efficient harvest over a wide area under the Fisheries Act and/or the Fisheries Resource Convention Act (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a; Koya, 1993). The fishing license system has two types: minister licensed fisheries and governor licensed fisheries (Cabinet Office, 2017). The minister licensed fisheries operate in a wider area with larger fishing fleets, whereas the governor licensed fisheries operate off the prefecture with smaller fishing fleets (Koya, 1993). The minister licensed fisheries include large purse seiners, offshore trawlers, distant water trawlers, tuna longliners, crab pot fisheries, etc. (Cabinet Office, 2017). The governor licensed fisheries are prescribed to medium purse seiners, small scale trawlers, and various types of local fisheries (Cabinet Office, 2017).

[2] Local FCAs are basically established in each fishing community (Makino & Matsuda, 2005). It is composed of local fishers (Makino & Matsuda, 2005).

The Minister or a prefectural governor limits the number of fishing vessels to be licensed under the fishing license system (Cabinet Office, 2017). The license may include some conditions, including input controls, such as the total gross tonnage of a vessel, and technical management measures, such as a restriction on operating periods, operation times, fishing areas, mesh sizes, target species, and/or gear types (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). These restrictions may be seasonal, depending on the characteristic of each region and fishing gear (Cabinet Office, 2017).

Under the New Fisheries Act, a restriction on the tonnage of the vessel will be exempted for both minister licensed fisheries and governor licensed fisheries that are managed under an IQ program to improve the safety operation (Fisheries Agency of Japan, 2019d, 2019c).

3.2.3 Total Allowable Catch system

Under the TAC Law, the TAC system has been applied to nine fish species: Pacific saury (*Cololabis saira*), Japanese jack mackerel (*Trachurus japonicus*), Alaska pollock (*Gadus chalcogrammus*), Japanese sardine, chub mackerel, spotted chub mackerel (*Scomber australasicus*), Japanese common squid (*Todarodes pacificus*), snow crab (*Chionoecetes opilio*), and Pacific bluefin tuna (*Thunnus orientalis*) (Fisheries Agency of Japan, 2019a). Currently, TAC is set for species that: 1) are important for Japanese people in terms of consumption and for fishers in terms of the number of landings; 2) are in poor stock status and must be managed urgently; or 3) are caught by foreign vessels around Japan; and have sufficient scientific data to set TAC (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a).

The Minister establishes TAC based on Allowable Biological Catches (ABCs) shown in the result of the fish stock assessment and the socio-economic situations of fisheries, after conferring with the Fisheries Policy Council[3] (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). ABCs are calculated to maintain or recover a fish stock at least to the minimum stock spawning biomass (B_{limit}), where stable recruitment can be expected (Fisheries Agency of Japan, 2019a).

In the early stage of the TAC system, some TACs were set above ABCs (Cabinet Office, 2017). However, each TAC has been established equal to or at less than ABCs since 2015 (Cabinet Office, 2017). After TAC is decided, the TAC is allocated to minister licensed fisheries and governor licensed fisheries (Cabinet Office, 2017).

For minister licensed fisheries, the Fisheries Management Organizations (FMOs) coordinate catch amounts for each member's vessel to ensure that the total catch of the members' vessels does not exceed the allocated TAC (Yagi, Clark, Anderson, Arnason, & Metzner, 2012). TAC may be allocated to each fishing area or fishing season by the organization (Fisheries Agency of Japan, 2019a).

Similarly, each prefectural government makes a TAC management plan to allocate TAC to each fishing license category, etc., to ensure that governor licensed fisheries do not exceed the allocated TAC (Cabinet Office, 2017) Each prefectural government makes the TAC management plan in consultation with the Area Fisheries Coordinating Committee[4] (AFCC) (Cabinet Office, 2017).

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[3]Fisheries Policy Council is the advisory body to the national government for national-wide fisheries coordination and the design of national and international fisheries policies (Makino, 2011; Makino & Matsuda, 2005). Fisheries Policy Council was established under the Basic Law on Fisheries Policy (Basic Law on Fisheries Policy, 2001).

[4] AFCCs are formed in each prefecture under the Fisheries Act (Makino & Matsuda, 2005). In general, each AFCC consists of nine elected fishers, four academic experts, and two representatives of the public interests (Makino & Matsuda, 2005). Fishing rights and licenses for governor licensed fisheries are issued by a prefectural governor, following advice from the AFCC. AFCC determines the allocation and restriction of fishing rights and/or licenses in their sea area by the Fishery Ground Plan and Committee Directions (Makino & Matsuda, 2005). Under the New Fisheries Act, the total number of members can be changed between 10 and 20, but more than half of members must be fishers, and at least one academic

The TAC Law will be merged with the Fisheries Act by December 2020 according to the timeline specified in the New Fisheries Act in December 2018 (Fisheries Agency of Japan, 2019a). Thus, the TAC system will be implemented more broadly under the New Fisheries Act by December 2020.

Under the New Fisheries Act, reference points such as Target Reference Point (TRP), the point defined a state of a fisheries resource or fishery which is considered desirable at which fisheries resource management aims, and Limit Reference Point (LRP), the point indicated a state of a fisheries resource or fishery which is not considered desirable, will be determined instead of B_{limit} (Fisheries Agency of Japan, 2018, 2019a; Rosenberg & Restrepo, 1996). TRP is established to maintain or rebuild a fish stock to achieve maximum sustainable yield (Fisheries Agency of Japan, 2019a). LRP is set to prevent overfishing (Fisheries Agency of Japan, 2019a). A pre-agreed guideline that determines TAC based on TRP and LRP will be established beforehand, including a plan to rebuild a fish stock to TRP when the stock is below LRP (Fisheries Agency of Japan, 2019a).

After TAC is determined, the TAC will be allocated to each management unit, which is divided by fishing gears, fishing areas, and fishing seasons (Fisheries Agency of Japan, 2019c). A management method of TAC may differ among each management unit (Fisheries Agency of Japan, 2019c). If it is not ready to introduce IQ in a management unit, the allocated TAC in the management unit is to be managed on the basis of the total catch quantities or the Total Allowable Effort (Fisheries Agency of Japan, 2019c).

The current TAC system covers 60% of the total catch in Japan for nine fish species (Fisheries Agency of Japan, 2019a). However, the reform of fisheries policy aims to gradually

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expert and at least one representative of the public interests must be included in the members (Fisheries Agency of Japan, 2019c).

expand the coverage from 60% to 80% on a catch basis (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a; Yabana, 2018). Currently, TAC is set for species that: 1) are important for Japanese people in terms of consumption and for fishers in terms of the number of landings; 2) are in poor stock status and must be managed urgently; or 3) are caught by foreign fishing vessels, around Japan; and have sufficient scientific data to set TAC (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a). Under the New Fisheries Act, TAC will be set for fish species which TRP is established, even fish species are not covered under criterion 1), 2) or 3) above (Fisheries Agency of Japan, 2019c).

3.2.4 Individual Quota

Currently, distant water longline vessels that catch southern bluefin tuna and Atlantic bluefin tuna as well as red snow crab pot fisheries that catch red snow crab have been officially managed by IQ (Cabinet Office, 2017; Fisheries Agency of Japan, 2019a).

The IQs of southern bluefin and Atlantic bluefin tuna are allocated based on the capacity of the fishing vessel, the status of the vessel's operation, and the amount of national TAC allocated by international meetings, the Commission for the Conservation of Southern Bluefin Tuna, and the International Commission for the Conservation of Atlantic Tunas, respectively (Fisheries Agency of Japan, 2014c). The IQ of snow crab is allocated to each licensed fisher based on the capacity of the fishing vessel, the historical catch of the vessel, and the status of the stock (Fisheries Agency of Japan, 2014c).

Since the 2014 autumn fishing season, the trial IQ program for Pacific stock of chub mackerel has been introduced to the North Pacific Federation of large- and medium-scale purse seiners (Fisheries Agency of Japan, 2017b, 2019a). The members of the Federation caught about 90% of the total production of the stock in 2015 (Fisheries Agency of Japan, 2017b). The

Federation implemented autonomous management measures, including issuing of fishing quotas among its members by month from 2003 to 2014 (Fisheries Agency of Japan, 2017b). In the 2014 autumn fishing season, the trial IQ program was introduced to 5 groups of purse seine vessels in the Federation (Fisheries Agency of Japan, 2017b). Since 2015, the trial IQ program has been expanded to all of the 35 purse seine vessels in the Federation that catch the Pacific stock (Fisheries Agency of Japan, 2017b). IQ is allocated based on the historical catch of each vessel (Fisheries Agency of Japan, 2017b). This trial program has been implemented as a test-case of an IQ program for TAC species in Japan.

Under the New Fisheries Act, IQ will be applied for licensed vessels to manage all TAC species if the fisheries are ready to be introduced (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). The Minister or a prefectural governor will determine IQ for each vessel based on the historical landings and/or other factors (Article 17) (Fisheries Agency of Japan, 2019a).

3.2.5 Individual Transferable Quota

The TAC Law does not allow the introduction of Individual Transferable Quota (ITQ). However, Article 22 of the New Fisheries Act mentions that transferring IQ is permitted in specific cases (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). Transfers of IQ are permitted in only four cases as stipulated by the enforcement regulations of the New Fisheries Act:

- In the case that IQ is transferred among vessels which have already been assigned IQ;
- In the case that a vessel which has been assigned IQ is discontinued from the fishing operation, and the IQ is transferred to another vessel owned by the same individual who owned the discontinued vessel;

- In the case that a vessel, which has been assigned IQ, is collapsed or sunken, and the IQ is transferred to another vessel that is owned by the same individual who owned the collapsed or sunken vessel;
- In the case that a vessel, which has been assigned IQ, is borrowed or returned to another individual with the right to use the vessel, and the IQ is transferred to the individual who receives the right to use the vessel (Fisheries Policy Council, 2019).

In addition, Fisheries Agency of Japan (2019d) states that a transfer is not approved when IQ of a coastal fisher is traded to an offshore fisher's fishing vessel, or an excessive concentration of IQ can occur.

3.2.6 Autonomous management initiatives

In addition to official regulations based on laws, there are many autonomous measures initiated by fishers (Fisheries Agency of Japan, 2019a). Examples of autonomous measures are a suspension of fishing, a seasonal closure, IQ, a restriction on body length, and a restriction on operating periods (Fisheries Agency of Japan, 2019a).

Before 2011, Resource Restoration Plans were developed to recover fisheries resources that were necessary to be rebuilt by the Ministry of Agriculture, Forestry and Fisheries and the prefectural governments in cooperation with AFCCs and Wide-Area Fisheries Coordinating Committees[5] (WAFCCs) (Tanoue, 2015). However, Resource Restoration Plans were placed into the framework for the Resource Management Guidelines and Plans in 2011.

[5] WAFCCs were established in 2001 under the Fisheries Act (Makino & Matsuda, 2005). There are three WAFCC in Japan: the Pacific WAFCC, the Japan Sea and Western Kyushu WAFCC, and the Seto Inland Sea WAFCC (Makino & Matsuda, 2005). WAFCCs consist of elected committee members from each AFCCs (Makino, 2011). WAFCCs coordinate fisheries resource management of fish stocks distributed in two or more prefectures (Makino, 2011).

The aim of the framework for the Resource Management Guidelines and Plans is to conduct a planned and practical fisheries resource management that fits the regional character of fisheries and fish stock status (Fisheries Agency of Japan, 2011).

Under the framework for the Resource Management Guidelines and Plans, fishers or FMO develop and implement a resource management plan, which includes autonomous management measures and official management measures in line with resource management guidelines drafted by the national or a prefectural government (Fisheries Agency of Japan, 2011, 2019a). Each resource management plan may include autonomous management measures, such as restrictions on the total catch amount, the time of operation, operational areas, and gear types, IQ, size limits, and restoration of fishing grounds, in addition to official management measures (Fisheries Agency of Japan, 2011).

The framework for the Resource Management Guidelines and Plans covers a wide variety of species and fisheries. As of March 2019, 2013 resource management plans have been implemented, which cover approximately 90% of total Japan's fisheries production (Fisheries Agency of Japan, 2019a).

Even after the reform of fisheries policy, the autonomous management initiatives will continue as resource management agreements, from former resource management plans, excluding fisheries managed by IQ under the framework for the Resource Management Guidelines and Plans (Section 6.3) (Fisheries Agency of Japan, 2019c).

3.2.7 Co-management

Fisheries co-management is the participatory and collaborative process of decision-making among representatives of local resource users' groups, government bodies, and research agencies (Jentoft, 1989; Jentoft, McCay, & Wilson, 1998). In general, resource users and the government share the responsibility to manage fisheries resources in co-management partnership (Sen & Raakjaer Nielsen, 1996). In Japan, local fishers have been essential decision-makers, and FAJ and prefectural governments also participate in fisheries resource management as critical players (Makino & Matsuda, 2005). In addition, FRA and prefectural research institutes provide scientific information that contributes to fisheries resource management.

For example, each prefectural government has the responsibility to issue licenses for governor licensed fisheries, following advice from the AFCC (Makino & Matsuda, 2005). Another example is the TAC system. As described in Section 3.2.3, some portions of TAC are allocated to each FMO for minister licensed fisheries by the national government. The FMO manages the allocation to avoid exceeding it. In addition, local resource users, prefectural governments, and the national government refer to and follow scientific information provided by FRA and prefectural research institutes to devise regulations and rules.

As the examples above illustrate, co-management plays a key function in fisheries resource management in Japan.

3.3 Results of high-level meetings about fisheries resource management in Japan

There are many tools for fisheries resource management, which are classified into input controls, output controls, and technical management measures (Section 3.1). TAC is one of the primary tools of fisheries resource management in Japan for some species. For the last two decades, TAC, IQ, and ITQ have been important topics in the discussion of fisheries resource management in Japan. Two government task forces were held in 2008 and 2014, and the reform of fisheries policy was conducted in 2018 to discuss fisheries resource management in Japan, including quota management systems (Ad-hoc Task Force on Fisheries Resource Management, 2014; Ad-hoc Task Force on the TAC System, 2008; Fisheries Agency of Japan, 2019a). In this section, the results of the three meetings are described.

3.3.1 Ad-hoc Task Force on the Total Allowable Catch System in 2008

In 2008, the Ad-hoc Task Force on the TAC System was formed based on the Basic Plan for Fisheries formulated by the Cabinet meeting in 2007 to discuss the current fish stock status and fisheries resource management in Japan, the current issues and directions for improvement of the TAC system, as well as the concepts of IQ and ITQ (Ad-hoc Task Force on the TAC System, 2008). The recommendations of the Task Force include the following points (Ad-hoc Task Force on the TAC System, 2008).

- Explanation and discussion meetings of ABC should be open to the public to allow stakeholders such as fishers to obtain an understanding of the method for calculating ABCs and their characteristics.
- TAC should be set not exceeding ABC as much as possible, while considering the business conditions of the fisheries. Discussions of setting TAC need to be conducted in a highly transparent manner to ensure fishers' understanding and consent. Specifically, at the TAC setting stage, public discussions must be held with the participation of stakeholders, including harvesters, processors, and distributors.
- There is little need to add TAC management to Japanese anchovy (*Engraulis japonicus*), Okhotsk atka mackerel (*Pleurogrammus azonus*), yellowtail (Seriola quinqueradiata), and Pacific cod (*Gadus macrocephalus*). These species are important for the Japanese people and fisheries in terms of the amounts of consumption and landings, respectively. The reasons why TAC management should not apply to these species include insufficient scientific data to determine TAC for these species, and that the stock status of each fish

species is stable. However, the discussion should be continued, taking into account the characteristics of the fisheries resources. Scientific data on these species should be continually accumulated.

- It is not appropriate to introduce IQ as an official management measure for all fisheries in Japan due to a large number of fishing vessels and landing ports, among other factors. However, IQ may be applied to a fish stock that needs strict TAC management. IQ may be implemented only in a season when a large number of landings are expected. These IQ applications may be introduced as a voluntary measure.
- It is not appropriate to introduce ITQ that allows transfers of quotas freely as an official management due to several reasons, including:
  - There could be significant negative effects not only on operating practices and orders that have been developed for many years but also on fishing societies;
  - The management of each fisher's catch would be difficult because the amount of each fisher`s quota could frequently change;
  - It is necessary to organize legal thinking regarding allowing the free quota transfers.

3.3.2 Ad-hock Task Force on Fisheries Resource Management in 2014

In 2014, the Ad-hoc Task Force on Fisheries Resource Management was appointed by FAJ to discuss fisheries resource management policies in Japan to rebuild fisheries resources and to increase or maintain capture fisheries production (Ad-hoc Task Force on Fisheries Resource Management, 2014; Fisheries Agency of Japan, 2014a). The primary purposes of the Task Force included a review of the TAC system and the framework for the Resource Management Guidelines and Plans, along with a discussion of the applicability of IQ and ITQ to Japanese fisheries (Ad-hoc Task Force on Fisheries Resource Management, 2014).

The Task Force released a report in 2014, which includes three points below regarding TAC, IQ, and ITQ (Ad-hoc Task Force on Fisheries Resource Management, 2014).

- TAC should conform to ABC recommended by scientists as a fundamental principle.
- On the basis of its positive effects, including improving the profitability of resource users, there is certainly room to apply IQ in Japan on the premise that IQ is not transferable. Thus, a trial IQ should be conducted for the fish species and fisheries that can be feasibly managed by IQ.
- At this time, the application of ITQ to Japan's fisheries is premature because of increased financial cost for new participants; negative effects of quota concentration against local fishing societies and fishing customs; resistance to stricter fisheries resource management due to the concession value of quota; appropriateness of selling the quota granted for free to seek a profit, etc.

3.3.3 Reform of fisheries policy in 2018

In 2018, an official document entitled "Reform of Fisheries Policy" was submitted by the Agriculture, Forestry, and Fisheries Industry and Regional Vitality Creation Headquarters (Fisheries Agency of Japan, 2019a). The primary purpose of the reform was to achieve the appropriate management of fisheries resources and the transformation of Japan's fisheries into a growth industry (Fisheries Agency of Japan, 2019a). The document specifies the contents of the reform (Section 1.2).

The reform of the fisheries policy regarding TAC, IQ, and ITQ includes the following points (Cabinet Public Relations Office of Japan, 2018).

- As a general rule, stock assessment will be conducted for all useful fisheries resources.

- The research system will be fundamentally expanded. In addition, various information during fishing activities will be utilized for estimating fish stock abundances.
- TRP will be set based on achieving maximum sustainable yield as a fisheries resource management target for each major resource. LRP will be configured at a level that is needed to strengthen a resource management measure that prevents overfishing.
- TAC will be set for each fish stock in each year. TAC species will be expanded gradually to cover 80% of the total catch amount in Japan.
- IQ will be implemented for fisheries or fishing areas that are ready.
- Transfers of IQ will be allowed in specific cases, including upon transfer of a fishing vessel.
- A penalty will be imposed for exceeding allocated IQ.
- Regulations that prevent the expansion of fishing boats, such as tonnage restrictions, will be eliminated for fisheries that meet specific conditions, including fisheries managed by IQ.
- Persons who have received a fishing license will be obliged to report various information.
- The fishing right system will be maintained from the viewpoint of appropriate fisheries resource management.

Chapter 4. Quota-based Management Systems in Other Countries

In this chapter, I describe the overview of the quota-based management systems in Iceland, New Zealand, Norway, and the United States. I also discuss how the systems were developed in each country.

4.1 Overview of the Individual Transferable Quota system in Iceland

Iceland, one of the most fisheries-dependent nations in the world, was among the first to implement a comprehensive ITQ system (Arnason, 2005, 2008). Before introducing ITQs, Iceland introduced different fisheries resource management systems, such as access licenses, fishing effort restrictions, and investment controls (Arnason, 2005, 2008). However, all of the management systems were unsatisfactory (Arnason, 2008).

Iceland implemented its first IQ system in 1976 for the Icelandic summer herring fisheries, which faced a complete moratorium in 1972 due to declining stock (Arnason, 2005). The positive experience of the individual vessel quota system in the herring fishery encouraged the capelin fishery to introduce the same system in 1980 (Arnason, 2005). In addition, in 1984, individual vessel quotas were introduced to the demersal fisheries except for small vessels under ten gross registered tons (Arnason, 2005). In 1990, the Fisheries Management Act was passed (Arnason, 2005). The Act stipulates that all commercial fisheries, except for small fishing boats under six gross registered tons, are managed by ITQ (Arnason, 2005; Organisation for Economic Co-operation and Development, 2017).

The ITQ covers about 35 different fisheries and 19 fish species (Arnason, 2005, 2008). These species make up 97% of the value of the landings caught in the Icelandic Exclusive Economic Zone (Arnason, 2005).

4.2 Overview of the Quota Management System in New Zealand

New Zealand was also one of the first countries to apply ITQs as a primary means of managing its commercial fisheries (Mace, 2012; Mace, Sullivan, & Cryer, 2014). The quota system is called the Quota Management System (QMS) (Mace, 2012; Mace et al., 2014).

By the late 1970s, fishing capacity had expanded well beyond that required to harvest the catch (Bess, 2005). At the time, constraints on fishing effort failed to protect and conserve fisheries resources from depletion, while conflicts intensified among fisheries sectors (Bess, 2005). In 1983, New Zealand implemented ITQ systems for some fish species, then QMS based on ITQ has been applied since 1986 (Lock & Leslie, 2007; Mace, 2012). Initially, 27 species or groups of species were included in the QMS (Hale & Rude, 2017). In 1996, 32 fish species, the majority of fish stocks, were incorporated into the QMS (Batstone & Sharp, 1999). 98 species or species groups and essentially all commercial fisheries were presently included in the QMS (Hale & Rude, 2017).

It is important to note that the Māori were the sovereign people of New Zealand and had utilized fisheries commercial, cultural, and recreational purposes (Hale & Rude, 2017). Seafood was an important part of the Māori diet (Hale & Rude, 2017). Traditional fishing rights of Māori were assured under the Treaty of Waitangi 1840 (Batstone & Sharp, 1999). However, Māori proprietary fishing rights did not have meaningful recognition between 1840 and 1987 (Hale & Rude, 2017).

In 1987, Māori succeeded in obtaining a court injunction against the allocation of ITQ (Hale & Rude, 2017). The government granted the Māori Fisheries Commission 10% of the available quota in the QMS under the Māori Fisheries Act 1989, which is the first legislated recognition of Māori property fishing rights since 1840 (Hale & Rude, 2017). In 1992, 20% of new species quota were added in addition to the 10% already agreed and implemented in the statute by the Māori Fisheries Act 1989 (Boast, 1999; Hale & Rude, 2017). It is estimated that somewhere between 30 and 50% of all quota holdings in New Zealand are owned by iwi[6], and the QMS has served to reinstate the fishing rights that were specified by the Treaty (Hale & Rude, 2017).

4.3 Overview of the Individual Vessel Quota system in Norway

Norway introduced non-transferable Individual Vessel Quota (IVQ) systems to the deep-sea trawlers and the pelagic purse seine vessels in the late 1970s (Standal & Asche, 2018). The Norwegian quota system started as an emergency measure to deal with collapse in fisheries resources such as Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), and Atlantic cod (*Gadus morhua*) (Hannesson, 2013). At first, IVQ was not intended to be transferable (Hannesson, 2013). However, some resource users realized that they could improve the profitability by buying another vessel and adding its quota to their own (Hannesson, 2013). In addition, politicians gradually realized that this could be effective for reducing overcapacity at the industry's own expense (Hannesson, 2013). Thus, some quotas became transferable as a tool to decrease vessel overcapacity.

However, there are some restrictions on quota trading. For example, quota can only be transferred within defined vessel groups and geographical regions (Hannesson, 2013; Standal & Asche, 2018). In addition, quota can only be bought together with the vessel to which it belongs,

[6] Iwi are the largest of the groups that form Māori society (Hale & Rude, 2017).

and quota can be transferred to a vessel or multiple vessels only when the fishing vessel to which quota belongs is scrapped or permanently removed from the fishery (Hannesson, 2013).

The IVQ system consists of different mechanisms to transfer quotas to reduce overcapacity described below.

Unit Quota System (UQS) was aimed to reduce fishing capacity and the number of offshore fishing vessels (Organisation for Economic Co-operation and Development, 2012). UQS provided a tool for an owner of two fishing fleets to transfer the quota of one fleet to the other on the condition that the fishing fleet that loses its quota is scrapped or sold (Organisation for Economic Co-operation and Development, 2012; Standal & Aarset, 2008). The first UQS was introduced to adjust the capacity to the available resources for cod trawlers in 1984 (Standal & Aarset, 2008). From 2005, the UQS in the offshore fisheries was converted to Structural Quota System (SQS) (Johnsen & Jentoft, 2018; Standal & Hersoug, 2014).

SQS was introduced in 2004 to reduce capacity in coastal fishing vessels (Organisation for Economic Co-operation and Development, 2012). It allows fleets between 15 and 28 meters to transfer quota from one fishing fleet to another if one fishing fleet is decommissioned (Organisation for Economic Co-operation and Development, 2012; Standal & Asche, 2018). Fleet owner retains 80% of the quota attached to the decommissioned fleet, while 20% is returned to the group of vessel owners belonging to the same group as the decommissioned vessel (Hersoug, 2005). In 2007, SQS also introduced to the coastal fleet in the group of vessels with 11 to 15 meters (Standal & Asche, 2018).

Quota Exchange System (QES) was introduced to increase the flexibility in the trade of quotas between various vessels in 2004 (Hersoug, 2005). The QES provides a mechanism for two vessel owners in the same vessel group to form a team to fish using both quotas on one of the vessels for a period of three out of five years (Hersoug, 2005; Organisation for Economic Co-operation and Development, 2005).

Overall, the IVQ system covers probably 75 to 80% of landings in Norway (Hannesson, 2013).

It is also important to note that the Norwegian government and fisheries authorities acknowledge their international obligations to maintain traditional fisheries by Sámi, an indigenous people (Organisation for Economic Co-operation and Development, 2017). A regional quota was established in the core area of the Sámi to protect their interests in the important fjord cod fisheries (Holm & Rånes, 1996).

The Sámi Parliament and the Ministry of Fisheries and Coastal Affairs agreed to promote local fisheries and management in the northmost areas of Norway (Organisation for Economic Co-operation and Development, 2017). The agreement contains the establishment of a right to fish for people who live in Northern counties, including Sámi areas (Organisation for Economic Co-operation and Development, 2017).

4.4 Overview of catch share programs in the United States

The United States introduced catch share programs[7] through its unique regional council system as the framework of federal fisheries management under the Magnuson-Stevens Fishery Convention and Management Act of 1976 (MSA) (Kent, 2012; Schikler, 2008). The MSA created eight Regional Fishery Management Councils: North Pacific, Pacific, Western Pacific, Gulf of Mexico, Caribbean, South Atlantic, Mid-Atlantic, and New England Fisheries

[7] Catch share includes IFQ, ITQ, and Limited Access Privilege programs that allocate a specific portion of TAC to individuals, cooperatives, communities, or other entities for their exclusive use (National Oceanic and Atmospheric Administration, 2019a).

Management Councils (Kent, 2012). Each Council has the authority to make Fishery Management Plans (FMPs) for the fish stocks in its region (Kent, 2012). The Regional Council framework was designed to encourage collaboration with federal and state governments, fisheries scientists, and commercial and recreational fishing sectors (National Research Council, 1999; Schikler, 2008).

The first ITQ program in the United States was the Mid-Atlantic surf clam and ocean quahog ITQ program created in 1990 under the FMP developed by the Mid-Atlantic Fishery Management Council (Schikler, 2008). The second ITQ program was the South Atlantic wreckfish ITQ program established in 1992 under the FMP developed by the South Atlantic Fishery Management Council (Schikler, 2008).

However, some fishing industry groups and public interest groups opposed ITQ programs (Schikler, 2008). In 1996, a moratorium on the establishment of ITQ programs was included in a reauthorization of the Act, and it continued until 2002 (Schikler, 2008). In addition to individuals and firms, fishing communities and regional fishery associations were added to the MSA to acquire allocations in ITQ programs in 2007 (Schikler, 2008).

As of October 14, 2019, there are 17 catch share programs in operation in the United States (National Oceanic and Atmospheric Administration, 2019a).

Chapter 5. Ten Elements and Options that should be Considered when Introducing Individual Quota Programs in Japan

In this chapter, ten elements essential to the design of an IQ program are discussed. The elements are: prerequisites, goals, eligibility, definition, allocation, administration, cost and payers, monitoring and enforcement, avoidance of excessive shares and negative social impacts, and review of performance. In each section, the element is described first, then options from the experience of the four countries are discussed with Japan's fisheries resource management experience and practice.

5.1 Prerequisites

The first element is prerequisites; i.e., the fisheries resource management capabilities that need to be in place before drafting the IQ program. Before adopting the IQ program in Japan, fisheries managers should ask researchers or research institutes to conduct fish stock assessments based on the best available science to prevent overfishing and rebuild overfished stocks. Then, fisheries managers should cap harvests for each species that will be managed under the IQ program at TAC based on the stock assessment.

5.1.1 Conduct a fish stock assessment based on the best available science

Setting an appropriate catch limit based on the best available scientific information is a crucial element for introducing the IQ program. If the catch limit is set too high against the current biomass, any fish stock can be at risk of becoming overfished. When a stock assessment is conducted for a fish stock, all fishing mortality, including discarding, recreational catch, and research purpose, must be included for a calculation of the ABC.

In Japan, there is an existing program for stock assessments. FRA currently conducts fish stock assessments for 50 important species and 84 stocks (Fisheries Agency of Japan, 2019a). By 2023, stock assessments will cover all the major 200 target species (Fisheries Agency of Japan, 2019b).

Thus, the current stock assessment program with planned continuous updates can be used for providing ABCs for each stock.

5.1.2 Set Total Allowable Catch for the fish stock based on the stock assessment

The next step is to set TAC for the fish stock based on the stock assessment. In Japan, there is the TAC system, and TAC is set based on ABCs shown in the result of the stock assessment (Section 3.2.3). The current TAC system covers 60% of the total catch in Japan and applies to nine fish species (Fisheries Agency of Japan, 2019c). The reform of fisheries policy aims to gradually expand the coverage from 60% to 80% on a catch basis (Fisheries Agency of Japan, 2019c).

Thus, the current TAC system with the expansion can be utilized for setting TAC for each stock.

5.1.3 Determine the frequency of the fish stock assessment and the Total Allowable Catch setting process

The final step of the prerequisite is setting the frequency of the fish stock assessment and the TAC setting process. Japan sets the management objectives of preforming stock assessments and setting TAC annually. In addition, according to the main points of the reform of the fisheries policy, TAC will be set for each fish stock in each year (Section 3.2.3) (Cabinet Public Relations Office of Japan, 2018). Thus, the fish stock assessment and the TAC setting process can be conducted annually. However, another frequency, such as multiple years, seasonal, or other terms, may be applied if there is a particular benefit.

5.2 Goals of the Individual Quota program

Setting clear goals of the program is one of the most critical elements for designing the IQ program. It is also essential for all stakeholders and fisheries managers to understand the goals before drafting the IQ program.

It may be difficult to articulate a single goal for the program since there may be multiple stakeholders that have different interests in the program (Bonzon et al., 2013). In this case, multiple goals may be set for the program. However, achieving multiple goals requires a more thoughtful and elaborate design of the program (Bonzon et al., 2013).

In general, fisheries resource management has three types of goals: biological, economic, and social goals. For example, in the United States, under the MSA, National Standards for fishery conservation and management seek a balance among preventing overfishing in National Standard 1, sustained participation of communities in National Standard 8, and minimizing adverse economic impacts on fishing dependent communities in National Standard 8 (16 U.S.C. 1851(a)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007). Similarly, the European Union Common Fisheries Policy also seeks a balance among environmental, economic, and social aspects for the sustainable use of fisheries resources (CR 2371/ 2002 Article 2) (European Union, 2002).

Biological goals, such as ending overfishing and rebuilding overfished stocks, are often the most critical for fisheries resource management (Bonzon et al., 2013). If the fisheries resource managed under an IQ program is rebuilt under harvest limits, the amount of IQ that a fisher receives may be increased. Thus, IQ may contribute to achieving a biological goal with incentives for fishers to promote the sustainable use of fisheries resources and better conservation behavior (Bonzon et al., 2013).

However, since IQ is simply an allocation of TAC, the impacts of IQ program on fish stocks depend on the amount of TAC, regardless of whether the TAC is divided into individuals (Bromley, 2009). Ending overfishing requires setting appropriate total catch limits or TAC for the fish stock based on the best available science. The differences between whether the TAC is allocated to individuals or not has an insignificant effect on achieving a biological goal directly (Essington, 2010).

Another common biological goal is to reduce bycatch. However, the bycatch issue is less important than the three main issues in Japan, which are the decline in fisheries production, the low abundance of many fisheries resources, and the decline in the number of fishers (Section 1.1).

Thus, in this section, economic and social goals under the IQ program are discussed.

5.2.1 Establish economic goals

Economic goals are essential factors for designing the IQ program.

In Iceland, ITQ was introduced to combat the overcapacity or overcapitalization in the fisheries (Runolfsson, 1999).

In New Zealand, the primary goals of QMS under the Fisheries Act in 1983 are to maximize economic return from fisheries and ensure the sustainability of fisheries (Mace et al., 2014).

In Norway, the transferable IVQ is aimed to reduce unprofitable overcapacity in the fishing fleet and improve its profitability (Hannesson, 2013; Standal & Aarset, 2008).

In the United States, the primary economic goal of ITQ programs is to provide incentives to reduce effort and overcapitalization in commercial fisheries and to enhance the efficiency of the fishing industry (Buck, 1995). For instance, the Gulf of Mexico red snapper Individual Transferable Quota (IFQ) program is aimed to reduce overcapacity and eliminate the race-to-fish conditions in the fishery (Agar, Stephen, Strelcheck, & Diagne, 2014).

As the examples of other countries' goals described above illustrate, potential options for the economic goals of Japan's IQ program are listed below:

- Reduce over capacity or overcapitalization
- Improve the profitability of fishers with greater efficiency
- Maximize economic return from fisheries.

5.2.2 Establish social goals

Social goals might not be major factors in comparison with economic goals for implementing the IQ program. However, negative social impacts are reported in some quota programs, in particular ITQ programs, such as the concentration of IQ, decline in the number of small-scale fisheries, and loss of small fishing communities (Section 6.5). Thus, it is important to set social goals to address potential and/or existing social programs.

In Iceland, one of the purposes of the Fisheries Management Act of 1990, the basis for implementing ITQ, is ensuring stable employment and settlement throughout the country (Fisheries Management Act, 1990).

In New Zealand, one of the purposes of ITQ is to allocate catch entitlements equitably based on each fisher's commitment to the fishery (Harte, 2000).

In Norway, one of the important goals of the IVQ system is to decentralize ownership and maintain the diversity of fleet structure and employment systems in coastal areas, especially in the fisheries dependent areas in the northern regions (Standal & Aarset, 2008; Standal & Asche, 2018).

In the United States, one of the essential purposes of ITQ programs is to promote safety in fishing vessels by slowing or eliminating the race-to-fish conditions and allowing fishers flexibility of their fishing operations (Buck, 1995). For example, one of the goals in the Pacific halibut and sablefish IFQ program and the Bering Sea and Aleutian Island (BSAI) crab rationalization program is to improve the safety of the fishery by allowing captains to stop fishing in inclement weather and stay in harbors (Fina, 2011).

As the examples above show, the potential options of the social goals for Japan's IQ program are listed below:

- Retain the historical geographic distribution of fisheries and the structure of the fishing fleets
- Protect particular coastal fisheries and communities
- Decentralize ownership and quota
- Stabilize employment in a fishing sector
- Increase safety of fishing operations
- Ensure equity and fairness of distribution of benefits from the fishery.

5.3 Eligibility to participate in the Individual Quota program

The third element is to define who has eligibility to join the IQ program. It is also a vital step to design the IQ program, especially for achieving social goals.

In this section, the criteria to determine the eligibility of fishers and the system for new fishers to participate in the IQ program are identified. When fisheries managers decide the criteria and system, they should review the goals of programs, in particular, social goals carefully.

5.3.1 Establish criteria for eligible participants

Determining criteria for eligible participants is the basis of the program.

In Iceland, eligible vessels for the herring and inshore shrimp fisheries were generally those who had a recent history of participation in the fishery (Arnason, 2005).

In New Zealand, the approaches for determining eligibility in inshore and offshore fisheries are different. The eligibility for inshore fisheries were fishers who had a minimum quota holding (Batstone & Sharp, 1999). The examples of the minimum quota holdings are three tons of shares for rock lobster (*Jasus edwardsii*) and shellfish and five tons of shares for the southern scallop fishery (Batstone & Sharp, 1999). Part-time fishers were excluded from commercial fishing (Hale & Rude, 2017). For deepwater fisheries, companies that had vessels, processing facilities, and catch histories of deepwater species were eligible in the program (Hale & Rude, 2017).

In Norway, licenses and permits are required for all major coastal and offshore fisheries respectively, and a limited number of licenses and permits are issued (Organisation for Economic Co-operation and Development, 2012, 2017). Basically, only fishers with a license or permit with a fishing vessel are eligible for the program (Organisation for Economic Co-operation and Development, 2012). For coastal cod fisheries, those who had certain landings from 1987 to 1989 were eligible to participate in the program (Holm & Rånes, 1996).

In the United States, federal law requires consideration of a variety of eligibility criteria such as a social connection to the fishery, economic barriers to access to the fishery, traditional fishing activity, and commitment to follow conservation measures to the fishery in the region (16 U.S.C. 1853a) (Magnuson-Stevens Fishery Conservation and Management Act, 2007).

For example, in the Pacific halibut and sablefish IFQ program, all vessel owners and lessors who had landings in 1988, 1989, or 1990 hold eligibility (Buck, 1995). In the South Atlantic wreckfish ITQ program, vessel owners who have a landing record in 1989 or 1990 were eligible for the program (Buck, 1995). In the Gulf of Mexico red snapper IFQ program, in addition to the initial ITQ holders (Section 5.5.1), anyone who held a Gulf of Mexico commercial reef fish license were eligible for the first five years of the program (Agar et al., 2014). In 2012, United States citizens and permanent residents were also allowed to buy and trade red snapper IFQs (Agar et al., 2014). In the Mid-Atlantic surf clam and ocean quahog ITQ program, anyone, including foreigners, can hold quotas, but only United States flag fishing vessels may catch these fish species (Buck, 1995).

As the examples above demonstrates, the potential options of criteria or combinations of criteria to determine eligible participants are listed below:

- Historical landings
- Active fishers with an active license
- Citizenship or permanent residents
- Social connection to the fishery
- Participation of the fishing community
- Owners of a fishing vessel
- Owners of a processing facility
- Conservation manners to the fishery in the region.

In Japan, license limitations have already been established based on fishing right and license systems. Bonzon et al. (2013) point out that initial IQ holders were the vessel license holders in most fisheries where a licensing system was already applied before implementing the IQ program. Thus, it may be politically feasible for Japan to include current fishing licensing holders, current fishing right holders, and/or current members of FCA as criteria for eligible participants.

5.3.2 Establish a system for new participants to receive Individual Quota

It is also an important step to develop a system to allow new participants to be eligible for the program before introducing the IQ program. Without designing this system, the program will not transfer to the next generation successfully.

The most common way for new entrants to obtain IQs is to trade quotas if those are allowed (Bonzon et al., 2013). However, there are other options for new participants to receive quotas described below.

In Iceland, a new non-ITQ small-boat handline fishing called "coastal fishing" was established to offer access to new participants and to protect employment in rural fishing villages in 2009 (Chambers & Carothers, 2017). Coastal fishing had 8,600 tons of quota in total in 2015, which was less than 2% of TAC (Chambers & Carothers, 2017). Coastal fishing is allowed for 14 hours per day from Monday to Thursday from May to August, with four jig machines (Chambers & Carothers, 2017). Each vessel has a daily catch limit, which is 650 kilograms of cod equivalents[8] of demersal species (Chambers & Carothers, 2017).

[8] A cod equivalent is a unit in quota trading, in which other fish species are given a weighted value that is a comparison of their market value to the value of cod (Chambers & Carothers, 2017).

In New Zealand, resource managers buy and reclaim quota from existing quota holders for new entrants (Government Accounting Office, 2004). For example, the government reclaims quota from fishers who do not follow regulations (Government Accounting Office, 2004). The government also bought back quota to award to Māori indigenous group in partial settlement of their claims (Government Accounting Office, 2004).

In Norway, during 1991 and 1992, a small portion of the quota was distributed for recruiting new fishers to the IVQ system; the amount of quota was 1,296 tons in 1991 and 3,096 in 1992 (Holm & Rånes, 1996). In 2009, the Norwegian government developed the Recruitment Quota (RQ) to provide access to young fishers that were under 30 years old at the time of application (North Pacific Fishery Management Council, 2019). The RQ creates a set aside of quota that is distributed annually to young vessel owners fishing with a gillnet, jig, and longline gear (North Pacific Fishery Management Council, 2019). The amount of RQ is determined by the Minister annually (North Pacific Fishery Management Council, 2019). RQ has been composed of 90 to 95% cod, saith (*Pollachius virens*), and haddock (*Melanogrammus aeglefinus*) and a small percentage of mackerel (North Pacific Fishery Management Council, 2019). The number of young fishers who receive RQ is also determined by the Minister annually, but there are ten recipients per year in most of the years (North Pacific Fishery Management Council, 2019). RQ is valid for ten years, and it cannot be transferred to another vessel (North Pacific Fishery Management Council, 2019).

In the United States, the transferability of quota shares to eligible buyers allows for new entrants (Government Accounting Office, 2004). The MSA allows offering loans to buy quotas (Government Accounting Office, 2004). For instance, National Marine Fisheries Service

(NMFS) created a low-interest loan program for new participants who catch fish using a small vessel in the halibut and sablefish fisheries off Alaska (Government Accounting Office, 2004).

As the above examples demonstrate, the potential options of a system for new participants to receive quotas are listed below:

- Transfer IQs where permitted
- Share redistribution
- Set-aside quota for new participants
- Set-aside quota for young new participants.

In Japan, new participants can start fishing activities when they purchase a license or scrap an old licensed vessel under the strictly limited entry system (Tanoue, 2015). Thus, a barrier for new entrants may be a difficulty in receiving a license or fishing right rather than receiving an allocation.

5.4 Definition of Individual Quota

The next step is to create the definition of IQ, which includes the duration of IQ, the recipient of IQ, the share unit of IQ, and the possibility of transferring IQs. All of them may directly or indirectly affect current and future fisheries industries and coastal communities. Thus, the definition of IQ should be carefully determined by reviewing the economic and social goals of the IQ program.

5.4.1 Determine how long Individual Quota is allocated

The duration of IQ should be determined after considering the balance between incentives for participants to promote the sustainability of the fisheries and assurances for new participants to join the program. Limited tenure weakens incentives for resource stewardship

(Costello & Kaffine, 2008). However, permanent tenure may have an impact on potential new participants because it may be difficult for new entrants to purchase or be granted IQ to start their fishing operations (Bonzon et al., 2013).

In Iceland, the duration of the IQ is indefinite (Arnason, 2005).

In New Zealand, quotas are allocated permanently (Hale & Rude, 2017; Mace et al., 2014).

In Norway, Quota Factor (QF) based on vessel length gives the annual IVQ (Johnsen & Jentoft, 2018). QF has no time limitation in practice (Johnsen & Jentoft, 2018). However, transferred quotas are valid for 20 or 25 years, depending on the vessel group (Standal & Asche, 2018). For example, transferred quotas are valid for 20 years in purse seine vessels and trawlers (Hannesson, 2013).

In the United States, there was no limit on the duration of the IQ-type programs prior to 2007. However, after 2007, Limited Access Privilege Programs, IQ-type programs, are subject to a 10-year limit unless extended (16 U.S.C. 1853a(f)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007). In practice, it appears that there is no hard-and-fast-limit on the duration of IQ type programs.

These experience of other countries shows that there are three options of the length of IQ allocation below:

- Permanent
- No time limitation
- Certain years.

5.4.2 Determine where Individual Quota is assigned

In Iceland, all quotas must be associated with a licensed fishing vessel (Arnason, 2005; Chambers & Carothers, 2017). Each licensed fishing vessel owned by an individual or a firm may have permanent IQ in the TAC for TAC species (Arnason, 2002, 2005).

In New Zealand, quotas are allocated to fishing permit holders (Hale & Rude, 2017).

In Norway, quotas are allocated and attached to the vessel through the IVQ system (Standal & Hersoug, 2014).

In the United States, quotas are allocated to individuals, firms, communities, or regions (Magnuson-Stevens Fishery Conservation and Management Act, 2007; Schikler, 2008).

As the experience of other countries above show, there are five ways to assign IQ below:

- Fishing vessels
- Fishing permit holders (Individuals)
- Firms
- Communities
- Regions.

However, under the New Fisheries Act, IQ will be allocated to licensed vessels to manage all TAC species (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). Thus, vessels are the option for Japan.

5.4.3 Determine the share unit

In Iceland, a percentage approach is used for the ITQ system (Arnason, 2005). Under the percentage approach, a participant of the IQ program receives a specific percentage of the TAC for a particular fish stock. The allocation in weight under the percentage approach is a simple multiple of the IQ holder’s assigned percentage and the TAC (Arnason, 2005). For instance, if an IQ holder has 5% of quota share in a program with TAC of 500 meteoric tons, then the IQ holder will be allowed to catch 25 tons of fish. But if the TAC is 1,000 tons next year, the IQ holder with a 5% share would be able to catch 50 tons of fish. Thus, the amount of the IQ has fluctuations due to the size of the TAC each year based on the result of the stock assessment and/or other factors.

In New Zealand, ITQ was initially distributed based on an absolute weight approach (Hale & Rude, 2017; Mace et al., 2014). Under this approach, ITQ was allocated according to a catch history with a fixed amount of quota assigned as total tons of fish issues in perpetuity (Mace et al., 2014). If the TAC changes, the government may have to take action to adjust each IQ. For instance, if the TAC decreases, the government has to buy a corresponding amount of IQ from the participants to reduce each fishers' IQ (Mace et al., 2014). On the other hand, if the TAC increases, the government may sell additional shares (Mace et al., 2014). In 1990, however, the share unit of quota in New Zealand switched to the percentage approach due to an immediate need to buy back quota to cut the amount of TAC for orange roughy (*Hoplostethus atlanticus*) (Hale & Rude, 2017; Mace et al., 2014).

In Norway, quotas represent a percentage share of the national TAC (Standal & Asche, 2018).

In the United States, ITQ represents a specific percentage of the TAC. For example, the percentage share of the TAC is used in the Gulf of Mexico red snapper IFQ program (Agar et al., 2014; Buck, 1995).

As the examples above show, there are two types of share units to allocate IQ below:

- Percentage approach
- Absolute weight approach.

The percentage approaches to IQ encourage fishers to participate more in collecting and analyzing scientific data and funding the majority of the scientific advising process (Hilborn, 2004). In addition, if the fish stock is rebuilt, each IQ is expected to be increased proportionately. Thus, the percentage approach may provide an economic incentive for the sustainable use of fisheries resources with participants of the program, compared with the absolute weight approach.

Fisheries Agency of Japan (2018) states that the percentage approach will be used for the IQ program in Japan. Thus, the percentage approach is the option for Japan.

5.4.4 Determine whether Individual Quota is transferable

A pivotal component in the design of the IQ program is whether transferring IQs is allowed or not. The transferability of IQs increases the flexibility of the IQ program. From an economic perspective, flexibility may promote reducing overcapitalization and increase the value of fisheries (Bonzon et al., 2013). From a social perspective, transferability provides an opportunity for new participants to join the program by purchasing quotas from existing participants (Bonzon et al., 2013). However, the transferability may create negative social impacts such as a concentration of IQ by a few participants and a heavy regional bias of IQ through the purchase of allocations. When fisheries managers decide the rules of transferability for IQ, including whether transfers of IQ are allowed, they should review the social and economic goals of the program very carefully.

In Iceland, both the TAC shares and the annual quotas are transferable to any Icelandic citizen who has a fishing license (Arnason, 2005). Purchased quota can be re-traded (Arnason, 2005).

In New Zealand, both permanent transfers and leasing are allowed (Lock & Leslie, 2007).

In Norway, transfers are allowed within a designated vessel group and a geographical area with certain conditions (Section 4.3) (Hannesson, 2013; Standal & Hersoug, 2014). However, leasing of quotas is not permitted (Hannesson, 2013).

In the United States, transfers are allowed both permanently and temporarily. For example, permanent transfers are permitted in the Mid-Atlantic surf clam and ocean quahog ITQ program, the South Atlantic wreckfish ITQ program, the Gulf of Mexico red snapper IFQ program, and the Pacific halibut and sablefish IFQ program with some restrictions (Agar et al., 2014; Buck, 1995). In addition, ownership of quota and fishing operations can be separated by leasing or other agreements under the Mid-Atlantic surf clam and ocean quahog ITQ program, the South Atlantic wreckfish ITQ program, the Gulf of Mexico red snapper IFQ program, and the Pacific halibut and sablefish IFQ program with some restrictions (Agar et al., 2014; Buck, 1995).

In the Pacific halibut and sablefish IFQ program, a temporary lease from commercial quota to recreational charter boat operations is allowed (North Pacific Fishery Management Council & National Marine Fisheries Service, 2016). When the fishing season or the particular contract term ends, the lessee of the IQ must return the IQ to the owner of the quota.

The experience of other countries shows that there are two options to transfer IQs as follows:

- Permanent transferability
- Temporary transferability (Leasing).

Transfers of IQ will be allowed under the New Fisheries Act and the enforcement regulations of the New Fisheries Act in specific cases (Section 3.2.5). Thus, both options may be possible within the limited conditions.

5.5 Individual Quota allocation

5.5.1 Develop the allocation protocol

The distribution of IQ can be the most challenging and controversial element of developing the IQ program (Buck, 1995). It may receive extra public attention, especially in the initial allocation process. The allocation protocol must be established before the implementation of IQ.

In Iceland, the initial allocation of the demersal fisheries was to be based on the catch history of each vessel for the three previous years prior to the introduction of the quota system in 1984 (Arnason, 2005). Initial allocations in the herring and inshore shrimp fisheries ITQ program were an equal share for all eligible participants (Arnason, 2005). In the capelin fishery, two thirds of the initial quotas were equally distributed for all participants, and one-third of the quotas were allocated based on vessel hold capacity (Arnason, 2005).

In New Zealand, initial quotas of offshore fisheries were allocated based on catch history and investment in offshore processing facilities (Hale & Rude, 2017; Lock & Leslie, 2007). In inshore fisheries, ITQ was initially distributed based on catches during the best two out of three years, 1981/82, 1982/83, and 1983/84 (Bess, 2005; Hale & Rude, 2017; Mace et al., 2014). ITQ is now allocated to Māori customary, recreational, and commercial fishers based on a formula. Under the Treaty of Waitangi Settlement, 20% of quota for any new QMS stocks is allocated to Māori fisheries (Lock & Leslie, 2007).

In Norway, the initial allocation of IVQs for coastal cod fisheries was based on the historical landings and vessel sizes (Holm & Rånes, 1996). The quota allocation for purse seine vessels is based on the vessel capacities (Hannesson, 2013).

In the United States, the initial allocation is usually based on the historical catch record with other criteria in some fisheries. For instance, ITQ for surf clam (*Spisula solidissima*) was based on four years of historical catches prior to the implementation of the ITQ system from 1986 to 1989 (Buck, 1995). ITQ for ocean quahog (*Arctica islandica*) were distributed based on average landings between 1979 and 1987 when fishing boats reported landings (Buck, 1995). In the Pacific halibut and sablefish IFQ program, initial IFQ was allocated according to total catch in their best five of seven years from 1984 to 1990 for Pacific halibut (*Hippoglossus stenolepis*) and five of six years from 1985 to 1990 for sablefish (*Anoplopoma fimbria*) (Buck, 1995). In the Gulf of Mexico red snapper IFQ program, the initial allocation was also based on their historical landings; the best successive years of catch from 1990 to 2004 for Class 1 vessels (2,000 pound trip limits) and the best five years of landings from 1998 to 2004 for Class 2 vessels (200 pound trip limits) (Agar et al., 2014). In the South Atlantic wreckfish ITQ program, in the United States started in 1992, allocations were based 50% on catch history from 1989 or 1990, and the other half was divided equally to all those who received allocations (Buck, 1995).

MSA allows for an auction to allocate quotas and collect fees (16 U.S.C. 1853a(d)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007). However, this approach has not been applied as the allocation protocol in the United States at the national level.

As the above examples above demonstrate, there are five options to allocate initial quotas listed below. It also may be a potential option to combine these:

- Historical landings
- Equal share
- The size of a licensed fishing vessel
- Investments in offshore processing facilities

- Auction.

If fisheries managers use historical landings as the basis of allocating quotas, they may offer an opportunity to select specific years for calculating historical catch for removing years that fishers did not go fishing often or did not catch much fish due to environmental reasons or other reasons.

In order to avoid the race-to-fish condition, catch landed after the start of discussions on an introduction of the IQ program should not be included in the calculation of initial IQ if the historical landings are used as an allocation protocol.

5.6 Individual Quota administration

Administrative systems are important for the success of fisheries resource management. A management body specialized in the IQ allocation, and a platform for catch account and tracking IQ transfers should be developed for the IQ program.

5.6.1 Establish a management body for the Individual Quota allocation

It is essential for the IQ program to establish a management body for the IQ allocation. The management body should be highly transparent, open to the public, and independent of other decision-making processes in fisheries resource management (Bonzon et al., 2013).

In Iceland, the Ministry of Fisheries introduced rules for the initial allocation (Eythórsson, 2000). In addition, five different preparatory committees were appointed by the government to discuss other details with the broad range of representatives not only from fishers but also from outside the harvesting sector (Eythórsson, 2000).

In New Zealand, the Crown has responsibility for quota allocation (Hale & Rude, 2017). However, to determine an individual catch history for the allocation of the quota in inshore fisheries, regional catch history review committees were created to validate the landings of each fishing vessel (Lock & Leslie, 2007).

In Norway, the Regulatory Council was established in 1983 as the meeting arena between the industry representatives and the fisheries authorities to discuss IVQ and other fisheries resource management issues (Hoel, Jentoft, & Mikalsen, 1996; Holm & Rånes, 1996). The final allocation decision remains with the Ministry of Fisheries, but recommendations from the Regulatory Council have influence and considerable power in the decision-making process (Hoel et al., 1996).

In the United States, Regional Fisheries Management Councils play key roles for fisheries resource management. Each council has the responsibility to develop the catch share program if appropriate for a fishery, including allocation criteria and transfer guidelines (Buck, 1995). The Regional National Marine Fisheries Services Office the implements the Councils' decisions (Government Accounting Office, 2004). For example, in Alaska, the Restricted Access Management Program in the Alaska Regional Office implements transferable allocation programs, including the determination of program eligibility (National Oceanic and Atmospheric Administration, 2020d).

As the experiences above illustrate, there are three options for a management body of IQ allocation in Japan as follows:

- Regional fisheries management body
- Independent committee
- National government.

There are existing three regional fisheries management bodies in Japan: the Pacific WAFCC, the Sea of Japan and Western Kyushu WAFCC, and the Seto Inland Sea WAFCC

(Makino, 2011). These committees may be utilized for a discussion panel to allocation decisions.

Under the current TAC system, TAC is allocated to FMOs for minister licensed fisheries and to each prefecture for governor licensed fisheries, after the TAC is determined by the Minister in consultation with the Fisheries Policy Council (Section 3.2.3) (Cabinet Office, 2017). FMOs may allocate TAC to each member fishing vessel to ensure that the total catch of the members' vessels does not exceed the allocated TAC (Section 3.2.3) (Fisheries Agency of Japan, 2019a; Yagi et al., 2012). Each prefectural government makes a TAC management plan to allocate TAC to each fishing license category, etc. in consultation with an AFCC (Section 3.2.3) (Cabinet Office, 2017). Thus, FMOs, the Fisheries Policy Council, and AFCCs may also function as decision-making bodies for the IQ allocation protocol.

5.6.2 Establish a platform for catch accounting and tracking Individual Quota transfers

Record initial allocation and IQ trades as well as monitoring the total catch amount of each IQ holder is essential for any IQ program (see Section 5.8.1 for more details about the monitoring system). These recording and monitoring functions may be linked in one scheme to track landings against IQ holding to avoid exceeding the IQ.

In Iceland, the Directorate of Fisheries, a public institution under the Ministry of Fisheries, provides a database that shows the status of each vessel's IQ and how much each vessel takes from its quota (Iceland Responsible Fisheries, 2020b). Information on each vessel's IQ and quota use is regularly updated and open to the public on the website of the Directorate (Iceland Responsible Fisheries, 2020b).

In New Zealand, FishServe[9], a company owned by the national fishing organization, supplies an online platform to check and manage ITQ trade and catch balancing (Hale & Rude, 2017).

In Norway, the Electronic Catch Logbook system provides the Directorate of Fisheries with information on each catch taken from the annual quotas by commercial vessels (Organisation for Economic Co-operation and Development, 2017; Williams & Wathne, 2018). Each vessel on a fishing trip must report the result of catch every day before midnight or landing (Williams & Wathne, 2018).

In addition, the Norwegian Fishers' Sales organizations[10] have played a key role in catch accounting (Organisation for Economic Co-operation and Development, 2017). The Raw Fish Act[11] allows the fishers' sales organizations the exclusive right to trade raw marine fish (Jentoft & Finstad, 2018). It is illegal for fishers to sell the catch outside the sales organization directly to a buyer under the Act (Jentoft & Finstad, 2018).

For example, Norwegian Fishers' Sales Organization for Pelagic Fish provides a platform to check catch accounting and amounts of quota for each vessel on its website electronically (Norges Sildesalgslag, 2020). It also operates electronic auctions for selling pelagic fish such as mackerel and capelin to buyers (Norges Sildesalgslag, 2020). Since the Norwegian Fishers'

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[9] FishServe was authorized by the Minister of Fisheries in 2002 to conduct certain administrative services on behalf of the Crown (Hale & Rude, 2017). It provides multiple functions to the commercial fishing industry to support the QMS (Hale & Rude, 2017). It also offers a range of administrative services to the commercial fishing industry, such as issuing fishing permits and collecting cost recovery (Hale & Rude, 2017).

[10] The first Norwegian Fishers' Sales Organization was established in 1938 by representatives from the regional department of Norwegian Fishers' Association, the first national organization for fishers established in 1926 (Jentoft & Finstad, 2018). The sales organizations are owned by fishers (Jentoft & Finstad, 2018). There are six sales organizations in Norway (Jentoft & Finstad, 2018).

[11] The Raw Fish Act was adopted as a temporary act by Parliament in 1938, but the Act became permanent in 1951 due to World War II (Jentoft & Finstad, 2018). The Act also allows the fishers' sales organizations the exclusive right to determine a fixed minimum raw fish price (Jentoft & Finstad, 2018). The Act shifted the bargaining power from the buyers to fishers (Jentoft & Finstad, 2018).

Sales Organizations are responsible for trading, they have complete data that are necessary for the quota management system (Jentoft & Finstad, 2018).

In the United States, there are some online fisheries information systems to track IQ allocation. For example, in Alaska, the National Oceanic and Atmospheric Administration maintains eFISH, an online reporting system, where registered buyers and fishers submit and view landing information and quota shareholdings reports (National Oceanic and Atmospheric Administration, 2019c, 2020a). Additionally, users can renew a fishery permit, report a landing amount and value, conduct quota-transfers, and pay cost-recovery fees through eFISH (National Oceanic and Atmospheric Administration, 2019c, 2020a). For the Gulf of Mexico red snapper ITQ program, all IQ transfers and landing transactions are recorded, monitored, and approved by NMFS on the website of the Southern Regional Office Catch Share Programs (Agar et al., 2014).

Based on the experience of other countries, there are two options for a platform for catch accounting and IQ transfer tracking platform provided below:

- Official platform provided by the national government
- Platform supplied by a private company or a fishers' organization.

In Japan, fishers send their catches via their FCAs, etc. to the Minister or a prefectural governor (Fisheries Agency of Japan, 2014b). The Minister and prefectural governors monitor catch status as an administrator and provide advice, guidance, recommendations, or issue catch orders (Fisheries Agency of Japan, 2014b). Thus, this current catch accounting system may be utilized with an update for tracking IQ transfers if needed.

5.7 Administrative cost and payers

As with other fisheries resource management programs, the IQ program needs some management costs. Without enough funding, it may be challenging to obtain the benefits from the IQ program entirely. Thus, it is crucial to estimate how much funding the IQ program needs and to determine who covers the cost of the program.

5.7.1 Determine who pays the cost

There may be many types of expenditures for implementing the IQ program. For example, monitoring and enforcement fees, administrative costs, and scientific research costs are necessary. In some cases, the program may require financial support and/or compensation for fishers who have to stop fishing when the number of fishing vessels is reduced due to overcapacity or for other reasons. Fisheries managers should estimate management and opportunity costs prior to implementing the IQ program and determine who will pay these financial costs.

In Iceland, the Fisheries Directorate is to collect a fee from vessel owners to pay for the cost of monitoring, enforcement, and research (Arnason, 2005). In addition, a new resource rent tax has been introduced since 2012. The aim of the tax is to address outstanding distributional concerns associated with ITQ and cover some management costs (Organisation for Economic Co-operation and Development, 2017). Vessel owners also have to pay a fixed daily observer fee and provide them with food and board (Arnason, 2005).

In New Zealand, when QMS was introduced, resource users of QMS stocks had to pay a resource rental fee, which was used for the cost recovery of fisheries resource management (Lock & Leslie, 2007). Currently, resource users have to pay fisheries and conservation services levies, which cover monitoring commercial fishing activities, fish stock assessment, research, observers, and other commercial fishing services (Lock & Leslie, 2007; Ministry for Primary Industries, 2020c). Resource users also have to provide food and accommodation for observers when they are on the fishing vessel (Ministry for Primary Industries, 2020d).

In Norway, vessel owners pay for the costs of the electronic catch logbooks (Williams & Wathne, 2018). In addition, the Raw Fish Act states that the Norwegian Fishers' Sales Organization shall be allowed to charge a fee on the first-sale of all fish to cover the costs for running the organization (Jentoft & Finstad, 2018). For example, fishers pay 0.65% of the catch value for the services of the Norwegian Fishers' Sales Organization for Pelagic Fish (Norges Sildesalgslag, 2020). These funds are used for the online platform to check catch accounting and amounts of quota as well as the online auction (Norges Sildesalgslag, 2020).

In the United States, the MSA imposes up to 3% of the ex-vessel value of the fish harvested under the program to cover actual costs regarding the management, enforcement, data collection, and analysis (16 U.S.C. 1854(d)(2)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007). For example, participants of the Central Gulf of Alaska rockfish program pay 3% of the ex-vessel value of the fish harvested under the program for cost recovery (National Oceanic and Atmospheric Administration, 2020b). The expenditure is paid at the time of the landing, submitting a landing report, or selling fish until the last quarter of the year (16 U.S.C. 1854(d)(2)(B)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007). The program costs are audited at the end of each fishing year, and if the costs are less than the 3% fee collected, a proportional refund is made to participants. If IQ is distributed by auction, the payment of auction may be used for the cost of the IQ program (16 U.S.C. 1853a(e)(2)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007).

As the experience of other countries shows, there are two options to cover the program cost. Fisheries managers may choose one of the options below or a combination of these:

- Government
- Resource users.

It is not very common that stakeholders, including vessel owners, fishers, FCAs, and/or distributors share some management costs in Japan. However, in other country, participants have taken a greater interest in fisheries resource management and displayed greater responsibility for the future of the industry after they started supporting the management costs (Gislason, 2000). Thus, it is still one of the options that resource users pay some costs of the IQ program in Japan.

5.8 Monitoring and enforcement

An effective monitoring and enforcement system is a crucial element for IQ programs. A monitoring system provides critical information for management, enforcement, science, and catch accounting (Bonzon et al., 2013). It is also important to account for discards and high grading because multi-species fisheries may improve returns by discarding less valuable catch (Fina, 2011).

A larger capacity of the monitoring and observer system may be necessary to check individual catches and landings under the IQ program compared to checking total catches and landings under the TAC system. As with any other fisheries resource management programs, the performance of an IQ program will depend on the compliance and reliable information (Bonzon et al., 2013). In addition, effective monitoring system creates a system that supports individual accountability of fishers. Thus, the effective catch monitoring and enforcement system should be integral for the IQ program.

5.8.1 Establish an effective catch monitoring and enforcement system

Fisheries managers have to monitor catches, landings, high grading, and regulatory discards, and conduct enforcement if necessary. IQ programs will likely require a real-time base monitoring system because an appropriate authority must conduct immediate action to control the situation when a fisher's catch exceeds IQ.

In Iceland, the Directorate of Fisheries is in charge of monitoring and enforcing fisheries operations and fish processing (Arnason, 2002; Iceland Responsible Fisheries, 2020b). The Directorate conducts a landing control, including weighing on official scales at the point of landing and checking the species composition of the catch, in around 60 landing ports in Iceland (Arnason, 2002; Iceland Responsible Fisheries, 2020b). Any catch landed ashore is to be weighed, and the collected information is sent to the central database of the Fisheries Directorates (Arnason, 2002; Iceland Responsible Fisheries, 2020b).

To further monitor adherence to ITQ and other regulations, the Directorate has an observer system (Arnason, 2002). On the basis of observer reports recorded on a fishing vessel and/or at a landing port, the Fisheries Directorate may assess fines or penalties (Arnason, 2002).

In New Zealand, the enforcement activity has shifted from the enforcement of input controls to the enforcement of output controls due to the introduction of ITQ (Arnason, 2002). Fishers need to submit catch and landing reports, and buyers need to submit trading records (Arnason, 2002). A hefty fine and forfeiture of ITQs can be imposed in case of under-reporting (Arnason, 2002).

Onboard observers collect a wide range of information, including catch and effort data and biological information for stock assessment (Hale & Rude, 2017; Ministry for Primary Industries, 2020d). Electronic monitoring (EM) has been introduced on commercial fishing vessels since 2018 to monitor, track, report fishing activities, and encourage compliance with regulations (Hale & Rude, 2017; Ministry for Primary Industries, 2020e).

All commercial fishers in New Zealand must report their catch information electronically through FishServe to obtain more accurate and up-to-date information regarding fishing activities (Hale & Rude, 2017; Ministry for Primary Industries, 2020b). The information includes the capture of protected fish species report, discard report, landing report, and the top five QMS fish species and top three non-QMS fish species for trawl fishers, and the top eight species whether QMS or not for other fishing gears within eight hours after fishing (Ministry for Primary Industries, 2020b).

In Norway, catch must be reported at sea electronically through Electronic Catch Logbook or the Coastal Fisheries Application (Williams & Wathne, 2018). The Electronic Catch Logbooks were introduced to most fishing vessels except for small vessels under 15 meters in 2008 (Williams & Wathne, 2018). The data are sent to the Directorate of Fisheries with information, including estimated catch amount by species and fishing effort, the fishing gear type, the geographic position, and the date and time of the catch (Williams & Wathne, 2018). The fishing vessels have to send the result of the catch every day before midnight and landings (Williams & Wathne, 2018).

The Coastal Fisheries Application has been applied to small fishing vessels under 15 meters since 2016 (Williams & Wathne, 2018). The Coastal Fisheries Application is used for reporting an estimated total catch amount by species to databases in the Directorate of Fisheries before entering to a landing port (Williams & Wathne, 2018). The Directorate of Fisheries and the Coast Guard use the data from both the Electronic Catch Logbook and Coastal Fisheries Application to monitor and control fishing activities in Norwegian waters, and inspect catches at landing places and seas (Williams & Wathne, 2018).

In the United States, a variety of monitoring tools have been used in fisheries. For example, in Alaska, the observer program, electronic reporting (ER), and EM are implemented (National Oceanic and Atmospheric Administration, 2019d). Over 450 human observers collect catch data on fishing boats and at processing facilities for various purposes, including monitoring quotas and prohibited species catch and collecting biological information for stock assessment in the observer programs for the Bering Sea, Aleutian Islands, and Gulf of Alaska groundfish and halibut fisheries (National Oceanic and Atmospheric Administration, 2020c).

EM is used as a tool for estimating catch and discard and for monitoring for compliance with regulations in some programs (National Oceanic and Atmospheric Administration, 2019b).

The web-based reporting applications such as eFISH (Section 5.6.2) and eLandings are used to report landings and production for IFQ programs in Alaska (National Oceanic and Atmospheric Administration, 2019c).

In the Gulf of Mexico red snapper ITQ program, law enforcement officers monitor landings, but the officers are not present at all landings due to the numerous landing sites (Agar et al., 2014). In order to allow sufficient time for officers to meet the vessel in the landing area, a landing notification must be submitted by fishers via their Vessel Monitoring System unit, telephone, or through the ITQ website at least three hours before the landing (Agar et al., 2014). Landing notifications include a pre-approved landing location, expected time of arrival, expected amount of landings, and expected dealer (Agar et al., 2014).

As the experience of other countries above illustrates, there are several options to monitor and enforce catch activities in fisheries listed below. It may be useful to combine these options for establishing an effective monitoring system:

- Human observers onboard a fishing vessel

- Law enforcement officers
- Electronic monitoring
- Human observers on landing areas
- Electronic reporting
- Self-reporting.

In Japan, there are existing monitoring and enforcement systems, including patrol vessels and inspectors in landing areas. Fisheries managers should consider what kind of changes in the current systems are necessary for establishing the most cost-effective enforcement policies for the IQ program.

It may be costly to enforce and monitor all fishing activities because there are many fishers, fishing ports, fishing vessels, outlets, and target fishes in Japan compared to other countries where IQ has been introduced. New technology such as EM and ER may help reduce costs of monitoring and enforcement. In particular, EM can be a cost-effective and reliable alternative for human observers (van Helmond et al., 2020). EM can incentivize discard reduction as well as better compliance (van Helmond et al., 2020). In addition, EM enables fisheries managers to enhance scientific data collection from fishing operations (van Helmond et al., 2020).

However, the video review of an EM record is a time-consuming and expensive procedure because it is done manually (van Helmond et al., 2020). It can be difficult to distinguish small similar-looking fish species in high volume catches (van Helmond et al., 2020). Age and maturity data can only be gathered through direct physical sampling such as human observers. In addition, the intrusion of privacy can be a significant concern for fishers since EM records activities on a vessel (van Helmond et al., 2020). Technical errors with EM were reported in Europe, such as storage failure, obstructed view because of dirty lenses, and power shortage among other issues (van Helmond et al., 2020). Initial financial costs and time to install EM are also needed (van Helmond et al., 2020).

Therefore, in order to determine the least cost, highest level of confidence, and most effective monitoring and enforcement method, characteristics of fishing vessels, fishing operations, the number of landing ports, and fish stocks, as well as the pros and cons of each option should be considered carefully. In addition, if human observers are stationed in key places, fisheries managers should estimate how much observer coverage is needed for collecting reliable data in advance.

5.9 Avoidance of excessive concentrations of Individual Quotas and other negative social impacts

In order to attain social goals such as protecting coastal communities (Section 5.2.2), it may be important to set a concentration limit of IQ that one participant can hold. It may also be essential to establish a restriction on trading and/or using IQ to relax negative social impacts.

5.9.1 Determine concentration limits of Individual Quotas

Determining concentration limits of IQ is one of the tools to relax excessive concentrations of IQ. The percentage or number of concentration limits is different among programs in each country.

In Iceland, the maximum permanent TAC shares held by any company or individual is 12% of the TAC for cod and 20% for haddock, saithe, Greenland halibut (*Reinhardtius hippoglossoides*), herring, capelin (*Mallotus villosus*) and deepwater shrimp, and 35% for redfish

(Arnason, 2005). In addition, individual companies must not have more than 12% of the value of all TACs in Iceland (Arnason, 2005).

In New Zealand, concentration limits are applied, ranging from 10% to 45% for some important mid-depth and deepwater fisheries (Batstone & Sharp, 1999). For example, the concentration limit of snapper (*Pagrus auratus*), stargazer (*Kathetostoma giganteum*), and terakihi (*Nemadactylus macropterus*) is 35%, and the concentration limit of hake (*Merluccius australis*), hoki (*Macruronus novaezelandiae*), and orange roughy is 45% (Stewart & Callagher, 2011).

In Norway, a percentage share of TAC in each group is divided into a system of QF[12] for cod fisheries and base tons[13] for pelagic species (Standal & Asche, 2018). There is a maximum number of QF and base tons in each group (Standal & Asche, 2018). For example, in 2014, a maximum of 4 QF per vessel was allowed for cod trawlers, a maximum of 5 QF per vessel was applied for longline vessels, and a maximum of 3 to 6 QFs was allowed for coastal fisheries, depending on the size of the vessels (Standal & Asche, 2018). The deep-sea purse seiners targeting mackerel and herring were allowed to concentrate 850 base tons per vessel in 2014 (Standal & Asche, 2018).

In the United States, some programs have a limit on the total amount of quota that individuals can hold. For example, in the Pacific halibut and sablefish IFQ program, concentration limits for the Alaska halibut are 0.5% in all areas combined; and the concentration limit for sablefish is 1% in all areas combined (North Pacific Fishery Management Council &

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[12] In 2015, cod trawlers were allocated to 31.6% of the TAC for Norway (466,439 tons) for northeast Atlantic cod and divided into 87.9 QFs (Standal & Asche, 2018). The deep-sea longline vessels were allocated to 12.7% of the TAC for cod and divided into 92QFs, and the coastal cod fishing vessels were allocated 57.3% of the TAC of cod and divided into 9,080.0QFs in 2015 (Standal & Asche, 2018).

[13] In 2015, the deep-sea purse seiners had 70% of the TAC (278,868 tons) for mackerel, and it was divided into 45,800 base tons (Standal & Asche, 2018).

National Marine Fisheries Service, 2016). In the Gulf of Mexico red snapper IFQ Program, the concentration limit is 6.0203% of total IFQ shares (Agar et al., 2014).

As the experience of other countries illustrates, there are two options for a concentration limit of IQ amount described below:

- Large concentration limit of IQ amount that an IQ holder can hold
- Small concentration limit of IQ amount that an IQ holder can hold.

5.9.2 Establish restrictions on trading and/or use of Individual Quotas

Each country has unique restrictions on trading and/or use of quotas that fit each country's social goals.

In Iceland, the main restriction on trading quotas is between the categories of small fishing fleets, fishing with hand lines, large fishing fleets, and fishing with other fishing gears (Organisation for Economic Co-operation and Development, 2017). The quotas of large fishing fleets can be traded to the category of small fishing fleets, but the quotas of small fishing fleets cannot transfer to the category of large fishing fleets (Organisation for Economic Co-operation and Development, 2017). Transfers of annual quotas between geographical regions must be approved by the Ministry of Fisheries to avoid destabilization of employment in the regions (Arnason, 2002).

In order to discourage speculative trading and holdings of quotas, any vessel which does not catch half of its annual quota every second year will lose its permanent quota shares (Arnason, 2005). In addition, no more than 50% of the annual quota received at the beginning of the fishing year can be traded (Arnason, 2005).

In addition, the community quota system established in 2003 allows fishers who agree to land the fish in a specific community to receive a quota (Chambers & Carothers, 2017). In the

2014 to 2015 fishing season, 7,000 tons of IQ for Atlantic cod less than 2% of TAC, was assigned to the community quota system (Chambers & Carothers, 2017). When fishers use the community quota, they have to land the fish in the specific community.

In New Zealand, quotas were established as freely tradeable rights on the theory that free trade is needed to maximize returns from the fishery although limited to a New Zealand corporation, which is defined as an entity with 75% stock ownership by New Zealand interests (Government Accounting Office, 2004; Hale & Rude, 2017).

In Norway, based on the fixed allocations among different gear and vessel groups, separate markets were constructed for each group (Standal & Asche, 2018). There are restrictions on quota trade between regions and vessel groups (Standal & Asche, 2018).

In the United States, the BSAI crab rationalization program includes a regional landing requirement intended to maintain the historical distribution of landings (Fina, 2011). The regional landing requirement is important for remote communities such as the community of St. Paul in the Pribilof Islands (Fina, 2011).

In the Pacific halibut and sablefish IFQ program, an owner-on-board requirement is applied to catcher vessel quota holders to ensure that quota is retained by active fishers (Szymkowiak & Himes-Cornell, 2015). It requires any catcher vessel quota holders who are not initial participants to be on board the vessel at all times when their annual quota allocation is harvested (Szymkowiak & Himes-Cornell, 2015). The requirement was designed to regulate speculative quota transfers to persons who are interested in quota as a financial asset (Government Accounting Office, 2004).

In the Pacific halibut and sablefish IFQ program, quotas can only be traded within the same vessel category in each management area (Buck, 1995). However, in the group of catcher vessel processors, as much as 10% of IFQ shares may be leased (Buck, 1995).

In Alaska, there are some special programs to promote participation from local communities with some limitations of eligibility. For example, the North Pacific Fishery Management Council created the Community Quota Entity (CQE) program to promote quota ownership by individual local residents controlled by community entities meeting certain criteria (North Pacific Fishery Management Council, 2019). The CQE program allows specific communities to buy quotas of sablefish and Pacific halibut in the Pacific halibut and sablefish IFQ Program (North Pacific Fishery Management Council, 2019). Eligibility for the CQE program was limited to local communities with: 1) less than 1,500 residents; 2) at least one landing of halibut or sablefish; 3) direct access to the Gulf of Alaska coast; and 4) no road access to a larger community (North Pacific Fishery Management Council, 2019). As of 2019, there were 46 coastal communities in the CQE program (North Pacific Fishery Management Council, 2019).

The North Pacific Fishery Management Council also established the Western Alaska Community Development Quota (CDQ) program in 1992 to promote participation in the BSAI fisheries from western Alaska communities (Haynie, 2014). For example, 10% of the Bering Sea pollock TAC is allocated to community groups in the Bering Sea pollock fishery (Haynie, 2014). The CDQ program also allocates some percentage of TAC for Pacific halibut, sablefish, Atka mackerel (*Pleurogrammus monopterygius*), Pacific cod, turbot (*Reinhardius hipoglossoides*), several crab species, and other species to local community groups (Haynie, 2014).

Additionally, the American Fisheries Act allows pollock fishers to establish cooperatives and permanent sector allocation share in the cooperatives with limitations on participation (Criddle & Macinko, 2000).

As the experience of other countries illustrates, there are several options for restrictions on trading and/or use of quotas described below:

- Geographic trading limitation
- Fleet-category trading limitation
- Trading limitation at the beginning of the fishing season
- Trading (leasing) limitation on a certain proportion
- Restriction on use of IQ in a certain region, cooperative, community, or group under a special program
- Regional landing requirement
- Owner-on-board requirement
- Any vessel that does not use a certain amount of quota will lose its shares the next fishing season.

In Japan, IQ transfers will be only permitted in specific cases under the New Fisheries Act and the enforcement regulations of the New Fisheries Act (Section 3.2.5). According to Fisheries Agency of Japan (2019d), a transfer is not approved when IQ of a coastal fisher is traded to an offshore fisher's fishing vessel or an excessive concentration of IQ can occur.

However, the New Fisheries Act and the regulations do not provide clear clauses about a concentration limit of IQ, geographic trading limitation, or fleet-category restriction. The above options may be helpful, if fisheries managers need additional rules on holding, trading, and/or using quotas to achieve a social or economic goal.

In Japan, there are existing fishing right and license systems (Sections 3.2.1 and 3.2.2). In addition, the New Fisheries Act will establish management units, which are divided by fishing gears, fishing areas, and fishing seasons (Fisheries Agency of Japan, 2019c). Thus, fisheries managers may take advantage of these administration systems or use management units to set limits on a fleet category or on geographic trading.

5.10 Review of performance

The final step is the review of the performances of the IQ program against economic and social goals. Fisheries managers should conduct a review of a program, including an evaluation of the program's performance against original goals. If necessary, the contents of the program should be modified to achieve the goals.

5.10.1 Conduct a program assessment against initial goals and adjust the program to achieve the goals if necessary

It is vital to assess the performance of the IQ program against the goals of the program and modify the program if needed.

In Iceland, there have been many changes to the programs. For example, vessels under ten gross registered tons were exempt from the ITQ system of demersal fisheries in the ITQ system in 1984 (Arnason, 2005). The main reasons were that these vessels were too numerous to include in the ITQ program administratively, and the catch of these small vessels occupied only about 2% of the demersal catch (Arnason, 2005). However, after the review of the program, the vessels between six and ten gross registered tons were incorporated into the system in 1991 (Arnason, 2005). In 2004, all small vessels were included in the system by the amended Fisheries Management Act (Arnason, 2005).

In New Zealand, ITQ was initially allocated based on the absolute weight approach (Section 5.4.3) (Mace et al., 2014). It was believed that the absolute weight approach would improve sustainability and provide revenues to the government (Mace et al., 2014). However, after the review, the QMS was modified from the absolute weight approach to the percentage approach in 1990 for various reasons, including over-optimism about the potential for quota increases, and an immediate need to buy back quota to cut the amount of TAC for orange roughy (Hale & Rude, 2017; Mace et al., 2014).

In Norway, the UQS was introduced to adjust the certain capacity to the available resources in 1984 (Standal & Aarset, 2008). However, an upper limit of quota per vessel was low, 1.5 QFs for small trawlers, and 2.0 QFs for a factory and fresh/freeze trawlers (Standal & Aarset, 2008). In addition, a vessel owner could hold transferred quota for a relatively short period. They could hold quota for 13 years if the vessel that loses its quota is removed from the fishery and sold, or for 18 years if the vessel is scrapped (Standal & Aarset, 2008). Thus, the incentive to scrap a fishing vessel was weak, and the capacity reduction, one of the goals of the system, was not achieved (Standal & Aarset, 2008). In 2005 when the UQS was converted to the SQS, the duration of the unit quota became no time limitation[14] and the maximum limit of quota on both a small trawler and a factory and fresh/freeze trawlers became 3.0 QFs to promote the reduction of the fishing capacity (Standal & Aarset, 2008; Standal & Hersoug, 2014). These changes caused a tremendous effect on the entire fleet structure, and the number of cod trawlers was down from 94 vessels in 2004 to 51 vessels in 2006 (Standal & Aarset, 2008).

[14] In 2007, the time limitation of 20 years on the SQS was reintroduced (Organisation for Economic Co-operation and Development, 2012). Structural quotas that were allocated for the first time before 2007 were decided that they could not be allocated beyond 25 years (Organisation for Economic Co-operation and Development, 2012).

In the United States, the MSA requires new programs to conduct a formal and detailed review. The review must be conducted in five years after the implementation and then no less frequently than once every seven years to conduct necessary modifications of the program to its goals (16 U.S.C. 1853a(c)(1)(G)) (Magnuson-Stevens Fishery Conservation and Management Act, 2007).

As the experience of the other countries illustrates, many countries modified their original quota programs to achieve original goals after the reviews. Thus, managers should conduct a periodic program assessment against original goals and then modify the program to achieve the goals, if necessary. In addition, fisheries managers should decide who or which institute performs the periodic program assessment, how frequently should the assessment be done, and to whom the report of the performance is submitted.

For the assessment of the performance, fisheries managers will need data to check how economic and social conditions are changed after the implementation of the program. Fisheries managers should identify evaluation items and collect the baseline data of each item before implementing the program to compare these data with the data collected over the course of the program.

After a performance review, the program design can be modified to attain initial social goals if it is needed. For example, if an excessive concentration of IQ occurs in a specific area, it may be adequate to add a geographic quota limitation or a regional landing requirement. If quota ownership becomes more concentrated, it may be reasonable to add a concentration limitation of the IQ amount. However, these social engineering measures would come at the costs of an efficiency goal.

It may take several years for the effects of the IQ program to be realized (Bonzon et al., 2013). Therefore, the modification should be conducted carefully from a long-term perspective with the review of the original goals of the program.

This chapter discussed ten elements that Japan should consider in the design of its IQ program and options for Japan to consider from the experience of individual quota-based programs in four countries with Japan's previous fisheries resource management experience and practice. The final chapter discusses broader issues that Japan will likely face when implementing IQ programs and options to tackle these issues.

Chapter 6. Discussion

This chapter discusses how Japan introduces IQ programs based on the experience of the four countries. As the examples from these four countries show in Chapters 4 and 5, quota-based management systems are different in each country. There is no ultimate IQ program template. Thus, Japan should design unique IQ programs that fit Japan's fisheries characteristics while drawing on the experience of other countries.

6.1 Make a long-term plan to introduce Individual Quota programs in an orderly manner

At first, Japan should make a long-term plan to introduce IQ programs in an orderly manner.

In Iceland, ITQ has been expanded in several steps to include all Icelandic fisheries but did not drastically change in any short period. In the early stage of the quota system, species managed under the quota system were gradually expanded to other fisheries. Individual vessel quotas were introduced in the herring fishery in 1976 and the capelin fishery in 1980 (Arnason, 2005). One of the most important steps was taken in 1984 when transferable individual vessel quotas were introduced in demersal fisheries (Arnason, 2005). In 2004, the Fisheries Management Act was amended to incorporate small vessels in the ITQ (Arnason, 2005). Overall, it took about 30 years to cover almost all fishing vessels for ITQ.

In New Zealand, implementation of the QMS also has a long history. When the QMS was first introduced, it applied to 26 fish species (Hale & Rude, 2017). In 1996, the government adopted the QMS as its preferred management measure for commercial fisheries (Hale & Rude, 2017). Thus, after 1996, the government encouraged the introduction of ITQ to other species, and 98 species or species groups were presently included in the QMS (Hale & Rude, 2017).

In Norway, the evolution of the Norwegian fisheries resource management regime towards ITQ has been slow and hesitant (Hannesson, 2013). At first, non-transferable IVQ systems were introduced to the deep-sea trawlers and the pelagic purse seine vessels at the end of the 1970s; and those were expanded to the coastal fishing boats in 1991 (Standal & Asche, 2018). In the cod fisheries, transferable IVQ was introduced to the cod trawlers in 1996 and the coastal fleets between 15 and 28 meters in 2004 (Hannesson, 2013). In 2007, the system was expanded to cover coastal vessels above 11 meters (Standal & Asche, 2018). Thus, it took many years to cover coastal fisheries and allow the transferability of quotas in Norway.

In the United States, Regional Fishery Management Councils have been developing ITQ programs for more than two decades, including the six-year moratorium on any additional programs (Fina, 2011). For example, for the federal fisheries off Alaska, the North Pacific Fishery Management Council adopted various management measures to help address economic and social issues, such as the CDQ program and fishery cooperatives under the American Fisheries Act (Section 5.9.2) (Fina, 2011). Each program has been tailored to the characteristics of individual fisheries through the Council processes with support from stakeholders, researchers, and the public over many years (Fina, 2011).

The process of developing and implementing each ITQ program can be lengthy in the Council process. For example, the North Pacific Fishery Management Council spent three years reviewing, analyzing, and adapting the Pacific halibut and sablefish IFQ program and then another three years implementing the program (Government Accounting Office, 2004).

As the examples above illustrate, the transition to the IQ system and the development of IQ programs can be slow and cannot be done in a hurry. There are many types of fishing gears and target species in Japan (Sections 3.1 and 3.2), and the characteristics of fisheries and fish stocks are different from each other. Thus, developing IQ programs for all national fisheries in Japan can be a very large task. The government of Japan should make a long-term plan to establish IQ programs and introduce them in an orderly manner.

6.2 Develop criteria to prioritize fish stocks for the Individual Quota program based on actual fisheries situations, regional characteristics, and Japan's previous fisheries resource management experience

Fisheries managers should establish criteria to prioritize fish stocks to which IQ should be applied with stakeholders. The New Fisheries Act states that IQ will be applied to licensed vessels for all TAC species, if the fisheries are ready (Cabinet Public Relations Office of Japan, 2018; Fisheries Agency of Japan, 2018, 2019a). However, there are many types of fisheries and fish stocks in Japan (Sections 3.1 and 3.2). It is not clear how to choose fish species that will be managed under an IQ program in the early stage under the New Fisheries Act.

From the perspective of fishers, high priority fisheries can be fisheries in which the race-to-fish condition and/or big economic program exist. Fisheries, where there is a strong request from fishers to be managed by an IQ program, can also be a high priority. However, it is important to note that rebuilding policies for overfished species are dependent on scientifically determined TAC and not IQ (Section 5.2).

From the perspective of fisheries administration, fisheries that have a small number of fishing boats and/or landing ports may also have relatively high priority in terms of comparatively low costs of monitoring and enforcement. Fisheries that have high selectivity may also have high priority because they are less likely to need to consider bycatch issues from the perspective of the administration (Section 6.4). In addition, fisheries that already have IQ-like programs (Section 6.3) or prerequisites (Section 5.1) may be relatively feasible for the IQ management under the New Fisheries Act.

These are only potential criteria among many. Fisheries managers should develop criteria for prioritization and introduction of IQ programs, while considering actual fisheries situations, regional characters, and previous fisheries resource management experience in coordination with fishers and other stakeholders.

6.3 Carefully choose the initial fish stocks to be managed under the Individual Quota program

Setting the initial[15] IQ program under the New Fisheries Act is very important for the long-term success of the program. Fisheries managers should choose the first fish stock or fishery that is to be managed by the IQ program, taking into account the perspective of the actual fisheries condition and fisheries administration described in Section 6.2.

In Iceland, the positive experience of the individual vessel quota system in the herring fishery, which was the first individual vessel quota program in the country in 1976, encouraged the capelin fishery to introduce the same system in 1980 (Arnason, 2005). In New Zealand, the ITQ for seven species introduced in 1983 served later as a model for inshore and other offshore fisheries, and the program's success made it easier to persuade fishers to support the introduction of more ITQ programs (Harte, 2000).

[15] Distant water longline vessels that catch southern bluefin tuna and Atlantic bluefin tuna, and red snow crab pot fisheries that catch red snow crab have been officially managed by IQ (Section 3.2.4). However, since those are not managed under the New Fisheries Act, they are not counted as IQ programs under the Act.

As these examples show, successful implementation breeds further application to and success in other fisheries. Thus, Japan should take careful consideration in choosing which species can be successfully managed under the first IQ program.

When fisheries managers decide the initial species with fishers and other stakeholders, they should take advantage of Japan's previous fisheries resource management experience. It may be more feasible to introduce an IQ program to the fisheries currently managed by an IQ-like program as an autonomous management measure under the framework for the Resource Management Guidelines and Plans or other systems.

There are, for example, 75 crab pot fisheries that catch horsehair crabs (*Erimacrus isenbeckii*) in Hokkaido Prefecture, four dredge net fisheries that catch hen clam (*Pseudocardium sachalinense*) in Hokkaido Prefecture, and four pot fisheries that catch finely-striated buccinm (*Buccinum striatissimum*) in Shimane Prefecture are managed by each autonomous IQ-like program (Fisheries Agency of Japan, 2014b). Four pot fisheries that catch northern shrimp (*Pandalus eous*) in Niigata Prefecture are also managed by IQ (Fisheries Agency of Japan, 2014b). Two offshore trawl fisheries that catch Alaska pollock in Hokkaido Prefecture are also regulated by IQ (Fisheries Agency of Japan, 2014b). In addition, the trial IQ program has been introduced to 35 purse seine vessels in the North Pacific Federation of large- and medium-scale purse seiners that catch chub mackerel (Section 3.2.4) (Fisheries Agency of Japan, 2017b).

These fisheries can be most politically feasible to introduce an official IQ program under the New Fisheries Act because they have already been managed by an IQ-like program. Fisheries managers should consider choosing which fish stock can be successfully managed under the initial IQ program in coordination with fishers and other stakeholders, taking into account the priorities of implementing IQ programs (Section 6.2) and/or the previous experience of IQ-like programs.

6.4 Allow some flexibility for fisheries that have low selectivity

There are various types of fishing methods used to catch many kinds of fish in Japan (Sections 3.1 and 3.2). Fishing gears are commonly classified into two categories: active and passive gears (Bjordal, 2002). The capture of active gears is usually based on an aimed chase of the target species such as purse seiners and trawlers, whereas the capture of passive gears is based on the movement of the target species (Bjordal, 2002). One of the examples of passive gears is set-net fisheries. It is used in coastal waters to intercept migrating fish schools in the leader-net placed across their routes, and then catches them in the chamber-trap (Fisheries Agency of Japan, 2017a).

A set-net is a widely used fishing gear in Japan and generally targets multiple fisheries resources. The total landings of set-net fisheries are 401,794 tons in 2018, which is about 45% of total landings of coastal fisheries in Japan (Ministry of Agriculture, Forestry and Fisheries of Japan, 2020). Set-net fisheries are vital for coastal communities in terms of providing employment opportunities and a source of protein.

If IQ is applied to set-net fisheries, fisheries managers should consider measures that avoid a shutdown of set-net fisheries due to exceeding the IQ of non-target species or bycatch species from the social perspective. In particular, the risk of the shutdown would be increased when IQ declines in accordance with the biomass of the non-target species or bycatch species and its TAC decrease. If set-net fisheries stop operation for a long period, many people in the community, such as crew members, distributors, and processors, as well as the supply of protein may be negatively affected. The same concern can be applied to other passive gears or multiple target gears that have low selectivity.

From the experience of other countries, there are five possible ways to avoid shutting down set-net fisheries or other passive gears in the IQ program.

The first idea is the transfers of quotas among participants which have already been assigned IQ. Although the coordination between fishers may be necessary, fishers who have much quota can transfer his/her quota to fishers who need to avoid the situation above. In other countries, transfers are allowed to reduce overcapitalization and/or the number of fishing vessels. Transfers also can work as a mechanism for new participants to enter the fishery. However, in Japan's case, the transfer system may solve social issues in coastal communities to prevent a shutdown of a fishery that has low selectivity if the transfer system operates under appropriate rules.

The second idea is grandfathering in set-net fisheries or other passive gears. In Iceland, although almost all fisheries are managed by ITQ, the spring lumpfish roe gillnet fishery is excluded from the ITQ system and managed by limiting the number of fishing vessels and days-at-sea (Chambers & Carothers, 2017). However, if a fishery is grandfathered in Japan, the fishery should be managed by the total catch quantities in management categories or the Total Allowable Effort under Article 8 of the New Fisheries Act to avoid exceeding TAC (Section 3.2.3).

The third idea is to carry over a certain amount of IQ from the previous year or bring forward a certain IQ from the following year. In Iceland, IQ holders are allowed to exceed annual quota up to 0.5% for pelagic species and 5% for other species to be deducted from the quota of the following year (Iceland Responsible Fisheries, 2020a; Organisation for Economic

Co-operation and Development, 2017). They are also allowed to transfer up to 15% of the annual quota to the next year (Iceland Responsible Fisheries, 2020a). However, these transactions will not be allowed under the New Fisheries Act in Japan. Thus, this idea may not be a realistic option at this time.

The fourth idea is to make a pool of each individual quota in a group, such as a management unit or an FCA. This idea is similar to the first idea in that requires IQ trades. If a fisher using a passive gear exceeds IQ due to unexpected landings or other reasons, the individual is allowed to receive additional IQ from the pool or transfer IQ to the pool.

The fifth idea is to order fishers who exceed quota to pay the deemed value of the excess catch. In New Zealand, commercial fishers who exceed their annual quota holdings may be charged the deemed values of the extra catch (Mace et al., 2014; Ministry for Primary Industries, 2020a). Fisheries New Zealand sets a rate of a deemed value for each fish stock (Ministry for Primary Industries, 2020a). In order to encourage fishers to use their quota and keep total catch within limits each year in New Zealand, deemed values are more expensive than the cost of trading quota (Ministry for Primary Industries, 2020a). However, it may be necessary to discuss legal issues regarding setting and charging the deemed value if the deemed value system is applied to Japan.

IQ is essentially a single-species management program. However, the nature of many fisheries is that fishing gears catch non-target species. These ideas may be considered to build some flexibility into the IQ program, especially for multiple target fisheries, including set-net fisheries, to avoid a shutdown due to an unintentional excess of IQ.

6.5 Careful thought must go into how quota transfers and trade limitations can be used to achieve economic and social goals

The transferability of quotas is allowed with some limited conditions under Article 22 of the New Fisheries Act (Section 3.2.5). The transferability of quotas is a large part of economic right-sizing the fishery. Unrestricted trading should lead to less efficient fishers to either improve their efficiency or sell their quota (Government Accounting Office, 2004).

However, the transfers of quotas may cause unintended consequences. IQ holders in small fishing communities may sell their quota to outside of the community. If IQ outflows to other communities, some fishing communities may lose their main job opportunities. It may be difficult for unemployed fishers in a community that is heavily dependent on the fishing industry to find a new job in another sector. In other countries, negative social impacts are reported under ITQ programs, such as the concentration of IQ and loss of small-scale fishing communities.

In Iceland, not all communities have been able to adjust to the ITQ system. More quota holders in the southwest of Iceland value the advantages of centralization than those in remote communities (Kokorsch & Benediktsson, 2018). Thus, several small and remote communities face difficulties in regard to employment opportunities and economic foundations (Kokorsch & Benediktsson, 2018). In particular, East Iceland has many vulnerable fisheries communities that are affected by the negative development of the local fishing industries and are seriously threatened (Kokorsch & Benediktsson, 2018).

In New Zealand, overall quota ownership continues to become more concentrated, especially for deepwater fisheries targetting on orange roughy and black oreo (*Allocyttus niger*), and certain mid-water species such as hoki and southern blue whiting (*Micromesistius australis*) (Stewart & Callagher, 2011). Although some 2,200 individuals and firms have quota in the

QMS, eight firms own about 75% of quota (Hale & Rude, 2017). The number of small-parcel quota owner entities that are allocated less than 100 tons declined from 1,357 to 1,205 between 2002 and 2016 (Hale & Rude, 2017). In addition, the reduction of the number of fishing vessels was significant in Riverton, Moeraki, and Havelock in the South Island between 1976 and 1997 (Hale & Rude, 2017). In Northland, the number of commercial fishing vessels in far north ports decreased from 257 to 134 between 1990 and 2009 (Hale & Rude, 2017).

In Norway, the number of fishing vessels started declining after IQ transfers were allowed. For example, the number of cod trawlers started to decrease from about the time when transfers were permitted in 1996 (Hannesson, 2013). The number of purse seiners also started to fall much earlier because indirect trading quotas started in the early stage via trading in boat licenses (Hannesson, 2013). The number of small fishing vessels with traditional fishing gears such as longliners, gillnets, and hand lines decreased since around 2000 when quota transfers were allowed (Hannesson, 2013). Many fishers and processing workers entered the ranks of unemployed or retired for health reasons rather than became employed in other industries (Hersoug, 2005). They receive a disability pension, which requires a higher cost than the economic gain from the fisheries (Hersoug, 2005).

In the United States, some fisheries managed by ITQ saw a decline in the number of fishers and vessels in small coastal communities. For example, many quota holders in small coastal communities in Alaska transferred their quota to other fishers or moved out of the communities after the Pacific halibut and sablefish IFQ program was implemented (Fina, 2011). As a result, the number of fishers who live in small communities and hold quotas declined (Fina, 2011). The total amount of quota and the number of fishing vessels in the communities also decreased (Fina, 2011).

In Japan, there are a lot of small fishing villages and communities, which are heavily dependent on fishing. Thus, careful thought must go into how quota transfers can be used to achieve social and economic goals.

Article 22 of the New Fisheries Act and the enforcement regulations of the New Fisheries Act do not explicitly mention what it considers to be excessive quota share or how it should be limited to achieve social ends, geographic trading limitations, or fleet-category restrictions (Section 3.2.5). If a transfer scheme is applied to coastal fisheries in an IQ program, fisheries managers may consider setting a concentration limit of IQ and a restriction on trading and use of IQs for achieving social goals such as protecting small-scale coastal fisheries (Sections 5.9.1 and 5.9.2).

It may also be useful to block small amounts of quota and distribute it to small communities. In Iceland, after TAC is determined, 5.3% of the TAC is calculated and allocated to coastal areas that face drastic declines in fishing opportunities or coastal communities deemed to be vulnerable in terms of population for all TAC species (Organisation for Economic Co-operation and Development, 2017).

In order to protect small fishing communities, an option can be to exempt coastal small-scale fisheries from the quota transfer scheme, particularly due to the goals of the IQ program that include the retention of the historical geographic distribution of fisheries and/or the protection of coastal fisheries and communities.

However, it is important to note that economic and social goals are often the results of trade-offs. These limitations and measures for protecting communities could be expected to undermine the economic efficiency that would otherwise be achieved where quota is transferable on the open market without any limitations (Government Accounting Office, 2004). Without market-based transfers of quotas, it may be difficult to achieve economic goals. Fisheries managers must strike a delicate balance between economic and social goals through discussions with fishers and other stakeholders. Fisheries managers and fishers may also have to decide how much economic efficiency they are willing to sacrifice to protect fishing communities.

There are many coastal fishing communities in Japan. The circumstances of the fisheries are different from community to community. Some fishers and communities may be willing to take the opportunity to protect communities in exchange for the chance to improve economic efficiency, but others may not be willing to do it.

Given the various circumstances of the fisheries and communities, it is unlikely that any single format of the IQ program can fit each community and achieve the goals of each program. IQ programs can be different from each other, depending on the circumstances of the fishery and the goals of the program. Therefore, fisheries managers should design an IQ program that fits the characteristics of fisheries and communities to achieve the goals of the program in close cooperation with fishers.

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APPENDIX

The comparison between Bonzan et al. (2013) and this paper, and rationales for modifications

Bonzon et al. 2013	This paper	Rationale for Modification
	1. Prerequisites 1.1 Conduct a fish stock assessment based on the best available science. 1.2 Set TAC for the fish stock based on the stock assessment. 1.3 Determine the frequency of the fish stock assessment and the TAC setting process.	Japan already has the stock assessment program and the TAC system. Japan will manage the main fishery resources on the basis of the TAC system under the New Fishery Act.
Step 1 – Define program goals 1.1 What are the program's biological and ecological goals? 1.2 What are the program's economic goals? 1.3 What are the program's social goals? 1.4 Balance trade-offs.	2. Goals of the IQ program 2.1 Establish economic goals. 2.2 Establish social goals.	The same step, but biological goals are not included. This is because ending overfishing as a biological goal requires setting appropriate TAC based on the best available science, not allocating IQ to individuals. In addition, reducing bycatch is not a big issue compared to the three main issues, which are the decline in fishery production, the low abundance of many fishery resources, and the decline in the number of fishers. Balance trade-offs will be discussed in Section 6.5.
Step 2 – Define and quantify the available resource 2.1 Which species will be included? 2.2 Which stocks will be included? 2.3 What will the spatial range be, and will there be different zones? 2.4 What controls on fishing mortality will apply to each species, stock and zone?	N/A	Under the New Fishery Act, IQ will be applied for all TAC species if the fisheries are ready to be introduced, and fisheries resources will be managed on the basis of TAC. Spacial range and zone boundaries are followed by a unit of stock assessment and/or TAC. Thus, it is not apparent Step 2 is necessary for Japan.
Step 3 – Define eligible participants 3.1 Will the privilege be allocated to individuals or groups? 3.2 Who is allowed to hold and fish shares? 3.3 Will there be limits on the concentration of shares? 3.4 How will new participants enter the fishery?	3. Eligibility to participate in the IQ program 3.1 Establish criteria for eligible participants. 3.2 Establish a system for new participants to receive IQ.	Basically same step, but the privilege will not be allocated to groups in Japan under the New Fishery Act. The lessons from other countries made me realize that concentration limits are important to achieve certain social goals. Thus, concentration limits are discussed as an independent element (The 9th element).
Step 4 – Define the privilege 4.1 Will the privilege be quota-based or area-based? 4.2 For how long will the privilege be allocated? 4.3 How is the long-term share defined? 4.4 What will the annual allocation unit be? 4.5 Will the privilege be permanently and/or temporarily transferable? 4.6 Will there be restrictions on trading and use of shares?	4. Definition of IQ 4.1 Determine how long IQ is allocated. 4.2 Determine where IQ is assigned. 4.2 Determine the share unit. 4.3 Determine whether IQ is transferable.	The same step, but the privilege in Japan's IQ system will be quota-based. The lessons from other countries also made me realize that trading restrictions are essential to achieve certain social goals. Each country has unique systems that fit each country's characteristics to achieve their social goals. Thus, those are discussed in the same element of concentration limits (The 9th element).
Step 5 – Assign the privilege 5.1 What decision-making body will determine initial allocation? 5.2 When will allocation occur? 5.3 Will there be an appeals process? 5.4 Who is eligible to receive shares? 5.5 Will initial shares be auctioned or granted? 5.6 How many shares will eligible recipients receive? 5.7 What data are available for allocation decisions?	5. IQ allocation 5.1 Develop the allocation protocol.	The same step, but a management body is discussed under IQ administration.
Step 6 – Develop Administrative systems 6.1 How will trading occur? 6.2 How will catch accounting work? 6.3 How will fishery information required for science, catch accounting and enforcement be collected? 6.4 Who covers the program cost?	6. IQ administration 6.1 Establish a management body for the IQ allocation. 6.2 Establish a platform for catch accounting and tracking IQ transfers.	The experience of other countries made me realize that monitoring and enforcement are important to control each fisher's quota. In addition, each country has unique systems with new technology. Thus, it is discussed as an independent element (The 8th element). In addition, since it is relatively new for resource users in Japan to share some management costs, cost payers are discussed in a separate element for a careful consideration (The 7th element).
	7. Administrative cost and payers 7.1 Determine who pays the cost.	
	8. Monitoring and enforcement 8.1 Establish an effective catch monitoring and enforcement system.	
	9. Avoidance of excessive concentrations of IQs and other negative social impacts 9.1 Determine concentration limits of IQs. 9.2 Establish restrictions on trading and/or use of IQs.	
Step 7 – Assess performance and innovate 7.1 Conduct regular program reviews. 7.2 Assess performance against goals. 7.3 Encourage innovation.	10. Review of performance 10.1 Conduct a program assessment against initial goals and adjust the program to achieve the goals if necessary.	The same step.