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FISHING INDICATORS OF JACK MACKEREL IN CHILE, 1995-2008

Leonardo Caballero G., Gabriela Böhm S.
Instituto de Fomento Pesquero – IFOP
Chile

INTRODUCTION

This document provides the main fishing and operational indicators of the industrial activity for jack mackerel in Chile, focusing on the pelagic fishery developed in the central-southern zone. Jack mackerel is the target resource of this fishery; it is caught with purse-seine and sometimes with mid-water nets inside and outside the EEZ, and it constitutes 85% of the national jack mackerel landings. In the northern zone, the fleet focuses primarily on anchovy, thus jack mackerel is a secondary resource caught mainly in areas close to the coast.

MATERIALS AND METHODS

The area of study corresponds to the central-southern zone, which comprises the V-XI regions (32°10'S- 45°30'S) and from the coast to the 200 nautical miles, as well as the area beyond the EEZ, with fishing operations conducted even beyond the 1000 nautical miles from the coast up to around the 46°S (Figure 1).

The information analyzed derives from the operational technical records of industrial purse-seine vessels that participated in the jack mackerel fishery. This fleet is composed by major vessels of hold capacity equal or higher than 80 m^3 using purse-seine equipment and nets. Some vessels can conduct mid-water trawling fishing activities as well. The information about fishing operations is collected in landing ports and/or processing plants, and with on-board observers to complement the preceding activities.

The daily fishing operation conducted by each vessel is recorded, allowing collecting data of effort and landing, such as: date and time of vessel departure and landfall, discharge port and plant, species and geographical position of the catch.

The catch corresponds to the amount of fishing per vessel and fishing trip reported by the industry in the area of study. Effort is considered to be trips with catches, total trips , and displaced hold of the vessels. Trips with catches are those in which jack mackerel (target resource) was actually caught; total trips consist of the sum of trips with catches and trips without fishing. .Trips without fishing are trips with no catch by vessels that had jack mackerel as target resource. Catch per Unit Effort (CPUE) is defined as the quotient between: a) capture and trips with fishing, and b) capture and total trips.

Furthermore, operational indexes of the fishing success are provided (%) and the mean length of the trip (days). The first corresponds to the quotient between trips with catches and total trips, and the second corresponds to the time passed between setting sail and arrival.

For the representation of the spatial-temporal distribution of jack mackerel catch, a geo-referenced system with 0.1 x 0.1-degree (latitude x longitude) grids is used.

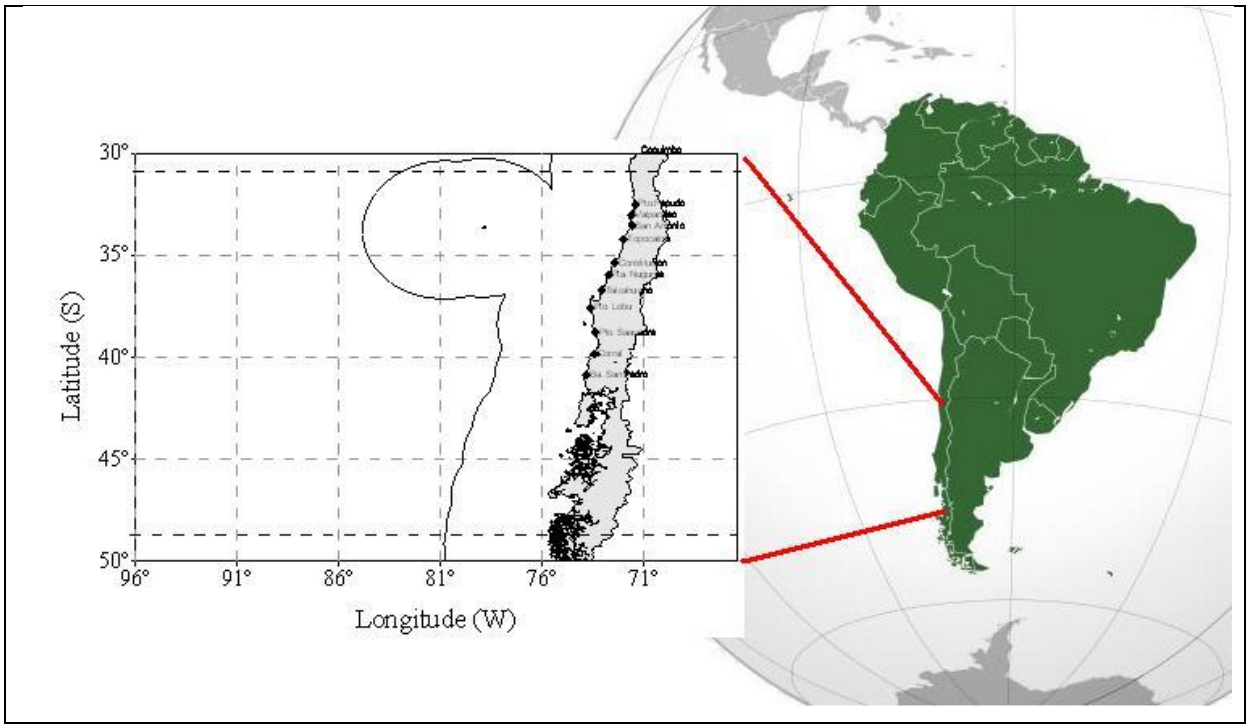

Figure 1 Area of study of the jack mackerel fishery off the central-southern zone of Chile

RESULTS

Catches

The jack mackerel fishery in the central-southern zone of Chile is the most important fishery at a national level; it showed a steady growth over the 1980's, reaching a 3,9 million tons top in 1995 (93% of the national total). Since 1996, landings decreased importantly, strongly falling in 1997-1998 due to the implementation of fishing regulations established to protect the resource (for example, bans, controlled research fishing), reaching in 1999-2001 a 1.1-million-ton average.

Regarding changes in the spatial coverage of the central-southern fleet, jack mackerel fishing operations are observed since 1992 that go beyond the first 100 nm from the coast and, in the middle 1990's the incidence of catches recorded between the 100 and 200 nm exceeds 26% (Figure 2).

Since 2003 an important change is observed in the operation of the fleet, translating into a significant increase of the catches from outside the EEZ, which represents 48% and 79% in 2007 and 2008, respectively. During 2008, the fleet widened its action range, both to the west and to the south, exceeding the 1100 nm from the coast.

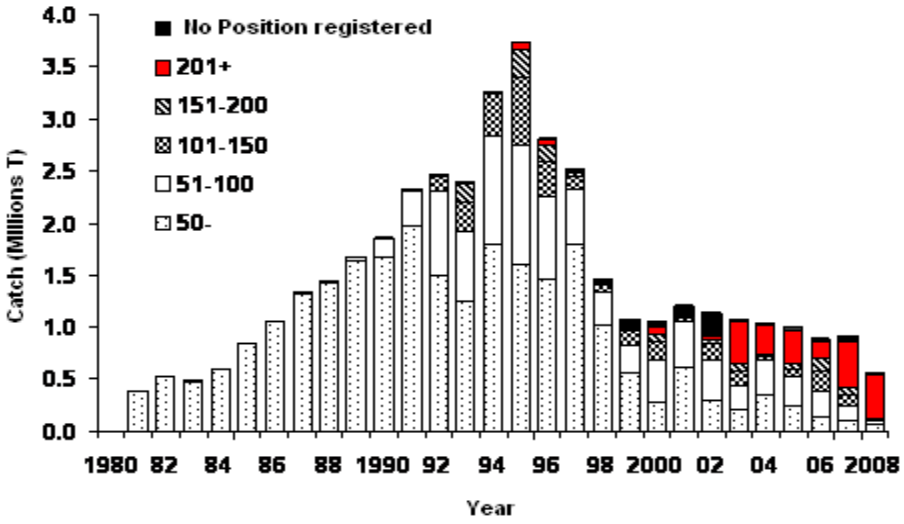

Figure 2 Industrial jack mackerel catches (t) from central-southern Chile, according to distance from the coast (nm), 1980-2008

In the last seven years, the central-southern industrial fleet has expanded gradually, both spatially and temporally due to distribution changes and availability of the resource, which has required larger, more technologically equipped and autonomous vessels. Currently the fleet covers the whole latitudinal central-southern area, and has extended longitudinally up to the limits of operational autonomy (Figure 3) (Aranis et al., 2009).

During 2008, the fleet has increased efforts to search and conduct more settings per fishing trip, with a view to maintain catches per trip, but finally, the operational result were not good, in terms of capture per day at sea. Likewise, a significant part of the catches was caught outside the EEZ (79%) (Figure 2) (Aranis et al., 2009)

In the northern-zone fishery, the activity on the jack mackerel is primarily coastal , as the fleet focuses on the anchovy (caught in the first 20-30 nm of the coast). Jack mackerel catches are mainly concentrated (> 85%) in the first 50 nm, and the rest between the 50 and 100 nm, with scarce records in the high seas (Figure 3).

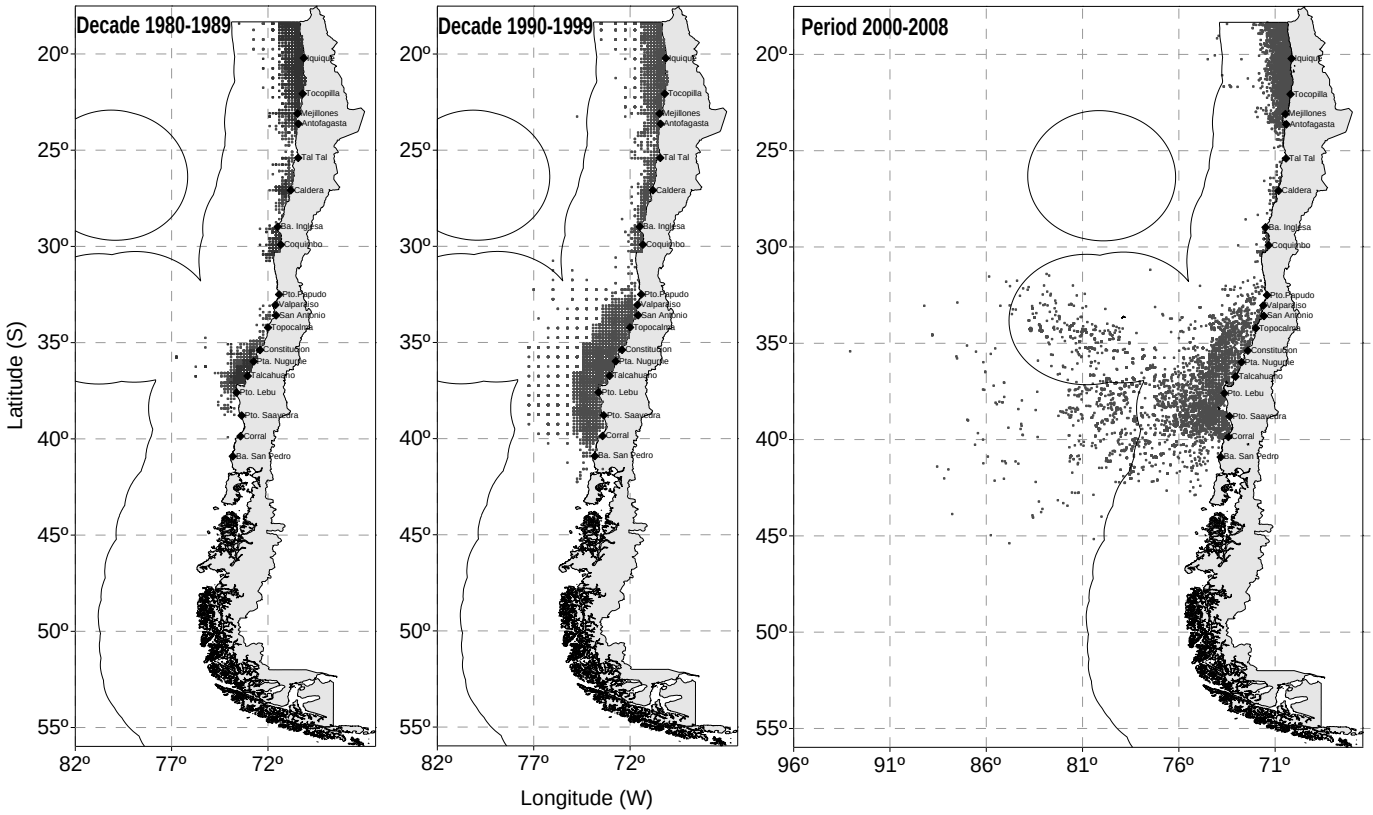

Figure 3 Spatial-temporal distribution of the jack mackerel catches by the industrial purse-seine fleet, according to 1980-2008

Fishing fleet

The increase of the jack mackerel abundance caused an important growth and development of the fleet since the 1980's. This meant the entrance of new larger vessels, of Nordic origin, changes in the fishing system and the introduction and massive use of the *jack mackerel net*. The fleet steadily grew until 1997, reaching 189 units (131 thousand m^3; average 693 m^3) (Figure 4); later, it would decrease due to a crisis in the fishery in 1997-1998 and because of the implementation of the Maximum Catch Limit per shipowner (MCL), in 2001.

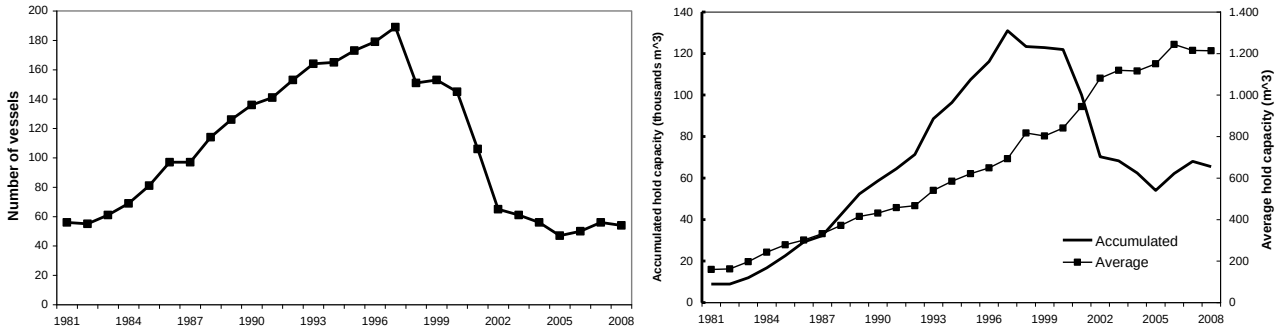

Figure 4. Evolution of the industrial pelagic purse-seine fleet in the central-southern zone of Chile; number of vessels, average and accumulated hold capacity 1981-2008.

The implementation of the MCL had the most important impact in the decrease of the fleet size, reaching the lowest number in 2005 with around 50 operating vessels and 54 thousand m^3 of accumulated hold capacity.

Larger, more autonomous vessels with higher fishing capacity replacing smaller vessels allow operating in adverse conditions, covering a wider area in high seas and conducting longer-lasting fishing trips (Aranis *et al*, 2005).

Fishing effort

In 2004-2008 a decreasing trend was observed in the three fishing effort indicators (trips with fishing, total trips, and displaced hold capacity, as a result of the lower number of vessels in operation and less but longer lasting fishing trips for a less available resource (Figure 5).

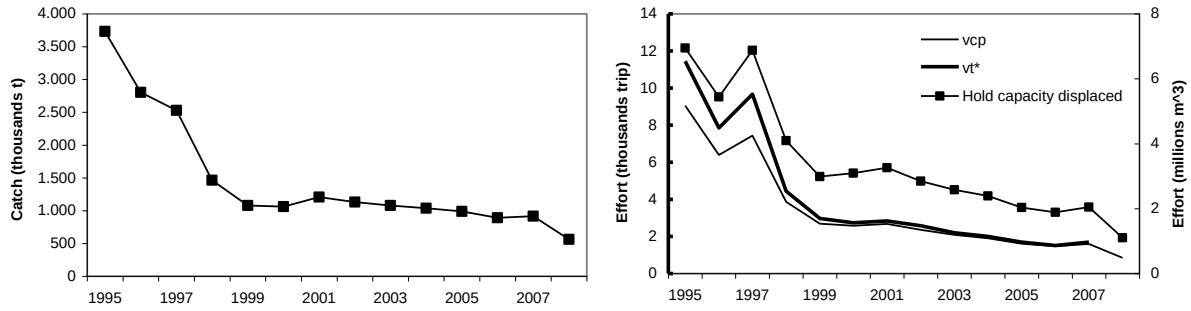

Figure 5 Nominal catches and effort; trips with fishing (vcp), total trips (vt), displaced hold capacity of the industrial purse-seine jack mackerel fleet in the central-southern zone of Chile, 1995-2008

The mean length of fishing trips has shown an increasing trend due to the fleet moving away from the coastal zone (see Figures 2 and 3). Between1995-2001 the mentioned length fluctuated in around 2 days, around 3 days in 2006, while in 2007 and 2008 it reached 4 and 7 days, respectively. This not only indicates that the fleet is moving away from the fishing grounds, but also that it is finding more operational difficulties to catch jack mackerel (Figure 6)

Fishing success, defined as the proportion between trips with fishing over the total amount of trips aimed at jack mackerel, maintained around 80% until 1997; later, it showed a sustained increasing trend, reaching 95% in 2007 (Figure 6), thus reflecting a more efficient operation of the fleet, which reduced significantly until 2005 and leveled out in the last years (53 vessels average).

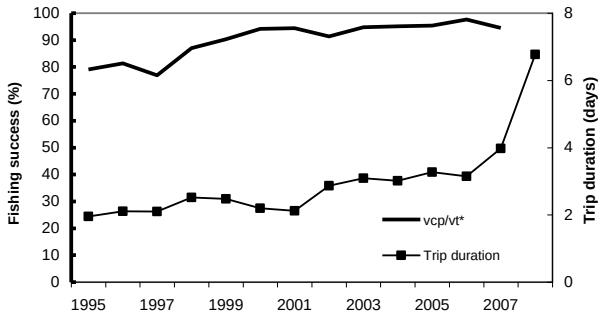

Figure 6 Average length of fishing trip and jack mackerel fishing success (vcp/vt*), industrial purse-seine fleet in the central-southern zone of Chile, 1995-2008

Catch per Unit of Effort (CPUE)

Until 2005, an increasing trend in the CPUE is observed (t/vcp y t/vt), which importantly rose regarding the historical average (Figure 7). Such increase was caused by the re-adaptation experienced by the fleet in terms of gradually operating more efficiently with fewer but larger, more efficient and more autonomous vessels, rendering this indicator useless to represent relative abundance.

In 2006, CPUE leveled out regarding the previous year and then decreased in 2007 in spite of the increasing trip length, related to a heavier seeking effort and the moving away of fishing grounds. The increase of CPUE in 2008 is mainly explained by the heavier effective effort of the fleet, in terms of longer lasting seeking and trips lasting almost double than they used to, which translated into less fishing trips. Nevertheless, catches decreased notoriously.

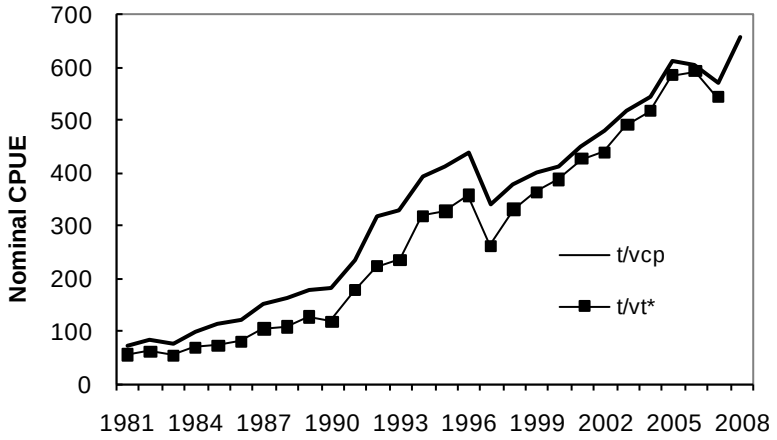

Figura 7 Nominal C.P.U.E; tons per trip with fishing (t/vcp) and tons per total trips (t/vt*), of the industrial purse-seine fleet in the central-southern zone of Chile, 1981-2008.

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