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**The Jack mackerel fishery in Ecuador:
Towards a participatory framework into the SPRFMO Scientific Committee**

Ecuador

The Jack mackerel fishery in Ecuador: Towards a participatory framework into the SPRFMO Scientific Committee

1. Context

Ecuador has been an active participant in the conservation of non-highly migratory species and the management of its fisheries in the area managed by the South Pacific Regional Fisheries Management Organization (SPRFMO). Ecuador is aligned with management decisions and conservation measures implemented in the Jack Mackerel fishery, as well as in the regulations for the protection of the diversity of the marine environment in the oceanic areas of the convention. Promoted by the sustainability of economic activity linked to pelagic fisheries, the reduction and human consumption industry. Ecuador has seen an opportunity in the Jack Mackerel fishery to minimize the risks associated with demand for raw materials. In this context, Ecuador has requested the SPRFMO Commission to increase its share of Jack Mackerel's catches by protecting Ecuador's economic activities and their national jurisdiction, taking care not to contravene the sustainability objectives of the Jack Mackerel fishery and conservation indicated by the Scientific Committee (SC) de la SPRFMO. Specifically, Ecuador seeks to increase its catches in the convention area by not less than 6.5 thousand tons per year, compared to the current allocation indicated by the SPRFMO regulatory framework.

This document explains some points that support Ecuador's request for increased catches. Two lines are argued. The first mentions the precautionary level identified by the SC on the stock size of Jack Mackerel, which does not appear to be at some level of risk under Ecuador's application. The second line relates to the opportunity to develop the fishery and the spaces to reduce the current structural uncertainties in the scientific advice provided by the SC.

2. A Brief History of the Jack Mackerel Fisheries in Ecuador

The first catches directed towards Jack Mackerel were made in 1983 with volumes close to 19 thousand tons. The sizes of these fish did not exceed 50 cm in total length (LT) and fishing operations were mostly carried out at the southern end of the Gulf of Guayaquil by purse-seine vessels (Aguilar, 1993). However, prior to 1982, no frequent landings of Jack Mackerel were reported, its name was used under other pelagic species (e.g. of the *Caranx* genus) making incorporation into official statistics unfeasible.

According to Armas (1991), the catches of Jack Mackerel until the early 90's were opportunistic and associated with oceanographic conditions that led to the latitudinal expansion of the stock distributed in Peruvian waters. However, since 1990, the appearance of Jack Mackerel in landings of medium-sized vessels (classes 3 and 4) began to be frequent, forming during a large part of the 90s a relevant species in the fishery statistics of small pelagic fish Figure 1 shows the annual landings between the period 1990 and 2016. In the mid-1990s, an average landings close to 52 thousand tons per year.

During the period of maximum landing (1994-2001), the catches of Jack Mackerel promoted the activity of the reducing industry (i.e. fishmeal) and conservative (i.e. canned sardines and mackerel). During this period, Jack Mackerel catches were projected as a complementary market to that generated by the typical small Pelagics (e.g. the Pinchagua, *Opisthonema* genus), safeguarding possible raw material demands.

Breve historia de la Pesquera de Jack Mackerel en Ecuador

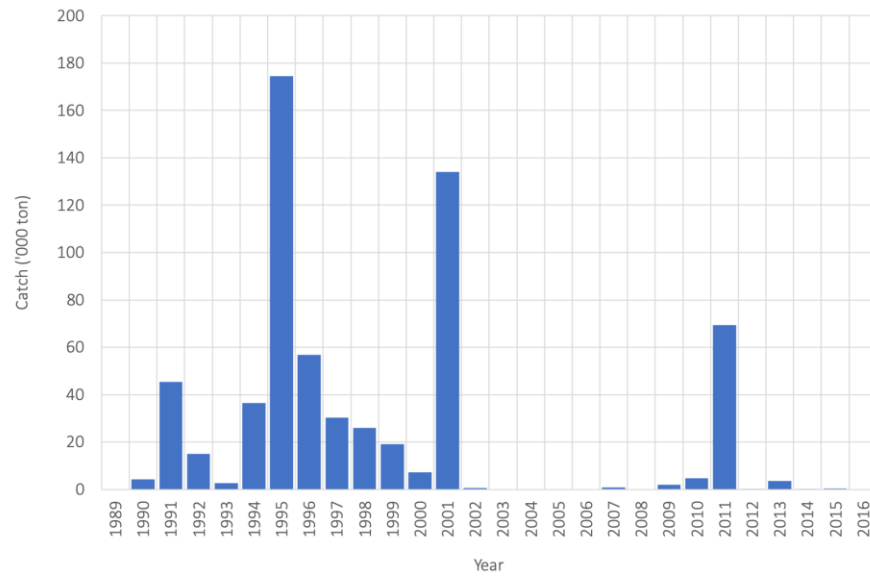


Figure 1: Annual total catch for Jack Mackerel caught by the Ecuadorian purse seine fishery from 1990 to 2016.

3. Condition of Jack Mackerel stock in SPRFMO

3.1 Status of exploitation

The management decisions implemented by SPRFMO over the last four years have allowed for an increase in the size of the Jack Mackerel stock (Table 1). The most recent stock assessment (SPRFMO SC6-Report) shows that the stock has increased by 76% compared to 2015. This has allowed the spawning biomass (SSB) to approach the thresholds defined by the maximum sustainable yield (MSY), which in the case of spawning biomass was defined by SPRFMO in 5,500 thousand tons (SBMSY). In addition, the stock of Jack Mackerel has enabled the recent fishing mortality rate (FCUR) to be around 67% of that associated with the MSY. Consistent with the increase in the stock of Jack Mackerel, SPRFMO has recommended limit catches that since 2015 have increased globally by 8.9%, representing an average annual increase in catches of 44 thousand tons (Table 1).

Table 1: State variables reported by the Scientific Committee during 2015-2018. F_{CUR} : Current or most recent fishing mortality estimated by the Joint Jack Mackerel (JJM) Model. F_{MSY} : Fishing mortality associated with the MSY.

	SC03 - 2015	SC04 - 2016	SC05 - 2017	SC06 - 2018
Spawning stock biomass	2,720	4,116	5,294	4,777
F_{cur}/F_{msy}	0.52	0.72	0.71	0.67
Advised catch	460	493	576	591

3.2 Harvest Control Rule

The Scientific Committee (SC) notes that currently spawning biomass (SSB) occupy the second level ($80\% < SSB < SB_{MSY}$) of the catch control rule (HCR, see Fig 2) (SPRFMO SC6-Report). For this level there is no definition of the level of fishing mortality (F_{REF}) to be implemented to determine the annual recommended limit catch. The SC has used the status quo to define this level, that is, it has assumed F_{REF} as the fishing mortality of the last year of evaluation (F_{CUR}).

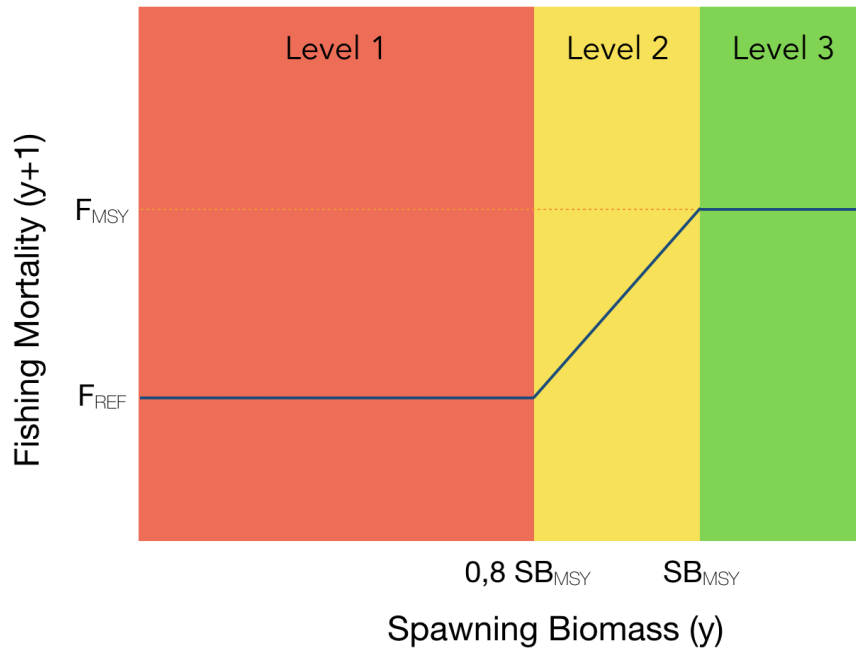


Figure 2: Harvest Control Rule (HCR) proposed by SPRFMO

In the last 3 years, the FCUR implementation has protected on average 39% of the catch associated with the MSY (ie difference between Advised catch - Table 1 - and the MSY - Table 2 -), reducing 212 thousand tons per year on average, the catch limit recommended under the application of FMSY (Table 2). This precautionary level of catch limit is increased (82% per year average) when contrasted with the total implemented catch shown in Table 2. Indeed, the catch safeguard in this case averages 343 thousand tonnes per year (i.e. difference between Implemented catch and MSY - Table 2)

Table 2: Implemented catch (Catch) and maximum sustained yield (MSY) during 2015 – 2016. MSY reported according model 1.5 (SC06)

	2015	2016	2017	2018
Catch	394	389	405	473
MSY	1,144	760	751	784

3.3 Precautionary Approach

SPRFMO has maintained low levels of exploitation in order to keep the precautionary protection principle in fisheries. In fact, without a definition on F_{CUR} (see Figure 2), it is well known that precautionary levels have been efficiently implemented, which is evident when contrasting the short increase that SPRFMO has allowed in the limit catch recommendation (8.9% see Section 3.1) versus the possible increase to F_{MSY} levels (39%, see Section 3.2). This precautionary level appears from uncertainties associated with i) a possible overestimation in the size of the stock evidenced in retrospective analyzes and ii) inaccuracies in the Jack Mackerel growth process, which can result in an escalation of the SSB and consequent increase in mortality for fishing

4. Jack mackerel fishery development in Ecuador

4.1 Jack mackerel fishery development in Ecuador

Ecuador has an important reducing industry that since 2002 has shown sustained growth (e.g. 4% annual between 2012-2016) in fishmeal exports. In recent years this industry has represented up to 12% of the total exported from the fishing sector. Although not as relevant as the flour producing industry, production for human consumption based on canned small pelagics is also a relevant item for the country. In the case of fishmeal exports, Ecuador in 2016 participated with 3.9% of world exports, compared to Chile, which reached 8.1%.

The small pelagic fishery in Ecuador involves about ten species, where pinchagua, mackerel (*Scomber japonicus*), chuhueco (*Cetengraulis mysticetus*), small bottle (*Auxis* spp), round sardine (*Etrumeus teres*), are the most important. The projections of Ecuador, is that the Jack Mackerel in the short term is part of this group of species, allowing a safeguard in the growth of economic activity linked to pelagic fisheries, specifically reducing the risks of growth stagnation due to non-availability of raw material.

During the second half of the 1990s, Ecuador protected the productive industry associated with the small pelagic fishery with average landing levels of 52 thousand tons (see Figure 1). Currently, this shelter does not require these levels of catch, since the fishery has decreased fishing effort (ie less boats) since the 1990s and the demand for raw material by canning and fishmeal processing factories is lower. However, the current percentage of catch allocation for Ecuador makes the participation of private capital in the extraction process operatively and economically unfeasible. The catch assigned to Ecuador by the SPRFMO in the last 5 years has not exceeded 1.5 thousand tons (Table 3), which represents less than 3% of the volumes used in the 90s when the canning and reducing industry incorporated Jack Mackerel catches in its production lines.

Table 3: Implemented catch (Catch) allocated to Ecuador according with the SPRFMO Conservation and Management Measure for *Trachurus Murphyi*

	2016	2017	2018	2019
Advised catch	1,100	1,179	1,377	1,413

4.2 Reduction of uncertainties that impact the scientific recommendation

It was previously mentioned (Section 3.3) that the safeguard of limit catches (i.e. catches significantly lower than those associated with the MSY) implemented by the SC is aimed at avoiding the uncertainties associated with specific issues in the modeling of the Jack Mackerel population. However, the scientific advice provided by the SC to the SPRFMO Commission also has other sources of uncertainty such as the unit of stock, its extension and the relationship with environmental variables. Indeed, the spectrum of issues discussed during the annual meetings of the SC has increased considerably in the last 3 years, addressing not only topics associated with Jack Mackerel, but also the interconnection with other fisheries and species.

In this context, the greater participation of Ecuador in the extractive activities in SPRFMO waters could provide evidence on biological (ie size structures, average weights, sexual proportion) and population (ie distribution area, demographic composition) that help clarify knowledge gaps for more robust scientific advice from the SC. For example, the highest catches reported by Ecuador in 1995, 2001 and 2011 (see Figure 1) were coincident with the highest landings reported by Peru, a situation that has been attributed to availability processes driven by macro-scale events such as ENSO (Ñiquen et al., 2013). Increases in catches were also reported in Chile in 1995 and 2001, indicating possible interconnections in the availability processes. In this sense, the implementation of a biological-fishing monitoring by Ecuador could be an important element in the clarification of uncertainties.

5. Discussion

The latest reports of the stock assessments of Jack Mackerel (SC04, SC05, SC06) indicate that stock conditions in the Southeast Pacific continue to improve. Fishing mortality rates in the last three years have decreased, which, together with a moderate improvement in recruitment, has contributed to the increase in parental biomass since the minimum recorded in 2010.

The spawning biomass has been close to 90% of the SBMSY provisional reference point. Simultaneously, fishing mortality decreased at a rate (e.g. 0.09% in 2018) well below the F_{MSY} benchmark. This situation has facilitated limit catch guard that could fluctuate between 212 and 343 thousand tons per year (Section 3.2), resulting in quite efficient precautionary measures by the SPRFMO. In effect, the increase in the catch limit since 2015 has not exceeded 44 thousand tons per year (Section 3.1), representing between 13% and 21% of the aforementioned receipt.

The history of Jack Mackerel catches in Ecuador shows that during the 1990s the annual landings averaged 52 thousand tons (Section 2), which were aimed at protecting the supply of raw material for the human consumption and reduction industry (Section 4.1). Currently, the request for an increase in limited catch by Ecuador is maintained in two main points: i) the safeguards that must be provided to maintain the stability / growth of the productive industry linked to pelagic fisheries, and ii) certification by part of the scientists of Ecuador that this increase does not lead to a risk in the population of Jack Mackerel that violates the precautionary measures affected by SPRFMO.

Regarding this last point, the increase of 6.5 thousand tons requested by Ecuador does not exceed 3% of the catch in limit catch that the SPRFMO has made through the implementation of the status quo (Section 3.2). This percentage is relatively low with respect to the levels of participation of the remaining fishing fleets. On the other hand, the status quo-based exploitation strategy, where F_{REF} is adopted equivalent to F_{CUR} , is a transitional decision pending a definition of the HCR.

According to the management measures for Jack Mackerel, F_{REF} could adopt different levels of fishing mortality, possibly higher than the status quo counterparts. However, with the intention of achieving the growth of the stock of Jack Mackerel, Ecuador promoted and adopted the decisions of the SPRFMO regarding exploitation levels (SC03). Ecuador, today, requires that the SC issue a position (qualitative or quantitative) on the impact that would increase in the stock of Jack Mackerel the increase in fishing mortality associated with the request for increased catch,

that is to increase the extraction by the Ecuadorian fleet in 6.5 thousand tons. This requirement is based on Ecuador's intentions not to violate the actions of the SC on precautionary measures and precautions on the exploitation of Jack Mackerel.

A greater participation of Ecuador in the extractive activities of Jack Mackerel under the administration of SPRFMO would allow, in addition to the previous points, a greater participation in the markets of tradable quotas. This market is not efficient under current rights allocation levels. In effect, 0.2391% (CMM 01-2019) of allocation is not financially attractive to promote private investment, much less, for the development of a quota trade that will relieve the pressure of the fishing effort.

On the other hand, small pelagic fisheries in Ecuador are not regulated under a catch quota system such as the one implemented by SPRFMO for Jack Mackerel. In this sense, Jack Mackerel catches implicitly through the SPRFMO regulations now contain a control mechanism that contributes to national management plans. Finally, the greater involvement by Ecuador could provide relevant.

6. Referencias

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