PERU

ANNUAL NATIONAL REPORT TO THE SPRFMO SCIENTIFIC WORKING GROUP

2010

INDEX

1. DESCRIPTION OF THE FISHERY

1.1. Catch per year and area

In the last five years, annual jack mackerel catch volume in Peru fluctuated between 26 000 and 280 000 tons, showing a decrease from 2006 to 2009, when 26 000 tons were caught. During this period, it is remarkable the catch decrease in the northern area and their increase in the central and southern area off Peruvian coast, which are currently the main fishing areas (Table I).

Table I. Jack Mackerel catches with purse Seine nets in Peru (2004 - 2009)

Years	Total catch (t)	Catch by area (t)		
		North – 09º59´S	10º00´S – 15º59´S	16º00´S - South
2004	106270	0	85899	20371
2005	49476	720	16980	31776
2006	280269	65247	191637	23385
2007	188529	5286	132192	51051
2008	120748	64	50085	70599
2009	25912	100	25312	500

2. CATCH, EFFORT AND CPUE IN THE JACK MACKEREL FISHERY

2.1. Trend in catches

The historical information about jack mackerel catches in Peru indicates that maximum levels were reached in 1977 and 2001, being both affected by the action of anchovy fleet, which temporarily aimed at jack mackerel fishing. Later on, jack mackerel catches reached between 50,000 and 280,000 tons per year, with peak values in 2006. Lower values are related to colder conditions on Peruvian sea, mainly by incidence of La Niña event (Figure 1). A key point on the development of Jack mackerel and Pacific mackerel fishery was the effect of legal rule D.S. 001-2002 (06-09-2002), that established the exclusive use of these species for direct human consumption, which has restricted catches and allow development of Industrial fleet with Refrigerated Sea Water (RSW) system.

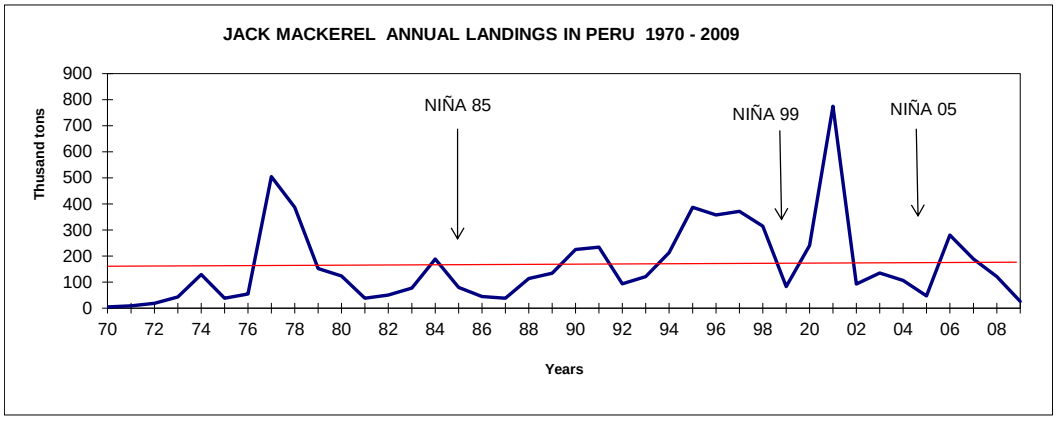


Figure 1: Total catch of Jack Mackerel with purse seine nets, 1970–2009

2.2. Fishing effort trend

During 2003 – 2009 fishing effort in jack mackerel fishery, measured as fishing trip, showed an increase in the number of trips in 2006 and reached 1022 trips with a gradual decrease in the last years.

Fishing trip duration did not show much variability and reached an average of 95 hours per trip. In 2009, trips duration was 86 hours, on average (Figure 2).

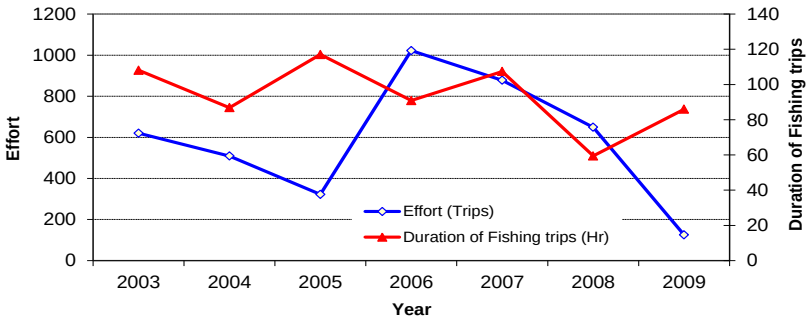


Figure 2: Number of fishing trips and duration of fishing trips with purse seine nets, 2001 – 2009 periods

2.3. CPUE trends

Two CPUE indicators are present in purse seine jack mackerel fishery in Peru. Both indicators: catches/ fishing trips and catches/trip hour showed the same trend, with highest values in 2006. However, a strong decrease has occurred during the last few years. Notice in this time series, the lowest value was in 2005, associated to incidence of La Niña event (Figure 3).

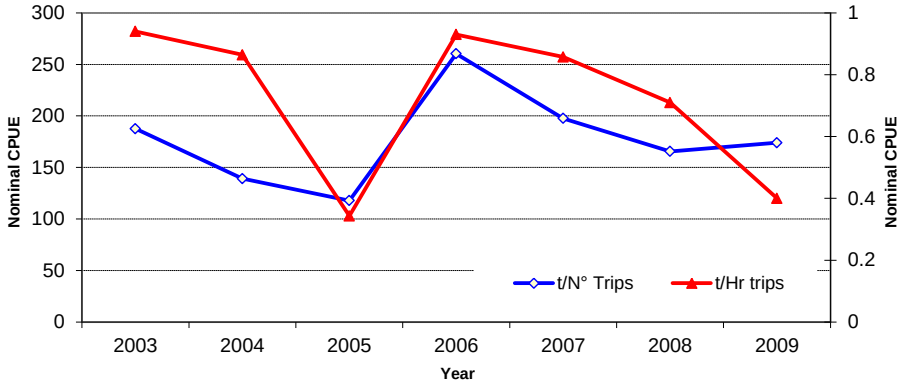


Figure 3: Nominal CPUE; tons of jack mackerel by fishing trips and by duration of fishing trips, using purse seine nets, 2001 – 2009 periods.

3. RESEARCH ACTIVITIES AND DATA COLLECTION

Monitoring of pelagic fisheries and research surveys, conducted mainly for anchovy allowed us to gather the fishing effort and biological data of jack mackerel and pacific mackerel. Nevertheless, we are aware of the necessity of getting data from 100 nautical miles offshore in front of Peru, in order to have more elements for fisheries management. Study area cover all the Peruvian coast, which is dominated by the Humboldt eastern boundary current system.

The main pelagic species are anchovy, sardine, jack mackerel and pacific mackerel. Stock assesments of the main pelagic resources were made with the hydroacoustic method, using a SIMRAD echosounder - echointegrator EK 500 and EK 400 operating at 120 and 38 Khz to a depth of 250 m (IMARPE, 1997). In the present, a combination of direct and indirect methods is used. In 2008-2009 IMARPE conducted a special research on Jack and Pacific mackerel, with focus on biology, habitat and fisheries, based on the Program "Bioceanographical research of Jack mackerel and Pacific mackerel resources".

4. BIOLOGICAL INFORMATION

4.1. Biological sampling

The biological information is obtained through random two-stage stratified sampling, where 10 individuals from each size range are considered. With this sampling, information about length, weight, sexual maturity, gonad and weight length are obtained. Ovaries, otoliths and stomach samples are taken to perform ovarian tissues, age, growth and feeding diet analyses, respectively. Sampling is done twice a month at all IMARPE coastal laboratories.

4.2. Length and age composition of catches

The jack mackerel annual size structure during 2007 - 2009 had a polimodal structure. There is a remarkable presence of a high percentage of adult individuals in 2007 and 2008, which had a modal size between 33 - 35 cm total length. Also, in 2009, there was an adult group between 41-42 cm and small groups between 14-16 and 23-25 cm (Figure 4).

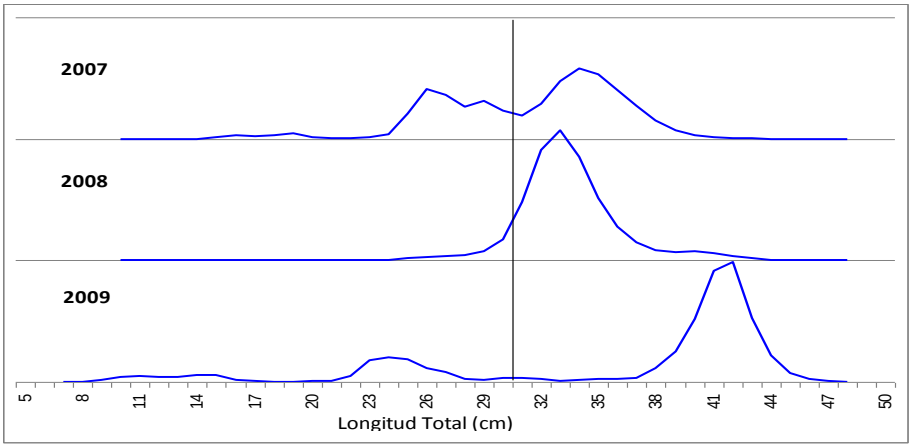


Figure 4. Annual Size structure of jack mackerel catches (in percentage) during 2007 – 2009

Last data for size structure of jack mackerel in winter 2010 show the presence of several modal groups, near to the coast at 10º S there was individuals between 30 to 48 cm total length, at 17ºS between 26 to 30 cm and far away from the coast, moreless 200 – 220 miles off 15-16ºS there was individuals with modal size in 19-20 cm.

4.3. Spawning activity

Data for spawning activity based on gonadosomatic index of jack mackerel showed a high spawning activity in 2007 and very low values in 2008 and 2009 (Figure 5)

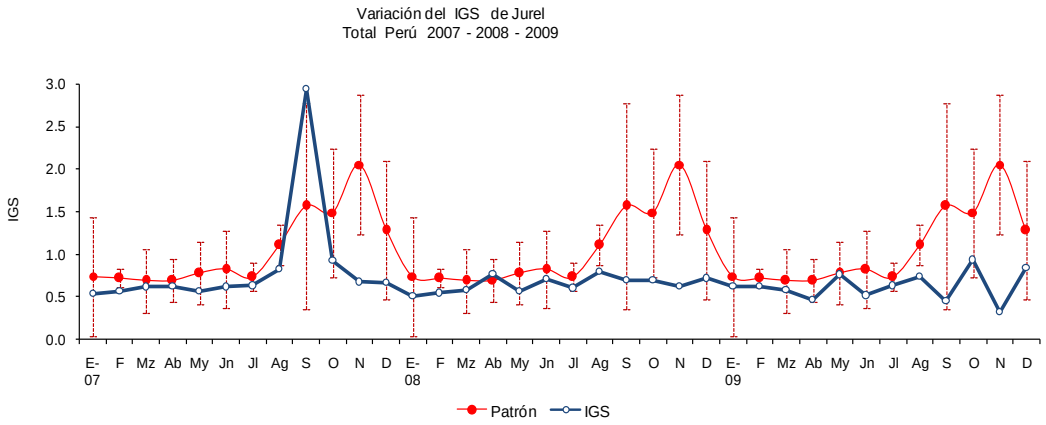


Figure 5. Gonodasomatic index of jack mackerel in Peru 2007- 2009

4.4. Biomass estimates and interdecadal changes

Jack mackerel biomass estimates for the period 1983- 2004, obtained by acoustic method in the Peruvian coast, clearly show two phases: a high biomass phase from 1983 to 1996 (average biomass= 4´ 800,000 tons) and a low biomass phase from 1997 (average biomass = 450, 000 tons), to present (Figure 6). Fishery can not explain this observed change.

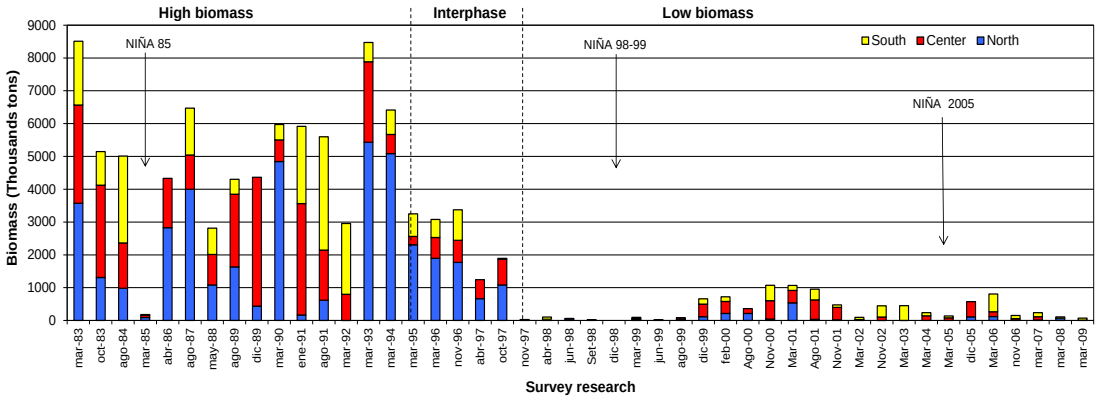


Figure 6. Jack Mackerel Biomass, according to hydroacoustic Assessment Survey (1983-2009)

In the period 1998 – 2009 the decrease of jack mackerel biomass could be linked to an increase in giant squid abundance, mainly in the north part of Peru (Figure 7). The areas occupied by jack mackerel before the mid 90's are now occupied by jumbo squid *Dosidicus gigas.*

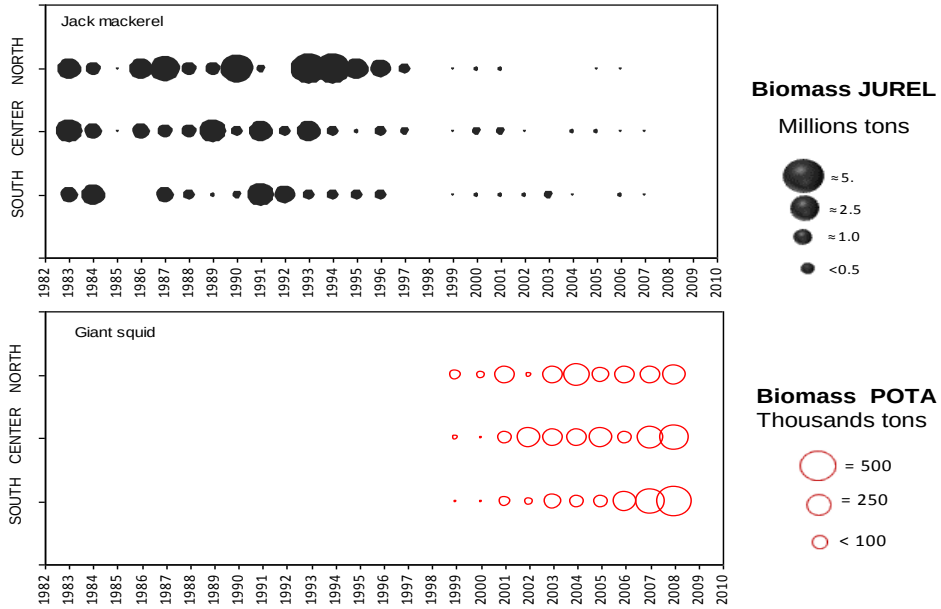
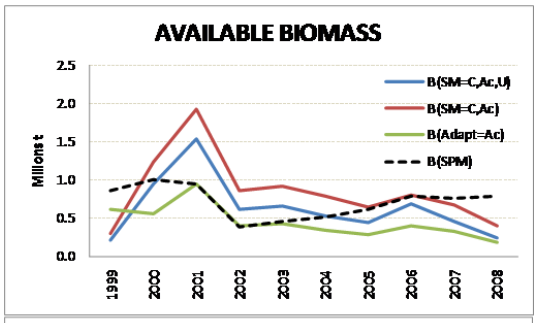
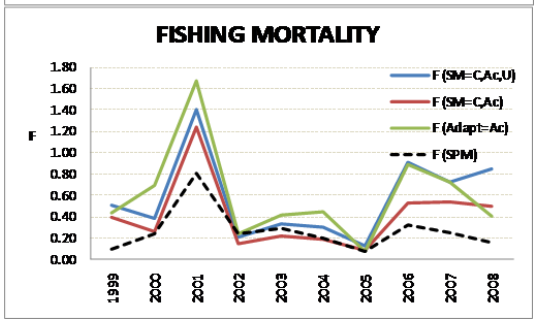


Figure 7. Distribution of Jack Mackerel (JUREL) Biomass and Jumbo squid ("POTA") biomass in Peru during 1982-2009

There are also references about trend change in some environmental variables like the depth of the oxygen minimum zone that has became shallower since the 90's in the Peruvian sea, so we understand that climate has played a key role in the decreasing availability of jack mackerel off Peru.

4.5. Stock assessment with age-structured models and Biomass Dynamic model





Age structured assessment models were implemented in order to estimate the available biomass of jack mackerel off Peru during the last ten years. Stock abundance and biomass, fishing mortality and exploitation rate were estimated by two approaches: Statistical Catch at Age Analysis (CAGEAN) and Cohort Analysis (ADAPT). Parameters supplied to models (growth, age-length key, M, maturity, weight at age) were estimated from fishery monitoring and surveys data. The CAGEAN was first tuned with commercial catch and acoustic biomass, later catch per unit effort was included. ADAPT was tuned only with total acoustic biomass.

On the other side, a biomass dynamic model, Schaeffer type, (Surplus Production Model – SPM) was adjusted with annual catch and CPUE data, available for the period 1999 to 2008. A maximum likelihood framework was developed in a MS Excel spreadsheet to estimate the parameters (K, r, q) of the model.

The available biomass off Peru estimated by the four exercises (1 ADAPT, 2 CAGEAN and 1 biomass dynamic model) showed comparable order of magnitude but some differences in the trend and the level of the last year. The highest biomass for the period 1999-2008 was observed in 2001(between 1 and 2 million t), after that, the biomass has kept at a level above 0.3 million t with a slight decreasing trend. The biomass dynamic model gave a more optimistic result, with an increasing trend since 2002 and a level around 0.8 million tons for the last year. As well as biomass, fishing mortality estimated by all the models showed similar trends, however the biomass dynamic model gave lower values than age structured models.

All these methods can only estimate trends of available biomass of jack mackerel off Peru. In the past, purse seine fleet has only focused on this resource when seasonally available and mainly for fishmeal. Since 2002 the pressure on this resource has diminished because it is only used for direct human consumption. In consequence the results of the biomass dynamic model probable give a more reliable figure on the state of jack mackerel off Peru.

5. PORT OBSERVER AND SAMPLING PROGRAM

The sampling aims to obtain the maximum number of samples to cover the largest possible geographical area, where the fishing fleet is distributed, assuming its position is related to the highest resource concentration. This improves the probability to obtain representative samples obtained from the population in study.

The main IMARPE head office is located in Callao. However, there are 8 laboratories in the Peruvian coastal region Tumbes, Paita, Santa Rosa, Huanchaco, Chimbote, Huacho, Pisco, Ilo and temporal stations in Chicama and Matarani.

6. IMPLEMENTATION OF MANAGEMENT RECOMMENDATIONS

6.1. Biological measures

Among the main regulative measures, we have:

- Mesh size 38 mm or 1½ inch.
- Minimum catch size: 31 cm.
- Juveniles limit in catch: 30% of total number.
- Jack and Horse Mackerel Fishery Law N° 011-2007-PRODUCE (12th April 2007), that promotes a rational exploitation of this fishery resources.

6.2. Effort control

The legal rule D.S. 001-2002, since 2002 established exclusive use of these species for direct human consumption, which has restricted catches and allowed the development of industrial fleet with Refrigerated Sea water systems.

In the late '90s started satellite monitoring of vessels, and from 2003, the Government of Peru ordered the implementation of satellite-based vessels monitoring systems in both: large scale and wooden industrial fishing vessels (D.S. N° 031-2003-PRODUCE).

The aim was to promote the development of the national fishing activity in high seas, mainly in the South East Pacific Ocean area. On July 2009, a legal rule named D.S. 022-2009-PRODUCE established the regulatory provisions for the exploitation of highly migratory fishing resources, such as jack and horse Mackerel, by national large scale fishing vessels in high seas.

C. October 2010