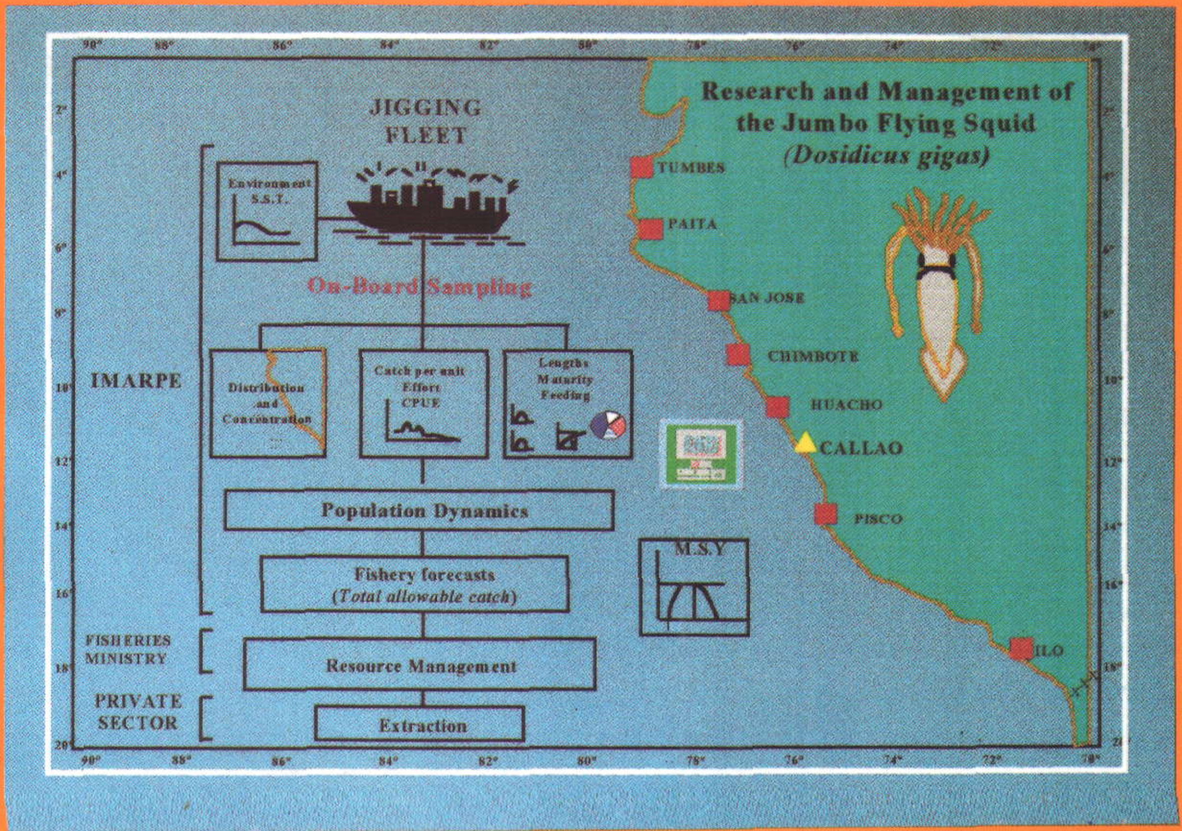
INSTITUTO DEL MAR DEL PERU
IMARPE

INTERNATIONAL SYMPOSIUM ON PELAGIC LARGE SQUIDS

TOKYO - JAPAN
JULY 18 - 19, 1996

JUMBO FLYING SQUID FISHERY IN PERU

(Dosidicus gigas)



Conducción Editorial
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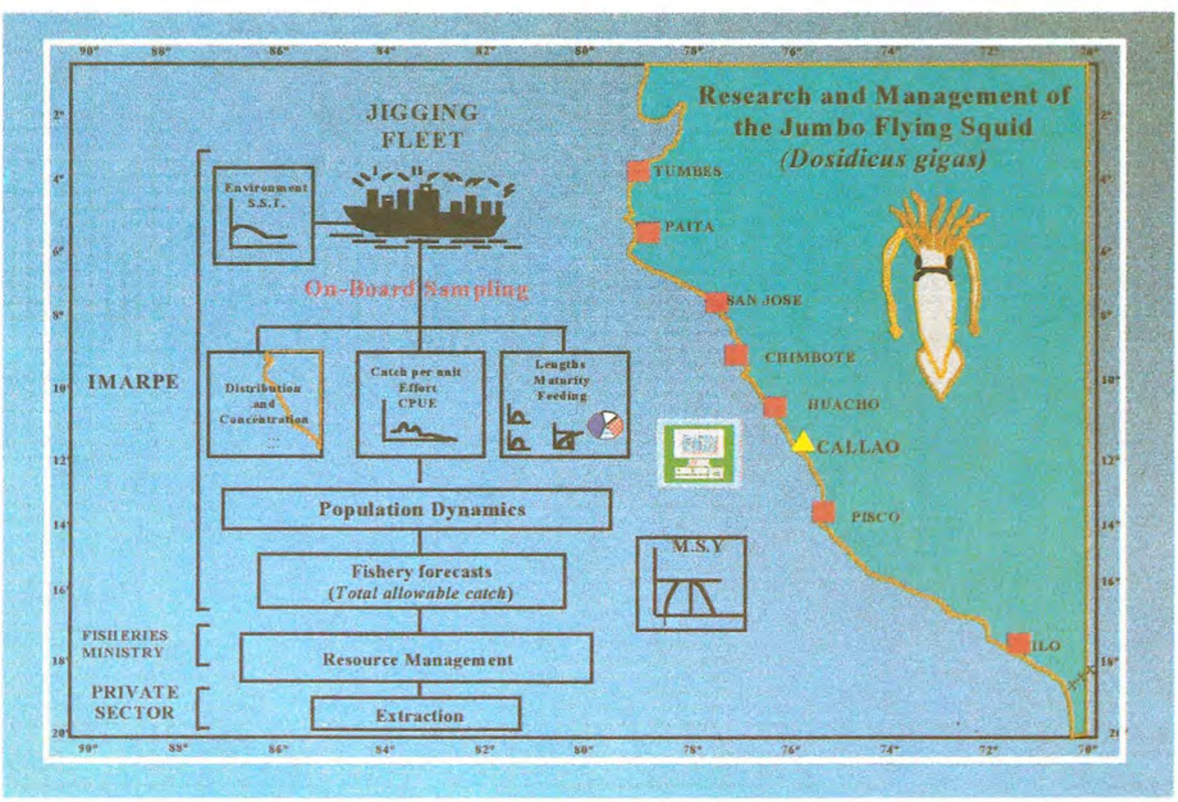
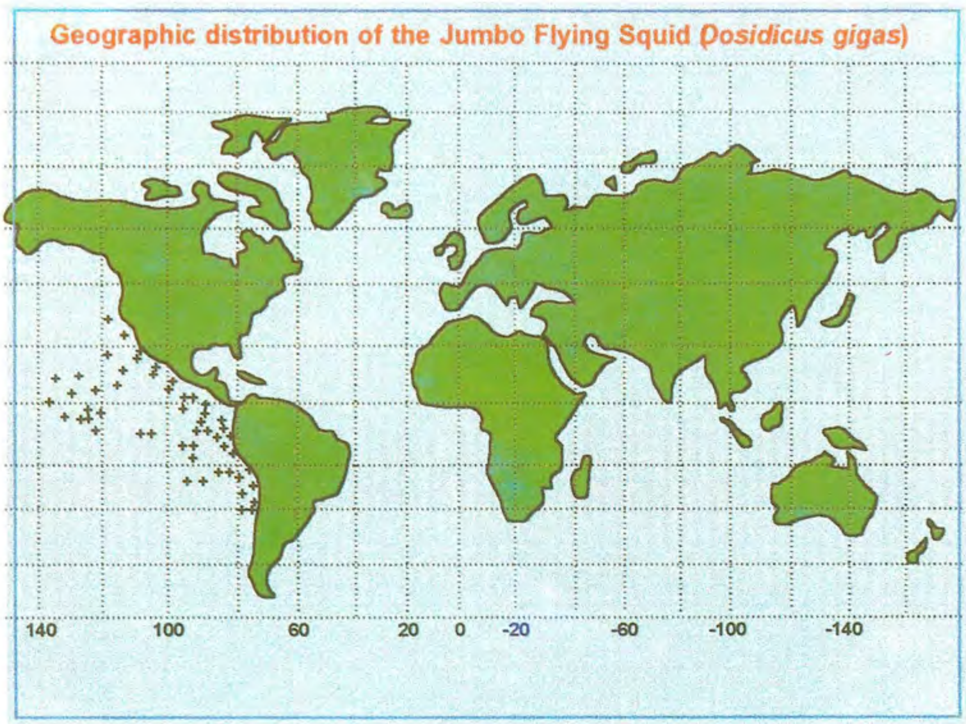


JUMBO FLYING SQUID FISHERY IN PERU

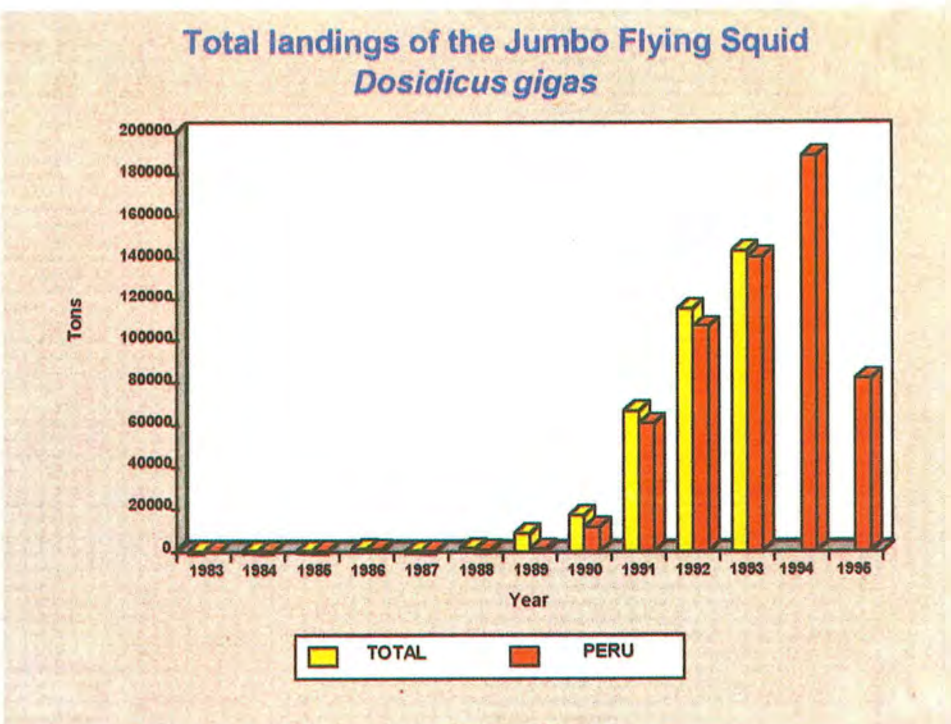
Dosidicus gigas

The diversity of species of squid, octopus and cuttlefish in world-wide marine ecosystems represent and important potential fisheries resource on account of their large volumes and high protein content. The most important species of cephalopod belong to the families Ommastrephidae, Loliginidae and Octopodidae.

The jumbo flying squid, also known as the giant squid or "pota" (*Dosidicus gigas*) belongs to the family Ommastrephidae and is the only species of the Genus *Dosidicus*. It is a pelagic oceanic resource, with some neritic components, which is associated with highly productive marine zones. It is highly migratory and attains large sizes, with a mantle length of up to 150 cm.



The species is widely distributed in the Pacific, from the Gulf of California (36° N) to the South of Chile (47° S) and reaching longitude 125° W off the coast of Ecuador. In Peru it is found both within the Maritime Domain (until 200 nautical miles, offshore) and in the adjacent open seas. The greatest concentrations in recent years have been located between the extreme North of the Peruvian Maritime Domain and 10º30_ S, up to approximately 100 miles offshore.



Landings of this species in the Central and Southeast Pacific between 1983 and 1993 ranged from 100 to 140,000 tonnes, of which the Peruvian catch accounts for 91.2%, with a marked increase after 1991 when extraction on an industrial scale was begun. In the years 1994 and 1995 catches amounted to 190,000 and 80,000 tonnes respectively.

The giant squid is a highly variable resource, which can present peaks of great abundance, such as those observed in Peru in recent years, as well as periods of low abundance; these are related to fluctuations in the marine environment which have a positive or negative influence on the concentration and availability of the resource.

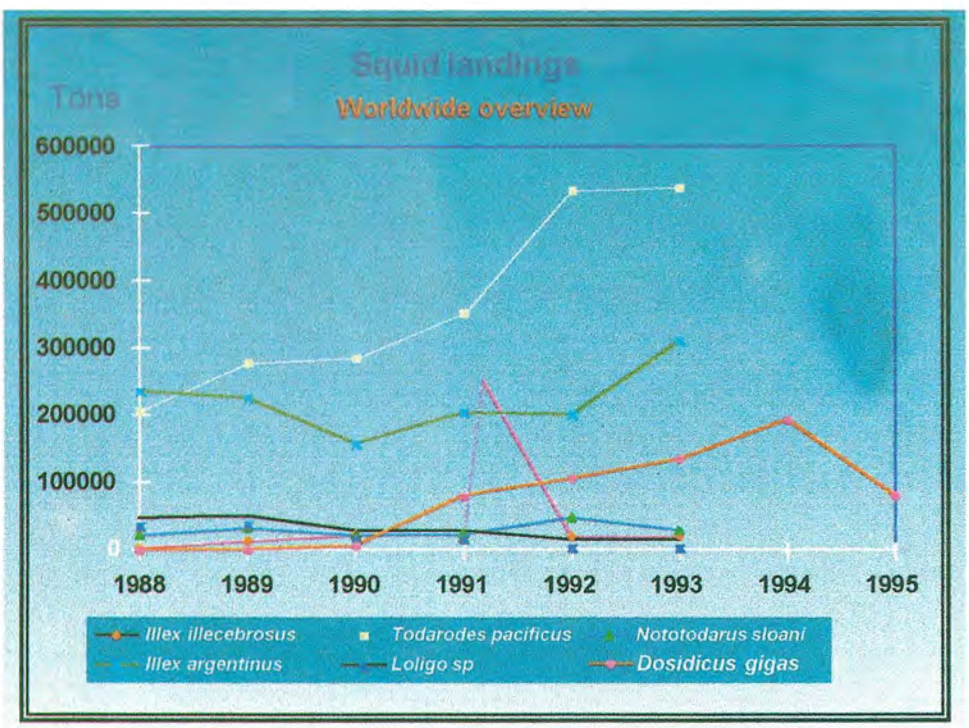
WORLD OVERVIEW

In general terms there has been a progressive increase in worldwide landings of giant squid and other species of squid between 1983 - 1993, in response to the high level of international demand.

In the Southwest Atlantic, the species which sustains the cephalopod fishery is *Illex argentinus*, with catches between 157,000 and 310,000 tonnes during the period 1988-93. Another important species is *Loligo sp.*, whose intensive extraction led to a reduction in catches from 39,000 tonnes in 1989 to 3,500 tonnes in 1993.

In the Northwest Atlantic, the species *Illex illecebrosus* is encountered, with landings of between 2,800 and 22,000 tonnes.

In the Northwest Pacific, the important Japanese squid (*Todarodes pacificus*) fishery catches between 206,000 and 538,000 tonnes.

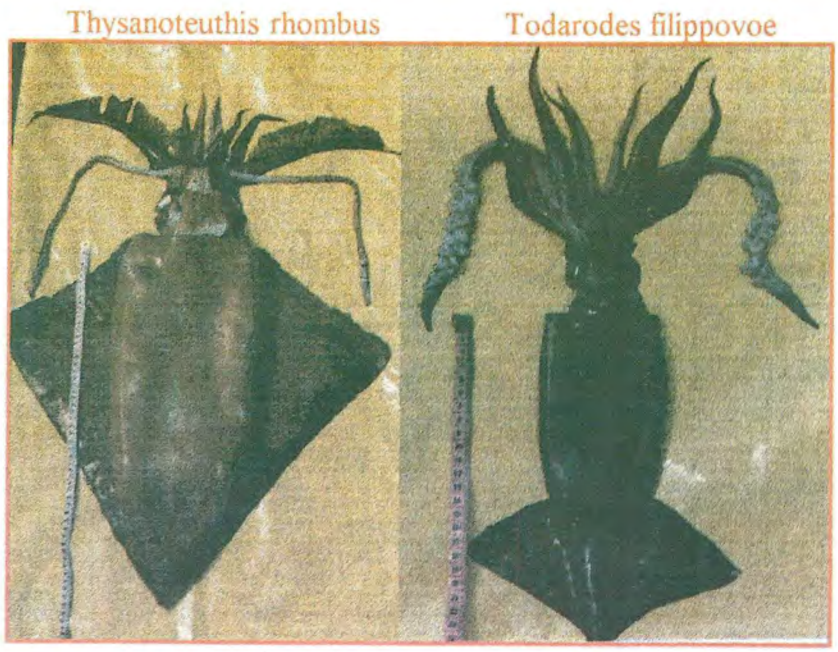


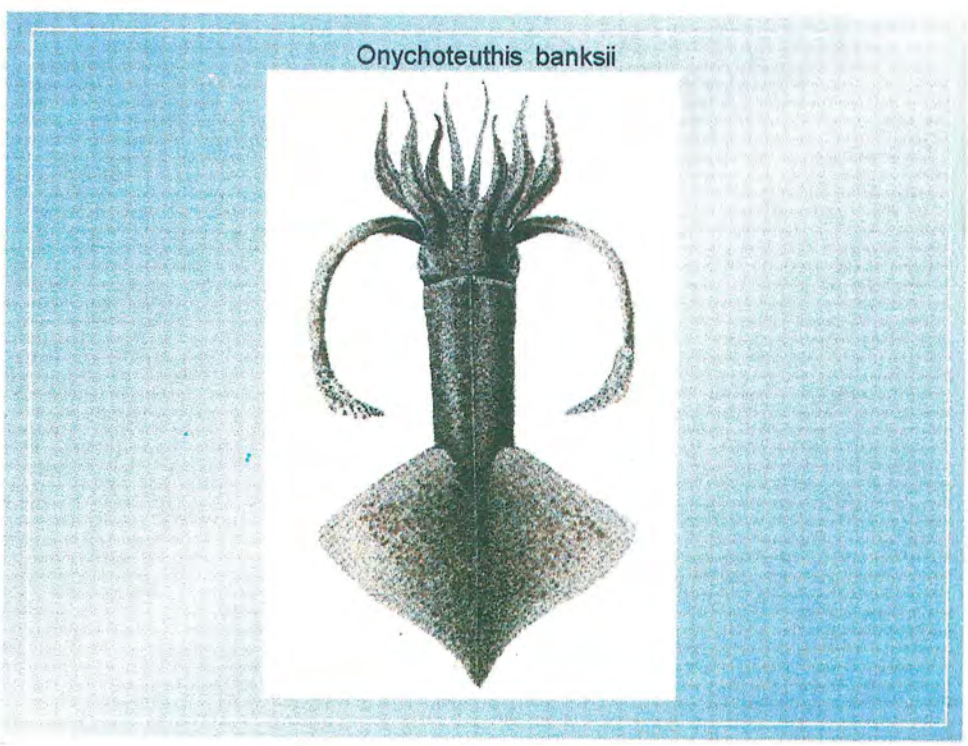
In New Zealand, the principal species is *Notodarus sloani*, with catches between 22,000 and 48,000 tonnes.

In Peru, landings of *Dosidicus gigas* between 1983 and 1995 ranged between 450 tonnes in 1988 and 190,000 tonnes in 1994.

THE JUMBO FLYING SQUID FISHERY

The industrial cephalopod fishery in Peru is sustained exclusively by the jumbo flying squid *Dosidicus gigas*. Other species which are present sporadically, but are not representative, include *Todarodes filippovae, Onychoteuthis banksii* y *Thysanoteuthis rhombus.*

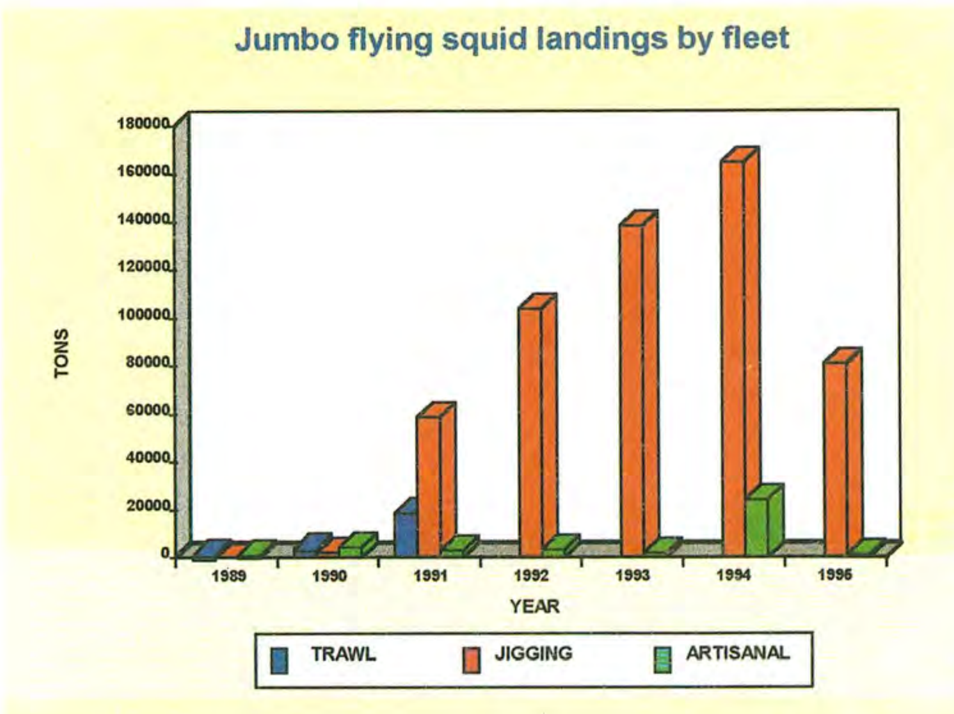




The "jigging system" fishery using jigs and attraction lights is highly selective for squid, which means that there is not a by-catch which would later be discarded. This avoids the unnecessary predation which occurs with the use of trawl nets and drift nets.

The artisanal fishery fleet is composed of artisanal vessels with a holding capacity of less than 10 tonnes, which occasionally fish for giant squid, using drift nets, purse seine nets, manual jigs and hand lines.

Catches of giant squid between 1989 and 1995 were made by the trawl, squid fishery and artisanal fleets.



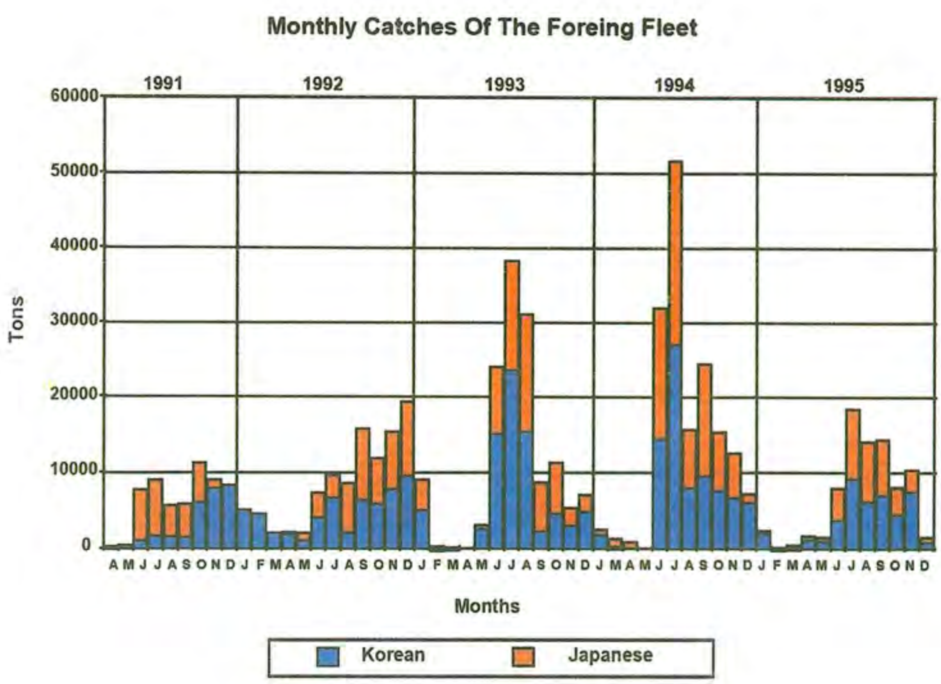
Catches of giant squid by the trawl fishery were incidental in nature and were made by Soviet vessels operating under license in Peruvian territorial waters, with a total catch of 19,771 tonnes between February 1989 and May 1991.

The first squid fishery vessels operated under Technical Cooperation Agreements signed with the Japan Marine Fishery Resources Centre (JAMARC), Peruko International Fisheries S.A. and Eduardo Muelle Maturana; the results enabled the feasibility of the commercial exploitation of giant squid to be established. Exploratory Commercial Campaigns were subsequently undertaken, yielding a total catch of 4085 tonnes between November 1989 and February 1991.

The industrial fishery was started in April 1991, and extracted a total of 545,000 tonnes up until December 1995, with annual catch values which increased from 58,000 tonnes in 1991 to 165,000 tonnes in 1994 and fell back to 80,000 tonnes in 1995.

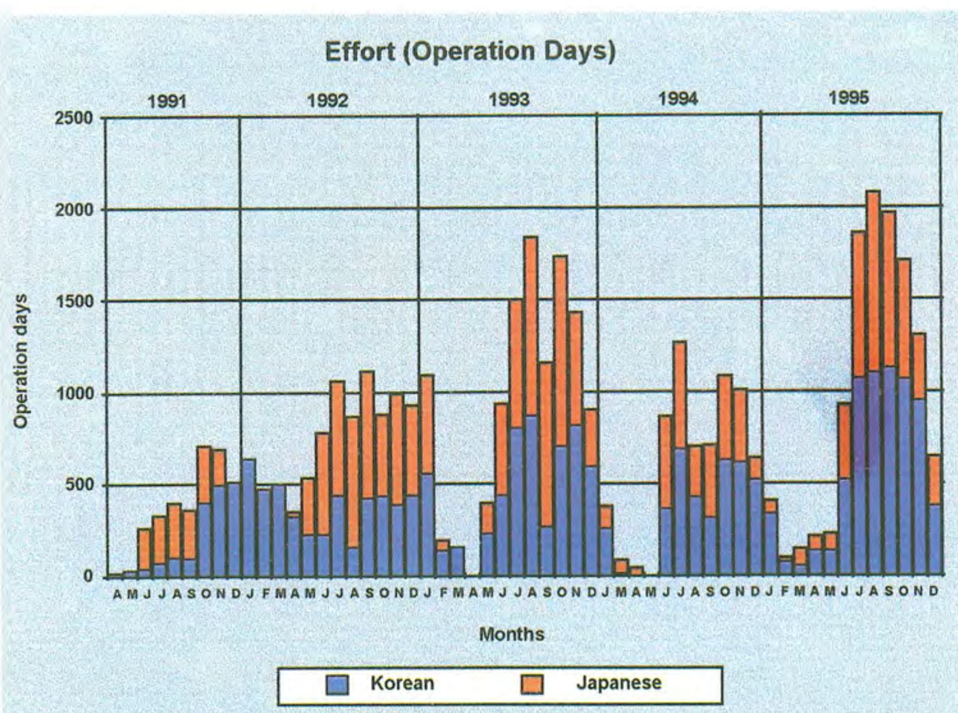
In recent years, the artisanal giant squid fishery has registered catches of between 1,000 and 24,000 tonnes per year, which has brought great benefits to the fishermen engaged in this activity.

The large-scale fishery, monthly catches range between 84 and 51,717 tonnes, with the main peaks being recorded between the months of July and December in all years. Thus the largest monthly catches in were 11,300 tonnes in October 1991; 19,400 tonnes in December 1992; 38,200 tonnes in July 1993; 51,700 tonnes in July 1994 and 18,500 tonnes in July 1995. Of the total catch, 257,000 tonnes (47.2%) were taken by the Japanese fleet and 288,000 (52.8%) tonnes by the Korean fleet.

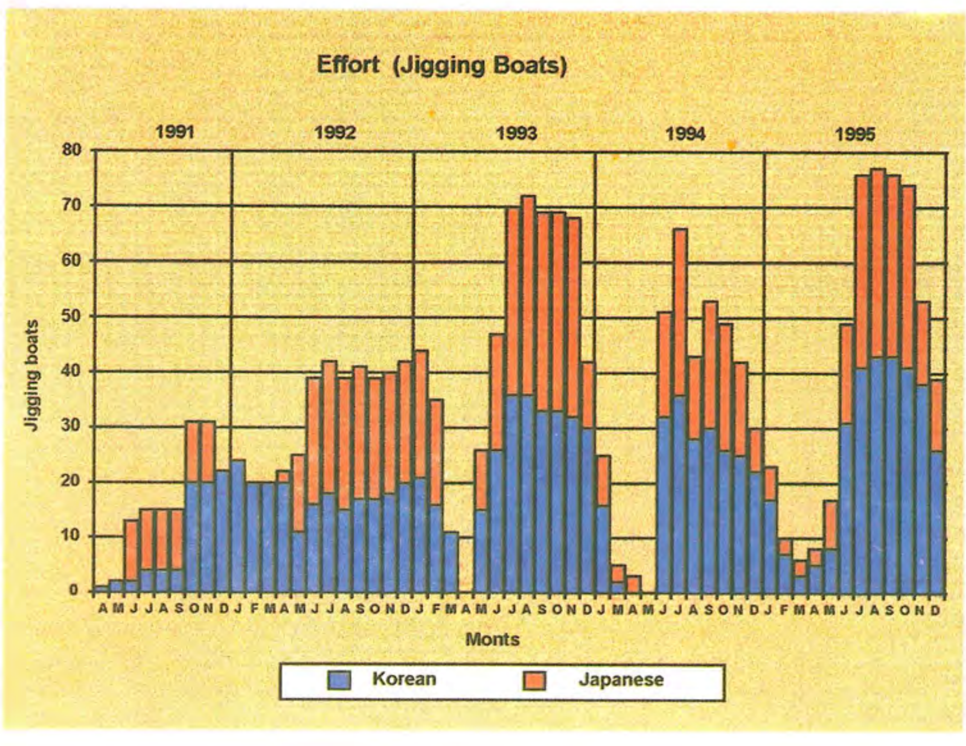


The number of vessels in the squid fishery fleet rose from 1 to 77 between 1991 and 1995, with maximum monthly values of 31, 42, 72, 66, and 77 in the respective years. The months of greatest fishery effort were from June to November, in the case of both the Japanese and Korean fleets.

The holding capacity of squid fishery vessels ranged between 250 and 1000 m^3.

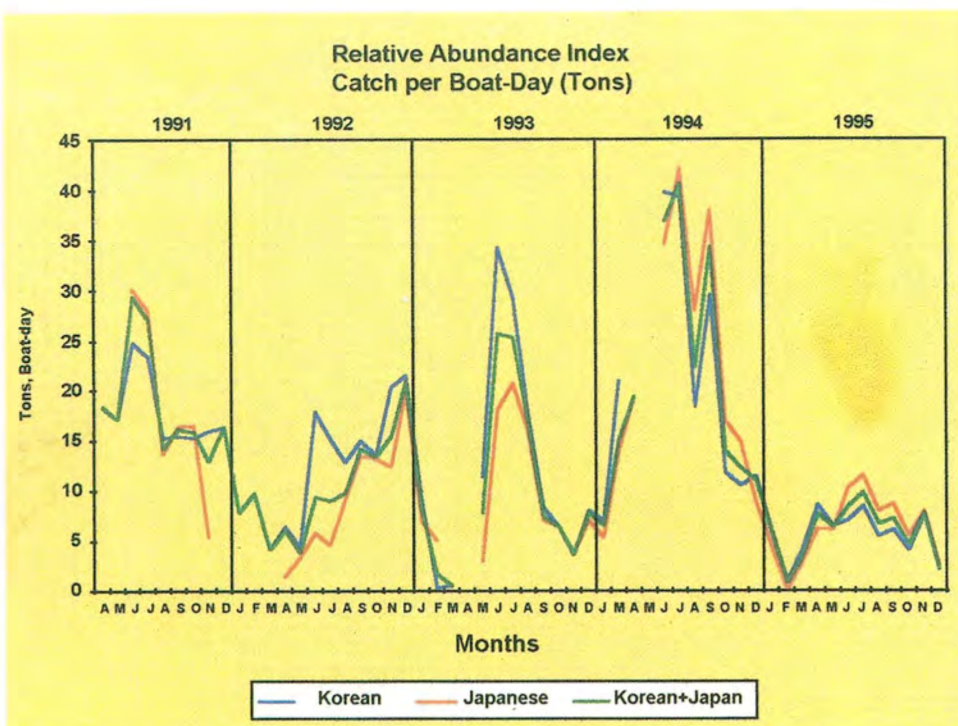


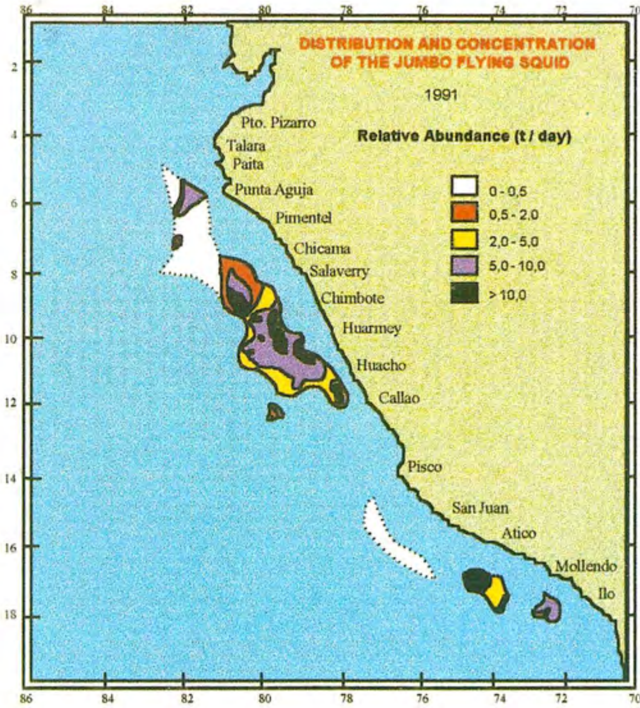
With respect to the total number of operating days of the commercial fleet, this increased from 17 to 2080 per month, with maximum monthly values of 709, 1116, 1736, 1270 and 2080 in the five years between 1991 and 1995 respectively, with the same tendency being observed in both the Japanese and Korean fleets.

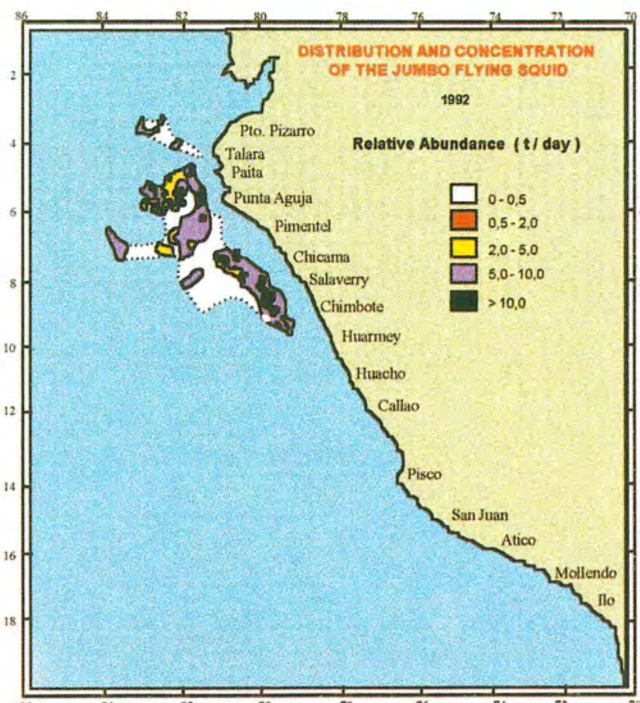


The higher relative abundance, during the period 1991-95, were recorded between June and December of each year, with peak months in June and July, except in 1992 when the peak month was December.

Indices of Catch per Unit Effort (CPUE) obtained by the Japanese and Korean fleets were very similar, with maximum values in 1994 and minimum values in 1995.




DISTRIBUTION AND CONCENTRATION
OF THE JUMBO FLYING SQUID
1991
Relative Abundance (t / day)
0 - 0,5
0,5 - 2,0
2,0 - 5,0
5,0 - 10,0
> 10,0
Pto. Pizarro
Talara
Paita
Punta Aguja
Pimentel
Chicama
Salaverry
Chimbote
Huarmey
Huacho
Callao
Pisco
San Juan
Atico
Mollendo
Ilo


DISTRIBUTION AND CONCENTRATION
OF THE JUMBO FLYING SQUID
1992
Relative Abundance (t / day)
0 - 0,5
0,5 - 2,0
2,0 - 5,0
5,0 - 10,0
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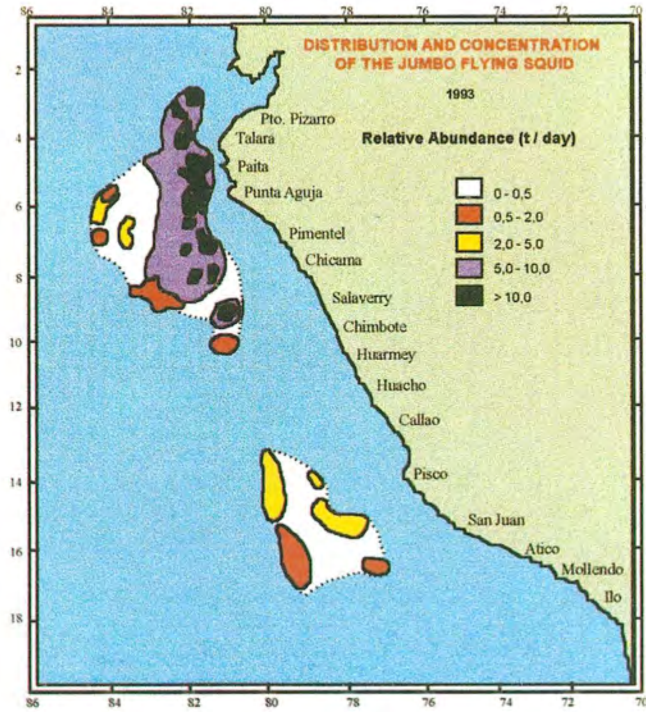
DISTRIBUTION AND CONCENTRATION OF THE JUMBO FLYING SQUID
1993
Relative Abundance (t / day)
0 - 0,5
0,5 - 2,0
2,0 - 5,0
5,0 - 10,0
> 10,0
Pto. Pizarro
Talara
Paita
Punta Aguja
Pimentel
Chicama
Salaverry
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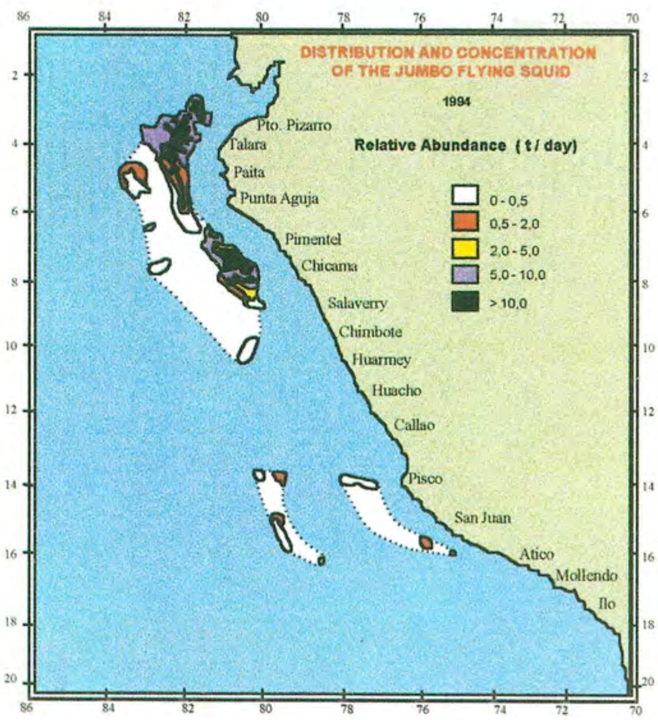
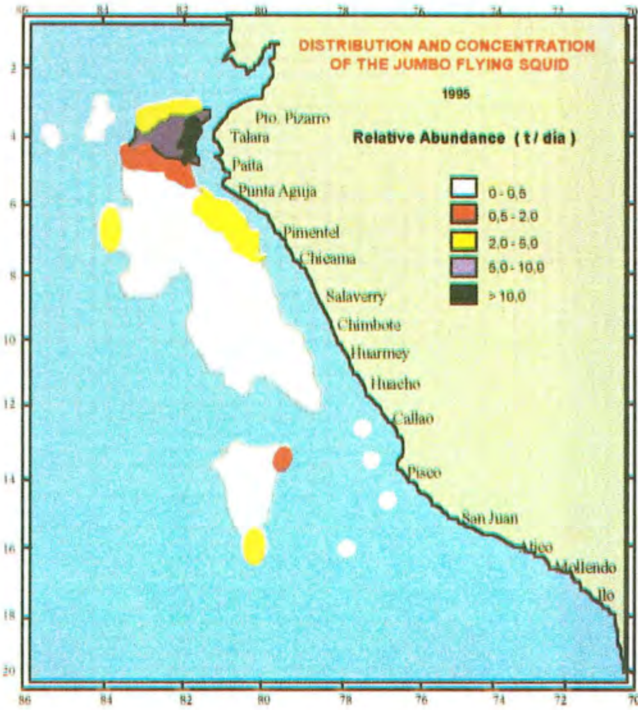
Ilo

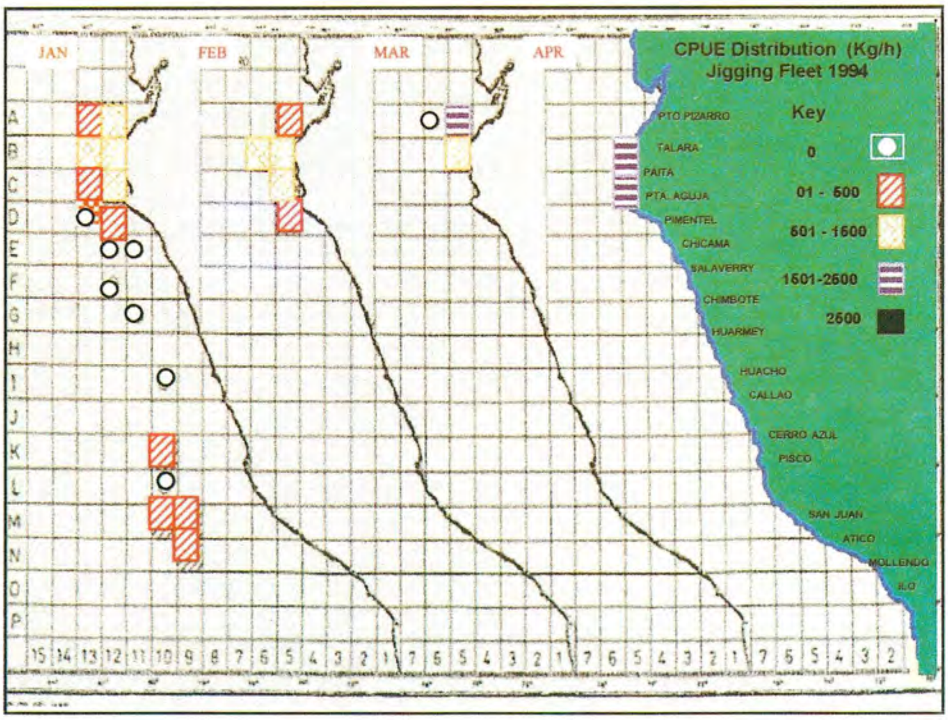

DISTRIBUTION AND CONCENTRATION OF THE JUMBO FLYING SQUID
1994
Relative Abundance (t / day)
0 - 0,5
0,5 - 2,0
2,0 - 5,0
5,0 - 10,0
> 10,0
Pto. Pizarro
Talara
Paita
Punta Aguja
Pimentel
Chicama
Salaverry
Chimbote
Huarmey
Huacho
Callao
Pisco
San Juan
Atico
Mollendo
Ilo

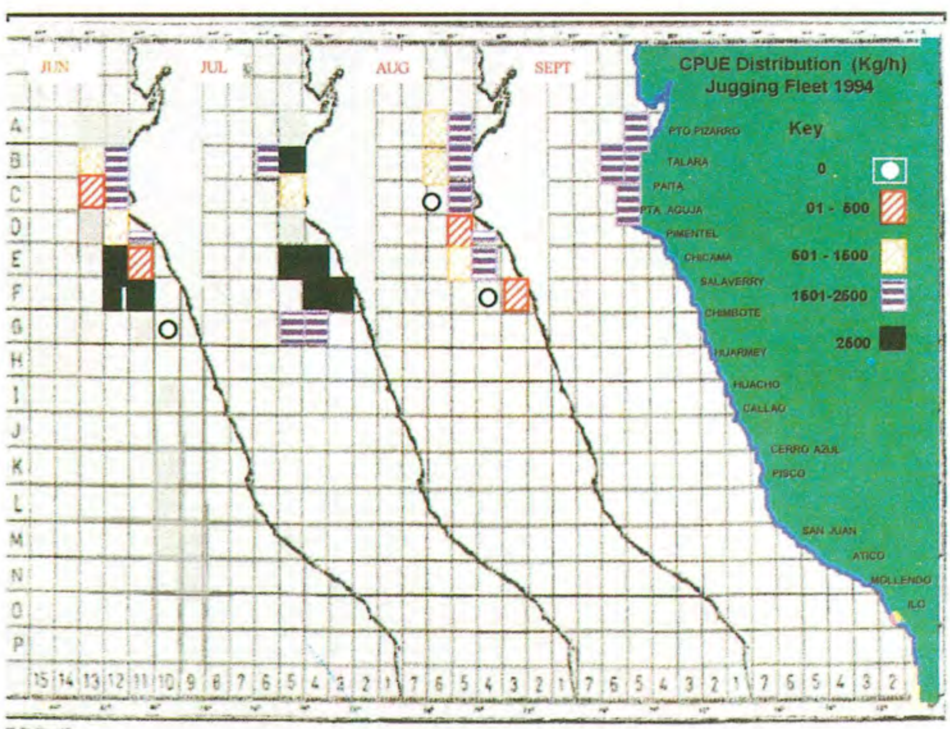


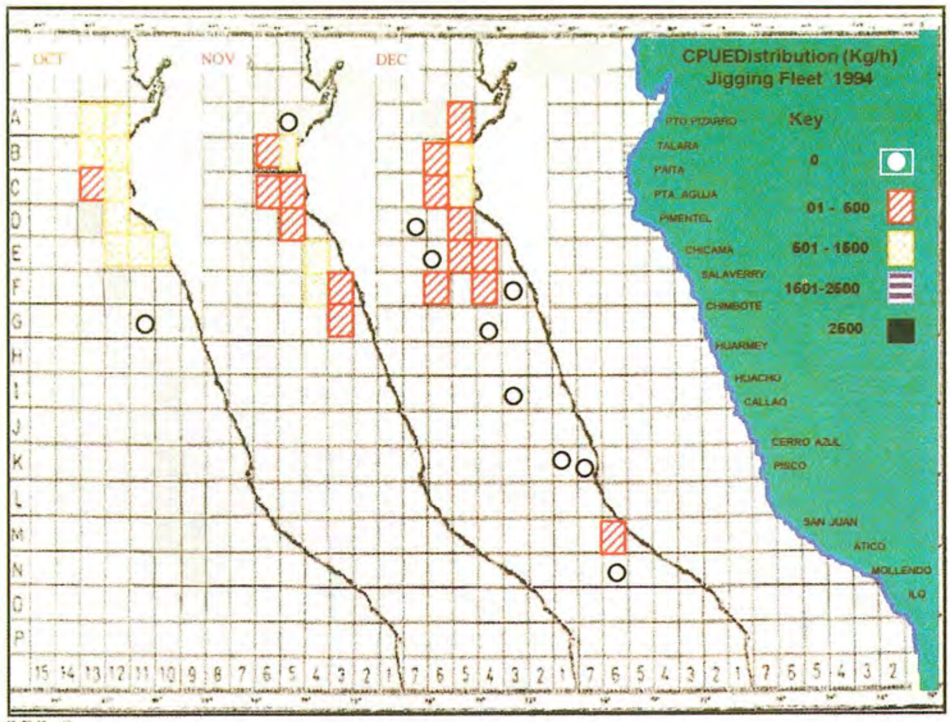
The distribution and concentration of the resource, represented by the categories of relative abundance and expressed in tonnes/day, are shown in the five distribution charts.

Between 1991 and 1995, the giant squid was distributed along the whole length of the Peruvian coast; but the greatest concentrations were recorded between 03º30´and 10º30´ S between 30 and 100 miles offshore.

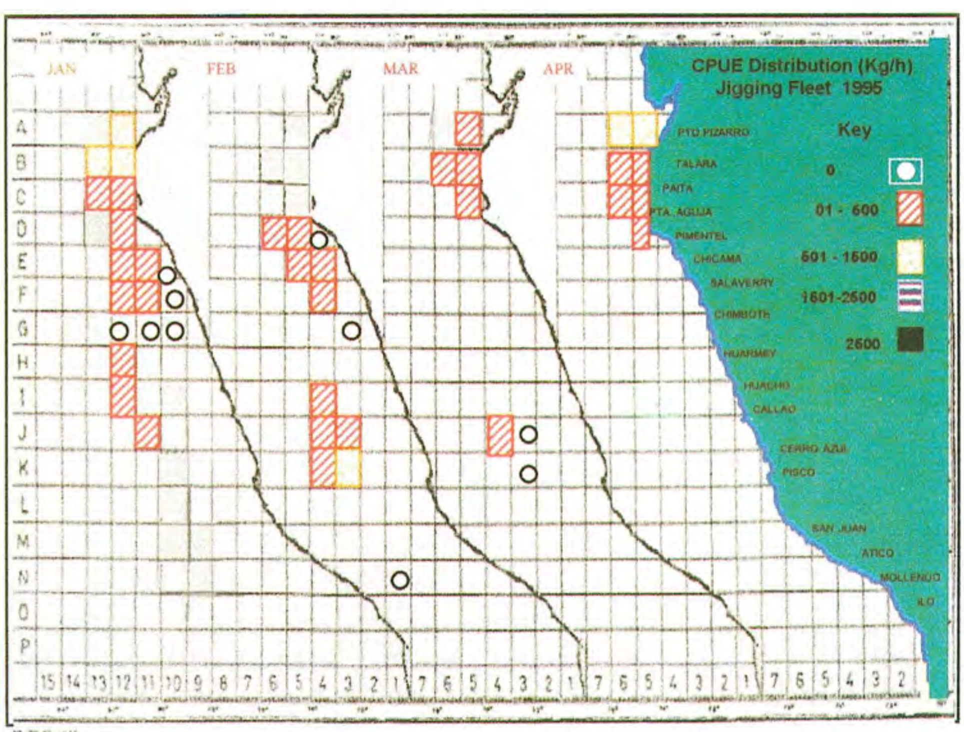
There are spatio-temporal variations in the patterns of distribution and abundance of the giant squid, which are related to the normal seasonal environmental fluctuations, as well as to occasional events such as the El Niño phenomenon, which affect our marine ecosystem with varying intensity and duration.

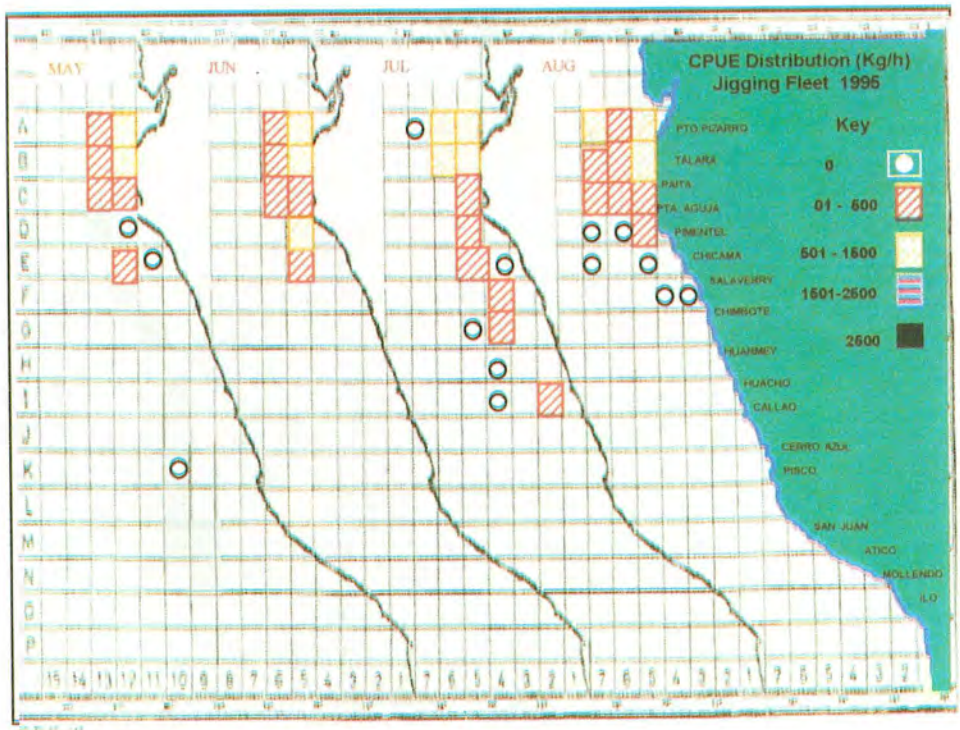




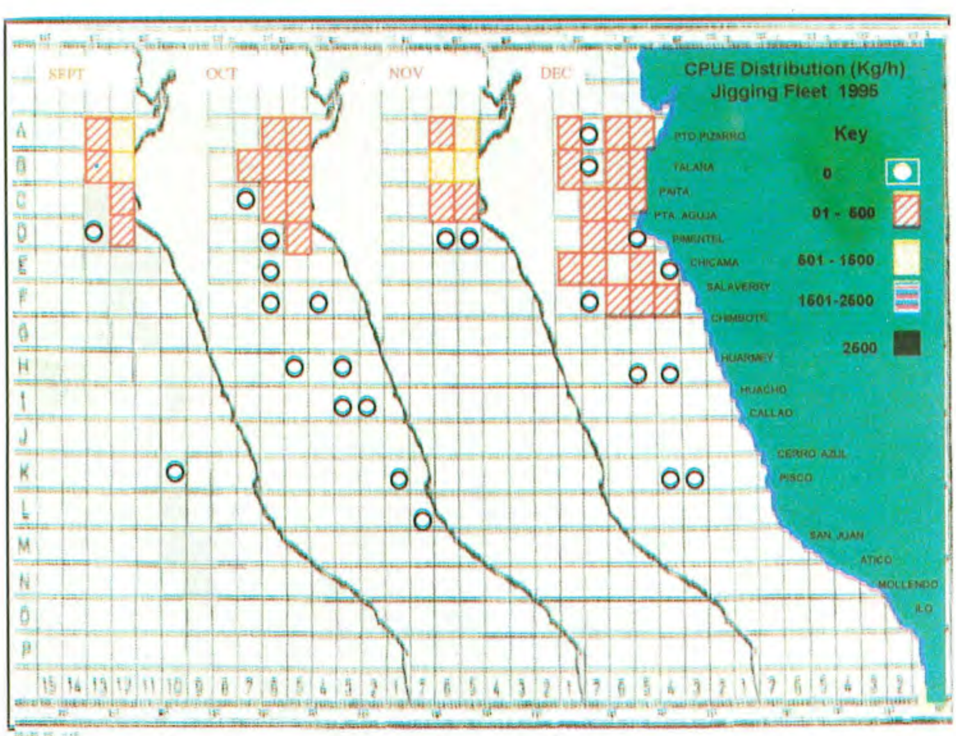


During 1994, the period of greatest concentration of the resource began in Autumn (of the Southern hemisphere), and continued through the Winter and to the end of Spring, with the area of greatest concentration tending to be displaced towards the South and West from the end of Spring and during the Summer.



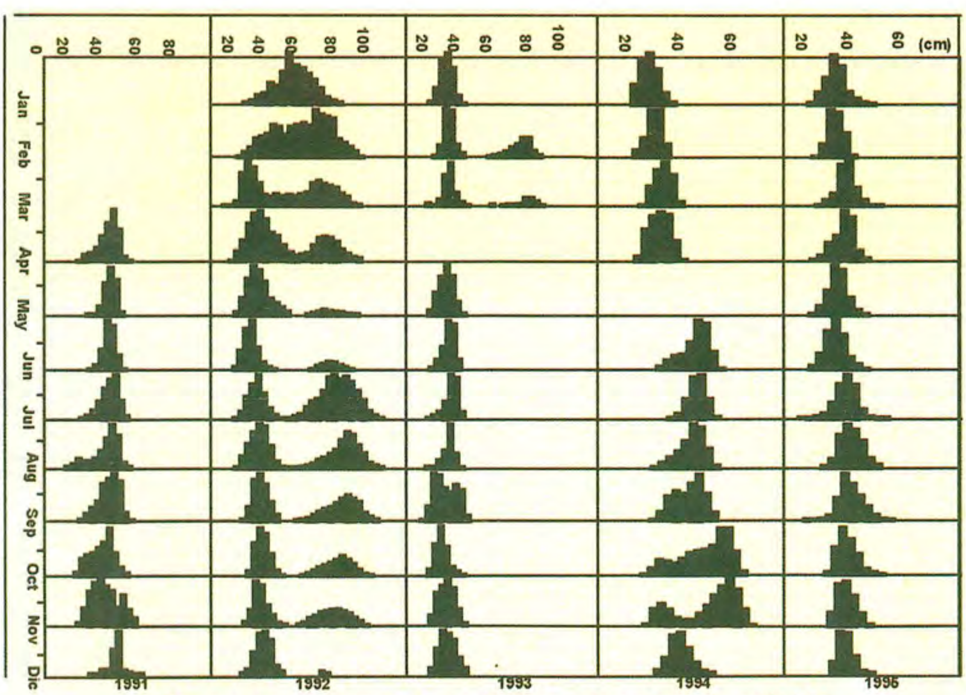


The distribution of the resource during 1995 was affected by colder surface water temperatures, which confined it to Northern areas between April and November, except in July, and reduced its availability and abundance.



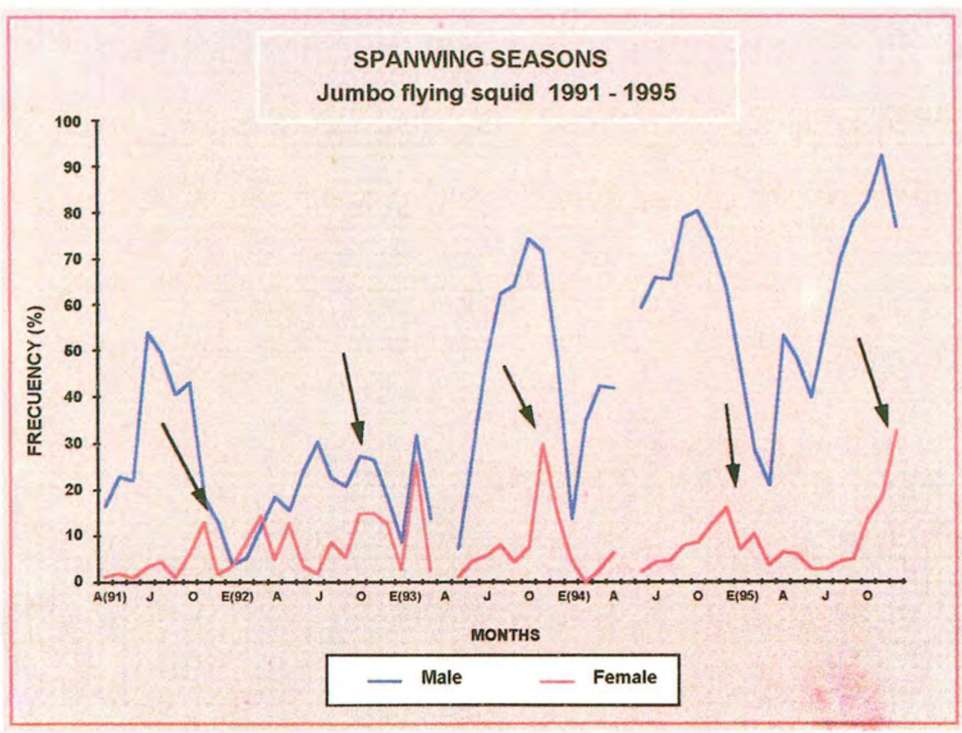
The sizes of giant squid during the period 1991 - 1995 ranged between a mantle length of 11 and 110 cm., and the monthly distributions showed between 1 and 3 modal groups, two of them well-defined.

The giant squid grows quickly, reaching sizes of between 41 and 53 cm. during the first year and between 64 and 80 cm. at the end of the second year.

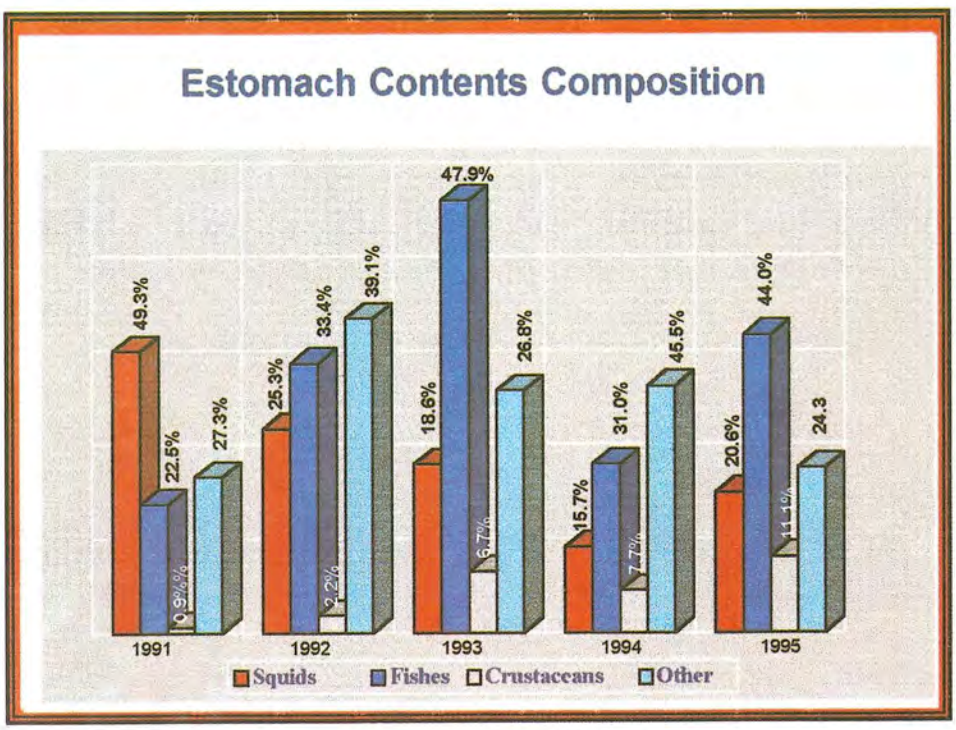


Monthly length-frequency distributions in *Dosidicus gigas* 1991-95.

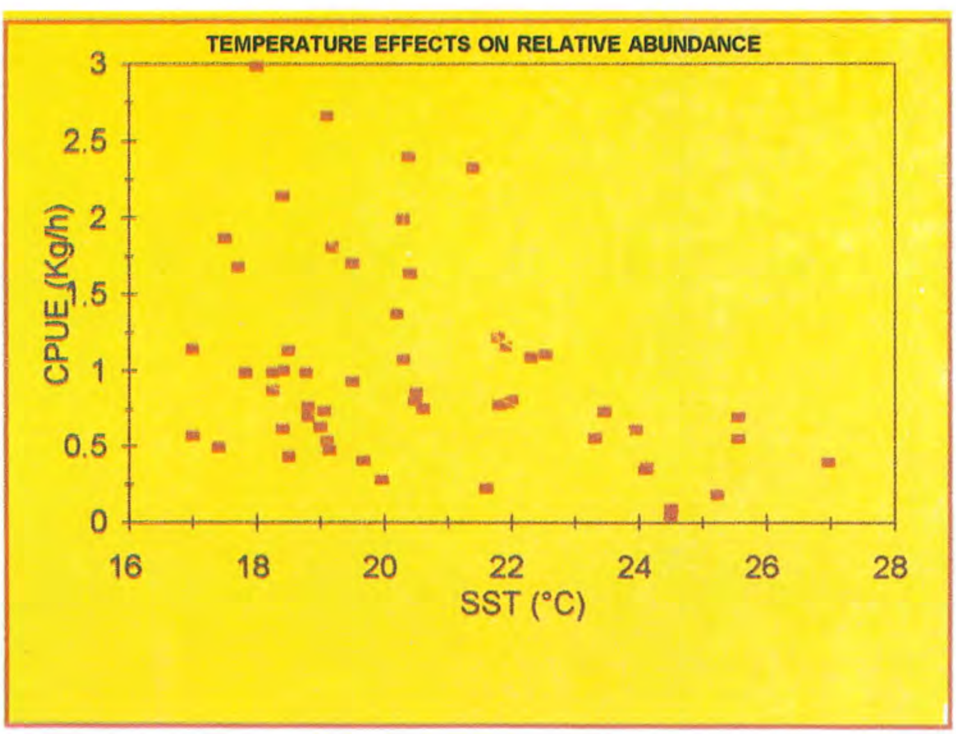
The analysis of the reproductive cycle of the giant squid reveals the presence of spawning individuals throughout the year, with greatest intensity in Winter (for males) and Spring (females).



The diet of the giant squid varies according to its stage of development. The smallest individuals feed mainly on Euphasids and other planktonic organisms, while medium and large individuals feed on fish, such as Mictophids, flying fish and others, as well as squids of the same species, with high indices of cannibalism.

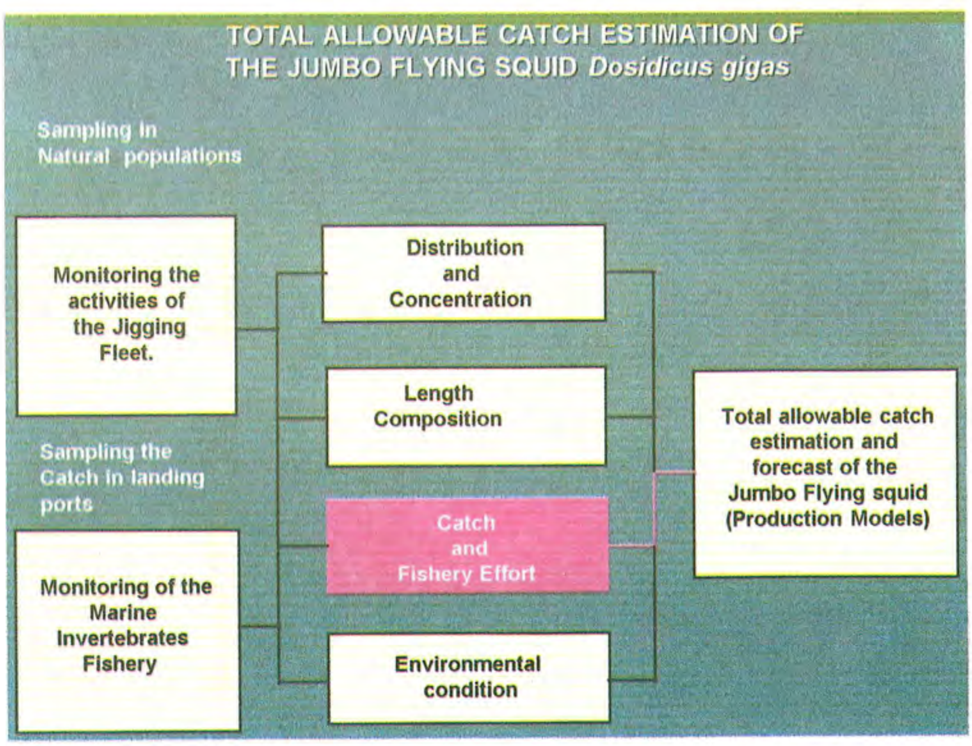


The giant squid is associated with masses of water with surface temperatures between 16 and 28° C, with the greatest concentrations being found within the range of 18 - 20° C. During the years 1991-93, environmental conditions corresponded to a warm period (El Niño of 1991-93) and were very favourable for the resource, as can be gauged from the high indices of abundance obtained for these years. The following year was characterised as normal, with high indices of recruitment which favoured increased catches. By contrast, in 1995, the presence of negative thermal anomalies along most of the Peruvian coast was responsible for a displacement of the resource towards the North. The intensification of the negative thermal anomalies during 1996 intensified this displacement towards the North and West along the Peruvian coast, leading to low yields in the traditional fishing grounds.



RESOURCE MANAGEMENT AND RESEARCH

According to the prevailing legal dispositions (the Regulations of the General Fisheries Law and the Resource Management Plan for Giant Squid or Pota), all fishing vessels flying a foreign flag and operating in Peruvian territorial waters with a fishing license are obliged to take on board a Technical Scientific Observer (TSO) from the Instituto del Mar del Peru (IMARPE), who receives continuous training in order to ensure that standardised, high quality and reliable information is obtained.



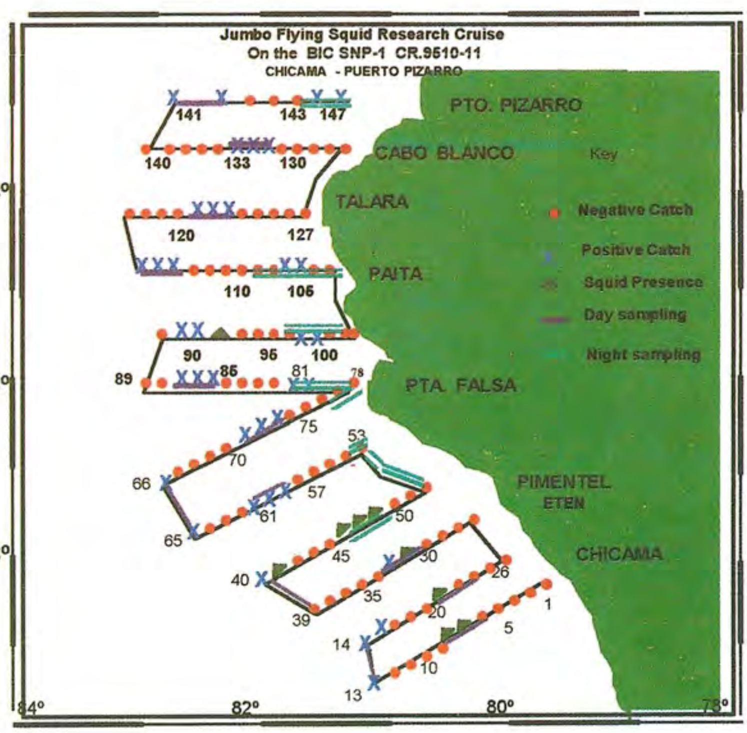
The TSOs record biological and fisheries data on a daily basis, and take random samples of the catch of each fishing vessel, in order to determine the composition of the catch according to size, gonadic maturity, weight, and stomach contents; these records are complemented by collections of biological material. In addition the TSOs record the fishing area, volumes of production, fishery effort, fishing depth, sea surface water temperatures, etc.

The production data relate to the total amount of processed and frozen giant squid, which is classified according to the type of product (whole, without visceral parts, mantle with fin, mantle without fin, head, fin, etc.); these data are used to estimate the Nominal (Total) Catch according to the established Conversion Factors (CFs).

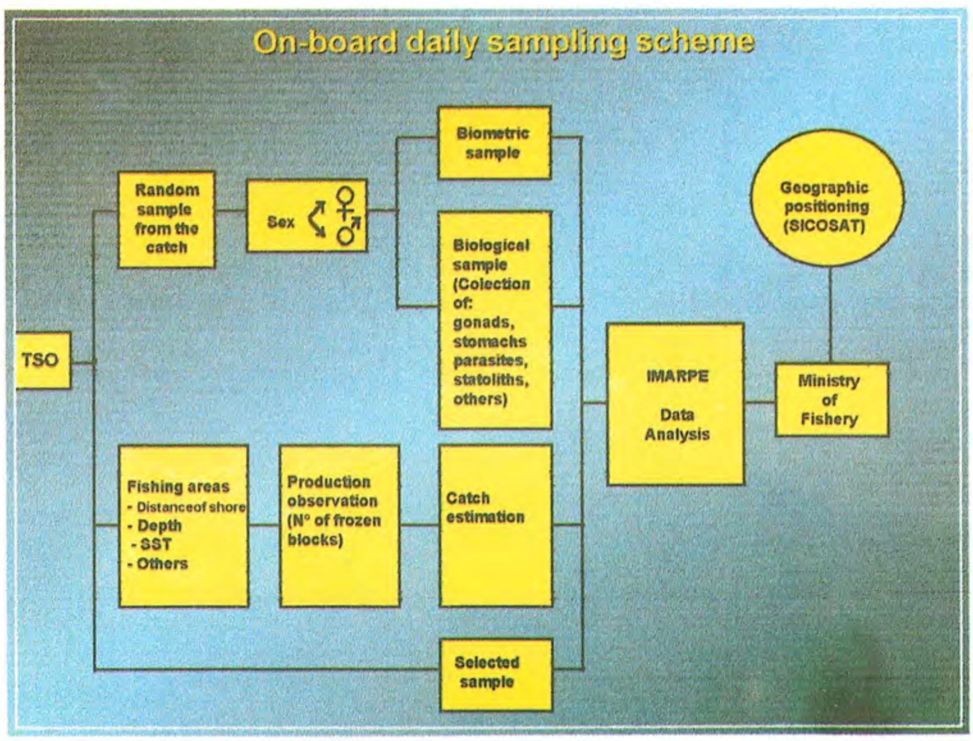
The information obtained is processed and analysed in IMARPE and is used to recommend the implementation of management measures by the Fisheries Ministry in order to ensure the optimal use of the resource.

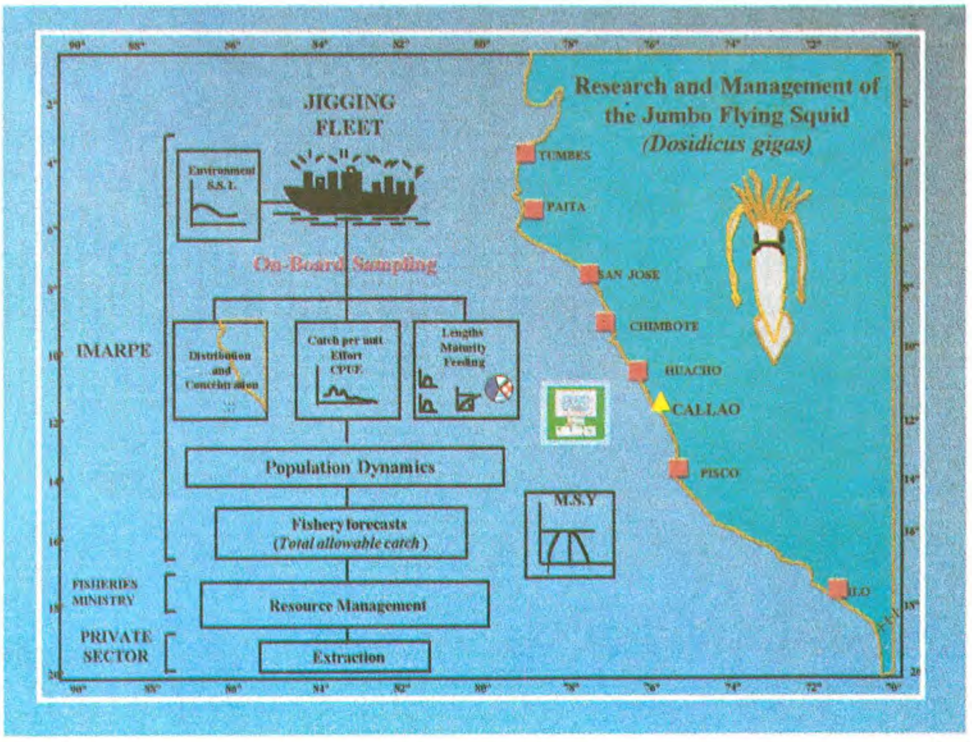
Throughout the fishing trip, the geographical location of the fishing vessel is transmitted automatically to the Fisheries Ministry by means of a Satellite Communications System, operating within the ARGOS system. The TSOs transmit the data they record by the same route.

In addition, IMARPE undertakes giant squid research cruises, in order to determine the distribution, abundance and biological characteristics of the resource in its different stages of development, and the interrelation between these factors and the marine environment.



The estimate of total allowable catch is made by analysing the information obtained from the population samples, taken at sea and from the catches at the landing site, which allows the maximum sustainable yield and the optimal effort for the resource to be calculated.





The giant squid fishery is of recent origin in Peru, and the research undertaken has given us a preliminary understanding of the resource. The development of our work in the future will aim to reinforce and amplify these results, especially with reference to the behaviour and population structure and dynamics of the species, the fundamental elements of an understanding which will guarantee the sustainability of the fishery over time and optimise the economic and social benefits for the nation.