Effects of the individual quota regime (IQ) on the pelagic fishing industry of jack mackerel (*Trachurus murphyi*) from the south central zone of Chile.

Rodrigo Zamora Gomez
SONAPESCA

Abstract
During the 1990s, when fishery resources were scarce, vessels competed for fishery resources in a so-called "Olympic race". This way of fishing resulted in many inefficiencies and poor economic performance, which in turn generated continued pressures to increase fishing quotas, thus contributing to the overexploitation of fishery resources, including jack mackerel (*Trachurus murphyi*). The fishery in central-southern Chile was characterized by an over-investment in fishing fleets, low incentives to develop a complementary industry—mainly due to the uncertainty regarding access and availability of the resource—and a markedly seasonal and concentrated fishing activity at the beginning of the season, which erupted in a climate of job instability. The start of 2001 saw a very important regulatory change with the emergence of the individual quota (IQ). The main advantages of the IQ included giving rationality to the industry, allowing planning of fishing activity, encouraging the growth of the industry, improving economic efficiency, and reducing the levels of uncertainty. This regime strengthened fishing rights and gave greater stability to the industrial fishing sector. This case study seeks to show the benefits of an IQ system and its contribution to the system of industrial fishing. The IQ system has served as a guideline for the establishment of the artisanal regime of extraction (régimen artesanal de extracción, RAE); this variant of the IQ system has largely improved the quality of small-scale fishing rights.

Keywords: Chile, Chilean jack mackerel, IQs

1. INTRODUCTION

1.1 Description of the fishery

Jack mackerel is the main fishing resource of the industrial fishery between the lll and X regions. It constitutes one of the main fishery products of the country, and in the volume of capture represents one of the most important fisheries in the world. The fishery for jack mackerel in central-southern Chile began commercially at the beginning of the 1980s and rapidly became the main fishery in the country, with an exponential increase in catches due to increased fishing effort and the greater availability of the resource in this area.

In addition, between 1978 and 1991, an international fleet comprised of trawlers factory vessels of the former Soviet Union, Poland and Cuba among others, operated on the high seas adjacent to the coasts of Chile, with catches averaging at 800 000 tonnes per year. National landings in the central-southern area reached a maximum volume of 4.5 million tonnes in 1995. These landings subsequently began to decline due to the application of measures by the fisheries management authority and the overfishing condition of the resource. The Chilean authority managed to stabilize landings between 2001 and 2007 thanks to the implementation of quotas that allow approximately 1.5 million tonnes to be captured each year.

Chilean fisheries are divided between "traditional" and "industrial" fisheries. The difference between these fisheries depends on the size of the boat and its loading capacity. They are also subject to different administrative requirements. The industrial boat has a length greater than or equal to 18 meters (m) in

length and at least 80 m^3 capacity. In addition, industrial fishing has access from five nautical miles (nm) to international waters even outside the Exclusive Economic Zone (EEZ) of Chile.

The small-scale fleet that operates on the jack mackerel resource is divided into two categories of vessels—those of less than or equal to 15 m in length and those between 15 and 18 m (greater boat), with a capacity of less than 80 m^3. This fleet operates exclusively within the first five nautical miles fishing zone but is allowed to fish outside this area.

1.2 Economic contribution and social implications of the fishing activity

Jack mackerel is a very nutritious fish that contains 19.75 grams of protein, high concentrations of potassium and vitamins D, A, B3 and B12, properties that make it sought-after by the fishmeal industry. Since the beginning of the 1970s, most of the exports have been directed to Nigeria, Sri Lanka, Peru, Cuba and United States of America.

Exporters of jack mackerel products destined for human consumption systematically increased until 2015, reaching a 20 percent increase in 2016, with 24 exporters. As for fishmeal products, there are 28 exporters, the same number observed in 2014.

The export value of jack mackerel destined to human consumption decreased dramatically from USD 185 million in 2009 to USD 85 million in 2016. Canned products experienced the most pronounced decline (from USD 82 million to USD 26 million), while frozen products went down less, from USD 100 million to USD 66 million.

2. MANAGEMENT OF THE FISHERY AND RIGHTS-BASED APPROACHES

2.1 Management of the fishery

From 2011 to date, management of the fishery has been made jointly with the SPRFMO. At the beginning (2011-2012), a global catch quota for the South Pacific was established based on history and landing, without allocation by country. From 2013 onwards, quotas were established and divided among each of the participating countries.

The Law N°20.657 modified the General Law of fisheries and aquaculture (LGPA, Ley General de Pesca y Acuicultura) in several ways, the most important improvement is the establishment of quotas. This development assigned a key role to the Technical Scientific Committees for the evaluation of the state of the resources and for the recommendation of a range of biologically acceptable quotas, using the best scientific information available to achieve the Maximum Sustainable Yield (MSY).

This new framework introduced the Individual Transferable Quotas (ITQ) class A for resources that are fully exploited and have global catch quotas. These quotas are fully transferable, separate from the original vessel of the quota, and have a duration of 20 years. Another mechanism exists as well that allows for the incorporation of new actors into the fishing industry, but only when the resource is not overexploited.

2.2 Brief history of former rights-based approaches used in the fishery

The year 2001 saw the beginning of deep reform in Chilean fisheries regulation with the implementation of instruments of assignment of individual quotas, called maximum capture limits (MCL), in the industrial sector. The application of the MCL had similar effects to the individual quota allocation systems: the elimination of the Olympic race; the elimination of the irrational exploitation of fishery resources and the exaggerated overinvestment in fishing effort; a better use of catches; an increase of investments in plant

and value addition to exports; and finally, stability and job security. It is worth mentioning that this adjustment process was carried out without direct incentives from the State.

2.3 Rights-based approach: allocation and characteristics

The new law includes Individual Transferable Quota (ITQ), with a duration of 20 years and the possibility of renewal, provided there are no reasons for revocation such as labour, environmental and fishing issues. Property of the vessel is separated from the fishing right. There are two kinds of ITQ: ITQ class A, which are the perpetrators of the MCLs and are assigned by historic criteria as a percentage of the industrial quota, and ITQ class B, which result from the auction of a maximum of 15 percent of the ITQ. The transfer of ITQ class A is simple and direct since holders can sell all or part of their ITQ without having to sell their vessels, which substantially reduces transaction costs. Any natural or legal person, whether industrial, small-scale or otherwise, can acquire an ITQ or part of it. This new law strengthened the fishing rights and gave greater stability to the industrial fisheries since it went from a 10-year period up to a 20-year period with the possibility of renewal. However, the small-scale sector, which today accounts for more than 50 percent of the landings, still retains much more precarious fishing rights.

3. CONTRIBUTION OF THE RIGHTS-BASED APPROACH TO ACHIEVING SUSTAINABILITY

3.1 Sustainable use of the resources

The purpose of the Management Plan is to "retrieve and keep the mackerel fishery biological, economic, social and ecological levels sustainable", which is consistent with the objective of the Ley General de Pesca y Acuicultura (LGPA) in relation to the conservation and sustainable use of fisheries (Art. No. 1B).

According to information published by the Undersecretariat for fisheries and aquaculture in Chile, the jack mackerel fishery has restricted access to new operators, a global quota of capture and individual quotas for vessel owners. The state of this resource was overexploited between 2013 and 2016, but there was a recovery of the biomass in 2017, and the resource can now be classified as fully exploited. Beyond the exclusive economic zone (EEZ), jack mackerel is available to any fishery, since it is widely available in international waters.

From the point of view of conservation of resources, individual transferable quotas are not considered more effective than global catch quota or quotas for individual fishing (MCL). However, they are capable of generating more cost-effective and productive incentives than other options of fisheries regulation, by encouraging efforts of self-regulation and longer-term planning horizons. In addition, they allow increasing levels of maximum sustainable yield and decreasing levels of incidental catches, which helps to distribute mortality by fishing over one period of time. However, their implementation requires a solid legal framework.

3.2 Economic viability of the fishery

After the introduction of the IQ, the number of vessels in operation decreased, thus generating savings in overall fishing costs. However, significant changes in the level of the annual total catch occurred until 2008. Econometric estimates analyzing the impact of the IQ system on yield capture (average per vessel) and on fishing efforts of industrial fleets (the number of vessels in operation and the number of fishing trips conducted by each vessel) have shown that with the IQ system:

- Catch per vessel has been higher on average than during the “Olympic race”;
- Monthly trips by vessel have been lower; yields per unit of extractive fishing have been better; and
- There have been substantial operational benefits derived from the current trend to allocate production towards direct human consumption (mainly frozen and canned).

3.3 Social equality

The IQ system resulted in lower employment levels in the fleets. However, the remaining fishermen were more competent, and their careers were longer, which created more stability in the monthly catches. The general safety at sea improved and the number of accidents reportedly declined after the introduction of the IQ. This result can be somewhat attributed to the better planning of fishing operations and improved fishing conditions.

Since the beginning of the preparation of the law, the aim was to improve the "quality" of artisanal fishing rights in order to achieve a more efficient market. In the case of the craft attached to an RAE on a voluntary basis, there was a recognition of their historic fishing rights. In 2010, the sectoral authority attempted to increase the length and coverage of the RAE for more fisheries and more small-scale groups. This gave them the possibility to include in the draft law a comparison of maximum capture limits for small-scale owners. It was decided to establish new RAEs, in particular, through the inclusion of criteria to recognize the historic rights, greater transparency and penalties for failure to comply with assigned quotas, and the possibility to transfer quotas directly between artisanal and industrial actors.

4. MAIN CHALLENGES AND WAY FORWARD

4.1 Challenges for the fishery

The challenges identified in the management plan of the fishery are the following:

1. Fishing quota compliance level;
2. Illegal, unreported, and unregulated (IUU) fishing;
3. Level of expenses associated with the transfer of quotas;
4. Effects of anomalous events in the fishery environment;
5. Low presence of agreements and conservation and management measures of fisheries in the area of distribution of the resource (EEZ and High Sea);
6. Lack of renewal in the registry of small-scale fishers;
7. Interaction with other species;
8. Industrial crew loses benefits due to quota transfer;
9. Ignorance of regional regulation when managing by-catch;
10. Interaction with other activities;
11. Lack of infrastructure and technology for value addition to the products; and
12. Theft of catches.

4.2 Improving fishery sustainability in the future

A plan of action or strategies need to be developed that allow compliance measures or management actions defined by a goal, which, in general terms, should consist of establishing the tasks or activities to be carried out; who should perform them; the deadlines to be met and; the identification of relevant actors with key functions/activities to ensure their implementation.

The action plans will include actions of coordination and direct execution through the Undersecretary of fisheries and its subsidiary bodies, which are binding to the Management Plan in accordance with the provisions of current legislation. The Undersecretary of fisheries and aquaculture in conjunction with the Committee of management of the fishery will establish management strategies.

The objectives of the fishing industry are to ensure that the Chilean product is internationally recognized not only for its quality but also for its sustainability. Some sectors have turned their efforts to develop, in

the short term, an eco-certification, such as the principles set out by Marine Stewardship Council (MSC), IFFO Responsible Supply, Friends of the Sea, among others.

Fisheries will thus be at the forefront of Chile's goal to achieve the Sustainable Development Goals (SDG), in particular, those related to reduced inequality (SDG 10), life below water (SDG 14), responsible production and consumption (SDG 12) and decent work and economic growth (SDG 8).

5. LESSONS LEARNED

Individual quotas that are transferable guarantee economic benefits to the owners of the quotas.
The increase of the duration of the quotas and the possibility of extension even after the 20 years of initial duration have provided investment security to the industrial fisheries.

However, the impact on resources has yet to be observed, as jack mackerel resources are only slowly recovering from over-exploitation.

Small-scale fisheries are still far away from a clear quota system, although the RAE is an interesting way forward in this direction. The sector is suffering from the no-entry and closed registries for fishers, as no replacement is taking place.

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