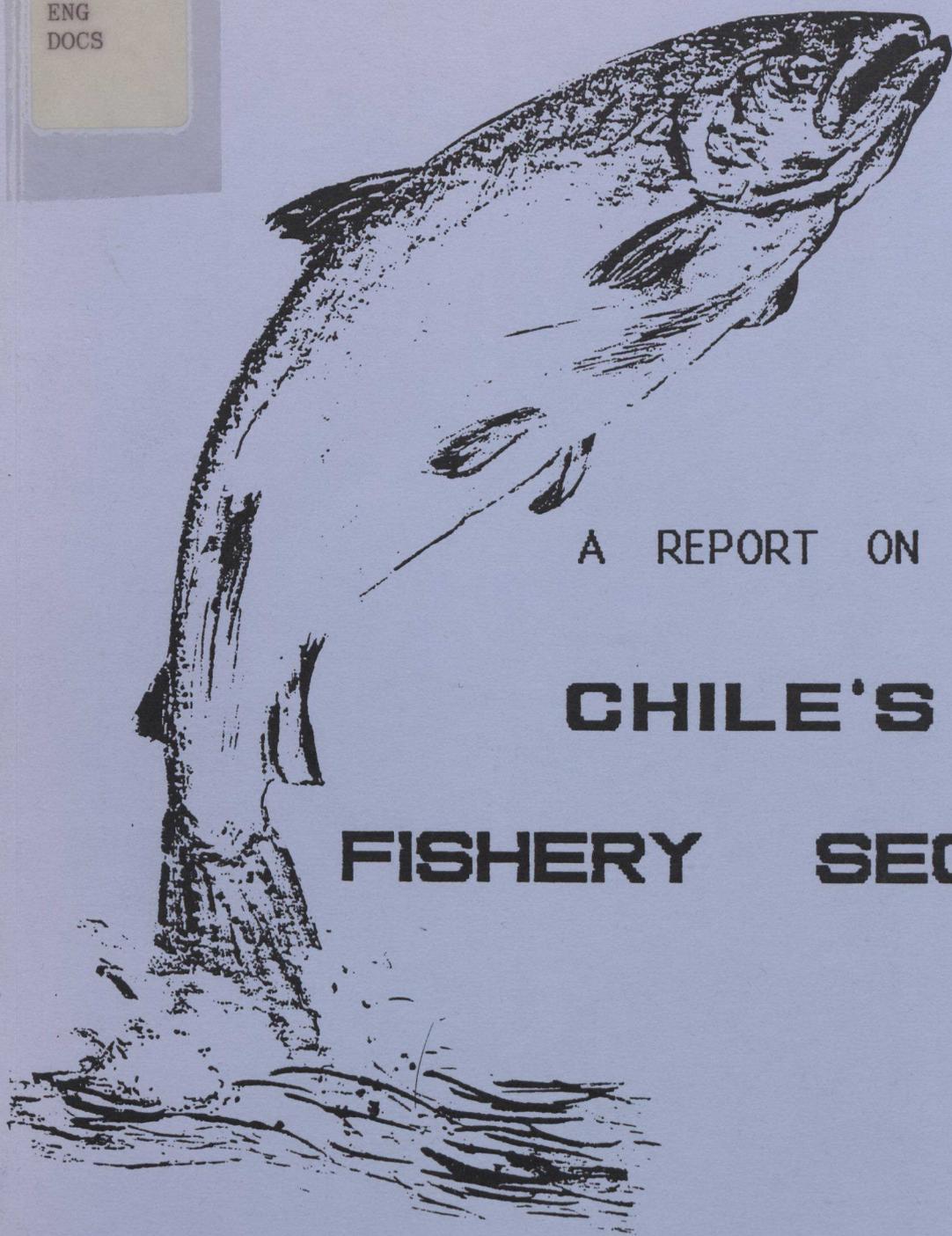


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A REPORT ON

CHILE'S

FISHERY SECTOR

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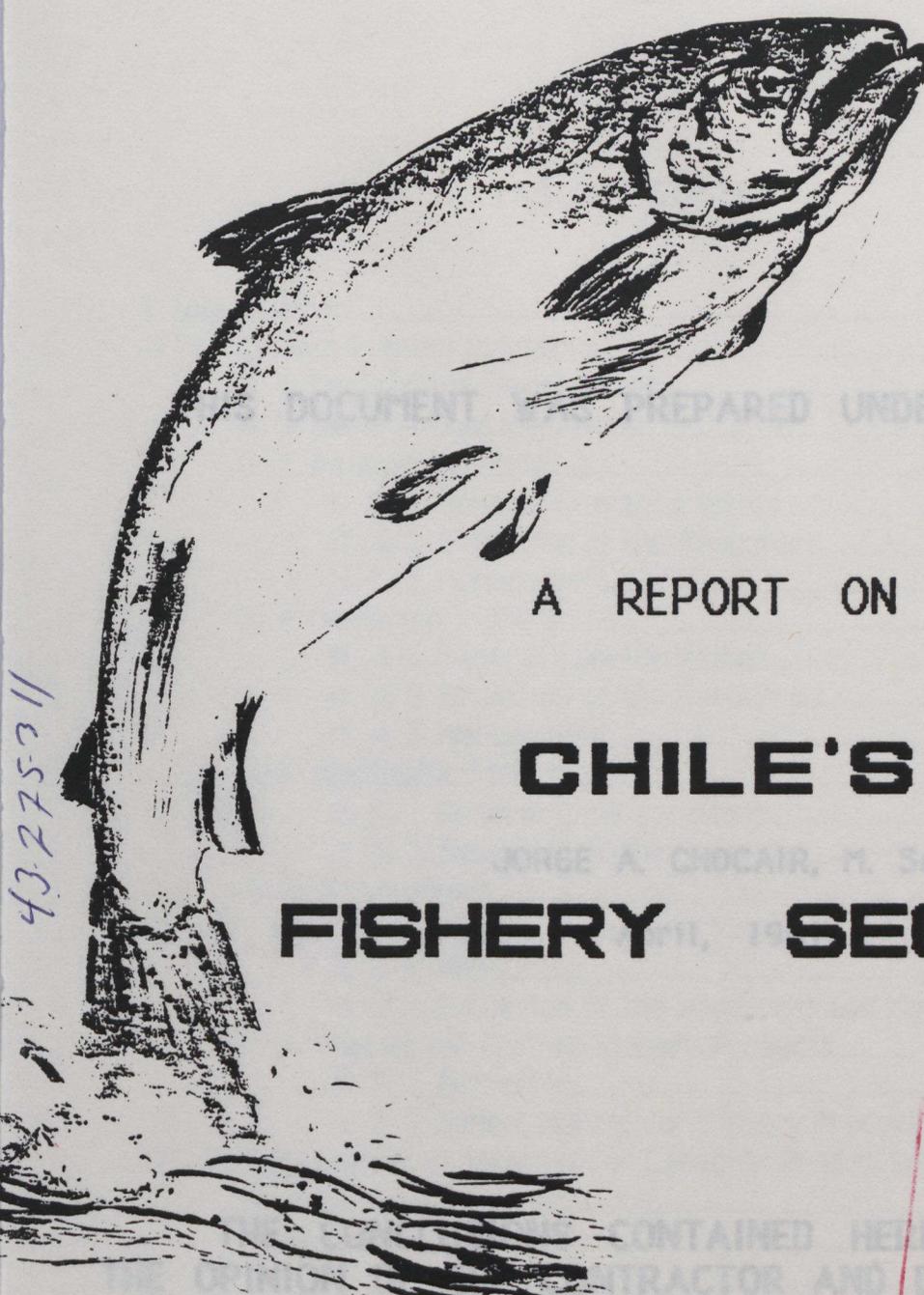
JORGE A. CHOCAIR, M. SC.

APRIL, 1991

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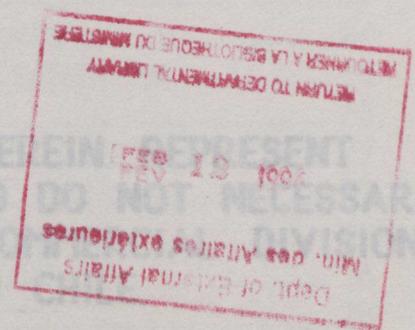
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A REPORT ON

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JORGE A. CHOCAIR, M. SC.

FISHERY SECTOR



PREPARED BY:

JORGE A. CHOCAIR, M. SC.

APRIL, 1991

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JORGE A. CHOCAIR, M. Sc.

April, 1991

**THE CONCLUSIONS CONTAINED HEREIN REPRESENT
THE OPINION OF THE CONTRACTOR AND DO NOT NECESSARILY
CONSTITUTE ENDORSEMENT BY THE COMMERCIAL DIVISION,
CANADIAN EMBASSY IN CHILE.**

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I. Introduction.

Chile has more than 1.6 millions of Km² of sea, and more than 700,000 Ha. of continental waters (lakes and rivers). Its environmental conditions and position in the hemisphere are also privileged. As a matter of fact, the Pacific Ocean facing the territory is one of the most productive

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I. Introduction.

Chile has more than 1.6 millions of Km² of sea, and more than 700,000 Ha. of continental waters (lakes and rivers). Its environmental conditions and position in the hemisphere are also privileged. As a matter of fact, the Pacific Ocean facing the territory is one of the most productive areas in the world due to the upwelling which generates the whole process of productivity.

Chile is a country of the Pacific rim (Fig. 1). It has more than 4500 Km. in length (not taking the Antarctic Continent into consideration, where it also has an important presence), and it has more than 14,000 islands. It is also relevant to note that Chilean territory includes Eastern Island, which puts the country in an advantageous position to operate and/or negotiate for fishing rights in the development of those areas (Fig.2).

At present, the country is in the process of political transition to full democracy. This transition, very peaceful and moderate to date, has been praised by the whole world. After one year of the elected authorities in the Government, it seems that the process of democratization is irreversible, and the differences among the parties from the left and the right are narrowing, putting the country in an excellent position for attaining real development. All political parties are in a position of moderation and have accepted the "free market system" as the key to obtain that economic development.

II. The Chilean Fishing Industry

II. 1. Legislative Environment

Currently, the trend is toward a better resource management of the fisheries rather than expanding. There is a new legislation proposal under the consideration of the Parliament.

The current legislation dates from 1931, and it seems to be inadequate to meet the challenge of a tendency to overfish the resource base. The landings from the traditional fisheries are, according to the experts, near the maximum sustainable levels of exploitation.

The proposal under discussion is called "Ley de Pesca y Acuicultura" (Fishery and Aquaculture Act), and is a modification to an earlier legislation approved, but not enacted, in December of 1989 by the Military Government. Due to criticisms against that Act, the new Parliament accepted to discuss a new one, but there are still big differences among the interested parties.

The major differences are the "quotas", and the mechanisms for the "licensing". There are political negotiations under way, in order to obtain the new legislation within the shortest possible time, however the discussions could keep going for some time. Some groups are also questioning the "validity" of the concept of "overexploitation" of some species, making the situation even more complicated.

One of the groups favoured by the new proposed legislation, is the "artisanal fishermen" subsector, which will have exclusive fishing rights within 5 miles offshore. The artisanal fishermen supply most of the fresh fish and seafood in general available for human consumption in the country. That exclusivity would give them stability and security.

At present the Chilean fishing activity is located exclusively in coastal waters under the Government's jurisdiction (200 miles Economic Zone). Fish, along with fruit and forestry exports constitute the main non-mineral export sector. The fishing activity produced almost 1 billion dollars in exports (USD \$917 millions) in 1990, representing 11 % of the total exported from the country.

The New Act proposes to establish two regimes of access to the resources:

a) General Access. This would apply when the fishery is under developed. It would only be required a 'non-transferable permit" issued by the Authority;

b) Restricted Access. This system would apply to those fisheries which have reached the "maximun sustainable yield", and there are risks of overexploitation. There would be different variables depending on each particular fishery.

Before going further, it is necessary and convenient to analyze the impact of the new Act, if enacted.

The discussions have been centered to the three systems for controlling the access to the resources: "global quotas", "fishing effort", and "individual quotas". There have been important discussions around these topics.

It has been said that "global quotas" are inefficient, because the operator is stimulated to capture most of the quota in the least of time, until the quota is reached. The impact of this system means "an excess of investment by the operator", because the total available capacity is only used marginally in one given period. The global quota would also impact the workers by bringing instability, because when the quotas are reached, there would be no reason to maintain the workers employed. Furthermore, a pressure on the authorities from different concerns, to increase the quotas, would be developed.

The "individual quota" system would permit to have the "wanted" level of capture and it would not incite the overinvestment, because the quotas "give the exclusive right over one stock of fish", therefore the captures could be planned over a whole season. According to the experts, this mechanism would have a positive impact, favouring the most efficient operators.

The control of "fishing effort", is also thought to avoid overinvestment, but it is a difficult and very expensive system to control, because there are many variables involved.

The one reason that could incline the preferences to the "individual quotas" is the cost of control. It is said that it is very difficult to control landings of large numbers of small boats, however the landings of fewer large size vessels are easier to control.

The Act under discussion has taken into consideration the need of funding fishery research in the country, and it is proposing the creation of a "Research Fund", which would have a very positive impact, especially considering that research in the aquatic environment, is very expensive.

There is a political "agreement" among various Parliamentarians to approve the Act, with some indications: a) keep the free access to a resource until otherwise is determined; b) to limit the number of vessels; c) global quotas could be enacted; d) after three years of the new Act, a portion of those global quota could be auctioned.

If the Parliament does not approve the "negotiated modification", then the Act approved by the Military Government could be enacted. That Act established that the access would be regulated by "individual, divisible and transferable quotas". The mechanism for assigning would be: 75% of the quota by "historic rights", and 25% of the quota by "auctioning". That Act does not consider a research fund either.

There is also, among some Parliamentarians, the idea of creating a Ministry of Fisheries and Aquaculture. Today, the Subsecretaria (Undersecretariat) of Fisheries is under the umbrella of the Ministry of Economy. It would make sense to have a special Ministry, because it would mean a better organization of the Public Sector, with a better coordination and better management. As an example, the Fisheries Development Institute (IFOP) is not under the Undersecretariat of Fisheries, but under the Ministry of Economic Development (CORFO).

That proposed Ministry would have a new Corporation to serve the artisanal fishermen and a large subsector constituted by small industries. These groups are in need of financing, technical assistance in different areas, in transfer of technologies, and so on. Those needs could be covered throughout that new Corporation.

The creation of a new Ministry of Fisheries and Aquaculture would have a very positive impact in the fishery sector community and in the country as a whole.

II. 2. General Considerations

The production in 1989 is the largest in the history of the country, reaching 6.6 million tones. According to preliminary figures, the year 1990 showed 20% less production, representing around 5.3 million tones. This production is similar to the level reached in 1988. According to statistics, Chile is situated 6th place in the world in production, but only 15th position in relation to the value of the products exported, a clear indication of the type of primary production in the Chilean industry. The fishing industry is slowly changing towards processed fish products, more value added, and also developing the aquaculture industry as a means of offsetting the levelling of the catch. There is a tremendous potential to develop the offshore fisheries, but it appears that the local industry is not ready yet to undertake the challenge.

Even though the total production fell in 1990; the capacity of the extractive power increased. The fleet is composed of 325 industrial boats (35 called "factory" fishing boats); and around 16,000 artisanal small boats. The main growth of that capacity occurred in the austral area of the

country (demersal fishery) and in the pelagic fishery of the south-central part of the country. (Lat. 37° S).

The Chilean fishing industry is composed mainly of four types of fisheries:

Pelagic , species living from the surface to around 100 m. deep (ex. sardine);

Demersal (white flesh fish and crustaceans of deep waters);

Benthonic (shellfish and seaweeds attached to the ocean floor);

Aquaculture (intensive culture of various fish, shellfish and seaweeds).

During the 80's, the investment increased. In general, investment has occurred in places where the fishing industry was developing, mainly in the VIII through XII Regions in the South (Fig.3). That has been reflected in the fleet, processing plants and in the aquaculture industry.

New investments to produce "Prime Grade" fish meal have taken place in the VIII Region. The main objective has been the increase of protein content to obtain "prime grade" fish meal for salmon feed. The industry has invested in "state of the art" fish meal processing plants. The industry also has invested in larger fishing boats. The fleet are fitted with the most modern technologies available in trawling, seiner and long-liners and are capable of landing species well suited for human consumption. They also can sail beyond the traditional range. These changes have meant a tremendous improvement, situating the Chilean fleet, as one of the most efficient and modern in the world.

Facilities for processing consumable products, mainly in the South as indicated above, have captured large investments, somehow less spectacular in comparison to the fish meal industry. However, the production of human consumable products requires more labor than capital. The shift to the production of human consumables is demonstrated by the increased construction of new fish processing facilities. As an example, in June 1989, 33 new fish processing lines were authorized. Since the opening of a long-line fishery in 1986, from the X Region southward, landing of fish species aimed for human consumption explain half of the annual growth this subsector had in the 3 years afterwards. This area could very well accept more investors.

The aquaculture industry, represented largely by the production of salmon, trout, seaweed, oysters, mussels, has drawn large investment and large companies from around the world. This investment included pen-raised facilities, fish feed plants, quality control and fish disease laboratories, frozen and smoked product plants, cold storage facilities and other aquaculture facilities; plus other services.

The fishing industry employs around 100,000 people, of which 57 % are artisanal and the remainder are industrial. The fishing industry represents 2.2 % of Chile's total labour force.

The newly elected Chilean Government has maintained clear-cut investment rules. That has reflected in the largest total foreign investments ever done in Chile during 1990. Among other policies; the Government is supporting foreign trade through the Export Promotion Office (ProChile); maintaining a competitive peso exchange rate; maintaining low custom duties for all imports, thus permitting the market to determine factor costs.

Private firms have responded by exploring new markets and expanding their production in the traditional ones. Additionally, Chilean producers are attending international fairs and trade shows. Very strict quality controls have been established as well, in order to keep the market for their products.

II. 3. Pelagic Industry

II. 3. 1. General Characteristics

By definition, the pelagic species, are living organisms that move freely in the superficial and subsuperficial layers of the ocean, forming large schools that do not depend upon the ocean substrate to accomplish their vital processes. The general pattern of distribution of pelagic animals reflects their nutritional dependency on the primary producers of the sea.

Pelagic species are captured from the I Region to the VIII Region and up to 100 miles offshore. In 1989, the landed pelagic fisheries represented 92% of the total catch of the country. The Chilean pelagic production is largely exported as fish meal for animal consumption and fish oil for industrial use (Table 1). Fish meal and fish oil utilize pelagic species such as sardine, anchovy and jack mackerel. It also uses discarded fish parts, from the freezing and canning industry. Manufacturing traditional edible products, based upon pelagic species, have limited possibilities of growth as a consequence of the small size of the world market for this category of canned fish, compared to the availability of the raw material. This excludes the tuna and tuna-like species. It has been mentioned that Chile alone could supply twice as many canned sardines as the world produced in 1987. The bulk of Chile's pelagic landing will continue to be

fishmeal. However, any effort to improve or to add value to the pelagic fish will be a great contribution to the Chilean economy.

In 1990, the pelagic fishery contributed with 4.9 million metric tones, in comparison to 6.1 million tones in 1989, which means a decrease of 26 % in relation to 1989. The Northern area was the most affected. That decrease, meant a lesser production of 311,000 tones of fishmeal, and 76,000 tones of oil.

The reasons for this crisis, are due to a decrease in the stocks of sardine and anchovy. The landing of sardine in the Northern zone of Chile decreased 48%. According to the experts, is a clear indication of overexploitation. The landing of the resource anchovy decreased 51%.

Chile is the largest exporter of fish meal in the world. In 1989 produced 1,833,200 tones of fish meal, falling to 1,400,000 tones in 1990. Of the total produced, 70% is exported, therefore 986,894 tones of fish meal were exported in 1990, against 1,292773 tones in 1989. (Source: IFOP). See Table Nº 1.

All pelagic resources are highly vulnerable to the environment and particularly to the unpredictable shifts in the "El Niño" current, that make these resources unpredictable. Landing of pelagic stocks have stretched the fisheries to their maximum biological ability to sustain fishable stock. The volatility of this resource means that this year's biologically sustainable level could be next year's ecological disaster. Resource management regulations are a must in order to sustain landing levels.

During the 70's, the pelagic industry was largely concentrated in the Northern part of Chile (Ist through IV Regions), but in the last 10 years has developed very strongly through the VIII th Region. This Region has been the forefront of developing, improving and expanding the fishing industry. The industry there is devoted to increasing both the protein content of fish meal and widening the fishing areas beyond the 80 to 100 miles strip now being exploited. The mackerel constitutes the core of the landing with 75%. The anchovy, sardine and hake represented 19%. The landing of mackerel shows an increase of 5%, even though there is a substantial increase in the size of the fleet, but with marked decreases in the capture of sardines and hake.

The pelagic industry employs in excess of 10,000 workers to run and maintain its fishing fleet. In 1988 there were 326 vessels fishing pelagic species. The southward movement of the industry is reflected in the number and size of new vessels. Due to the fact that weather is worse and more unpredictable in the south than in the north, vessels are forced to spend more time at sea. The fishing fleet in the southern has added larger vessels, which also are capable of reaching more distant fishing grounds.

The processing industry for fish meal, fish oil and canned fish products, employs some 5,000 workers. Canneries are largely concentrated in the Ist and VIII th Regions, other types of processing facilities are located in the III rd and IV th Regions. Canned production of fish is shared between the local and export markets. Frozen products made of pelagic species have little popularity in most markets.

II. 3. 2 Situation of the Resources.

According to the Chilean Fisheries Development Institute, IFOP, sardine biomass grew significantly since 1974, peaking in 1984. After that year, IFOP concluded that sardine species showed signs of overexploitation, and has recommended to the Undersecretariat of Fisheries periodic fishing bans on the industry. As it was mentioned elsewhere, the landing of sardine in the northern region fell 48%. This situation reaffirms the diagnosis of overexploitation, reflected in, a clear damage to the demographic structure (the class over VII have vanished from the stocks), a contracted biomass and very weak recruitments.

Mackerel and anchovy are the other main species supporting the pelagic industry. Jack mackerel and anchovy landing have shown signs of instability in the north. Landing of anchovy fell 51%, due to the high overexploitation of this resource, not permitting the recovery of the spawning stock, plus an unsuccessful recruitment in 1990.

The Southern pelagic fishery (VIII Region), is dominated by the mackerel, which constitutes 75% of the landing. According to IFOP, the mackerel biomass now faces overfishing. This overfishing is produced not only by the Chilean fishing fleet alone, but also by Russian factory vessels fishing just outside the VIII Region Economic Zone.

Another interesting resource is the swordfish, with landing of 4,800 tones in 1990. The official figure for 1990 should be similar to that of 1989, showing 2.1% increase in the exports.

The forecast for 1991 is a decrease in the landing of sardines, and the mackerel will keep its level or will show a slight increase, due to the increase in effort. The anchovy landing will be dependant on the strength of the recruitment.

11. 3. 3. Management.

The Fisheries Development Institute continues the monitoring of the resources, in order to provide updated information to the Undersecretariat of Fisheries. However, maintaining Chile's pelagic resources will require controlling the access to these fisheries. The legislation under debate in the Parliament which should be enacted sometime during 1991, will give the Government to obtain a rent generated by the payment of the licenses, which will be oriented to more research, so that better management practises are put into effect.

11. 4. Demersal Fishery

11. 4. 1. General Considerations

By definition, demersal species are, living organisms that in their adulthood live close to the ocean floor and depend upon the ocean substrate to perform some of their vital processes.

The demersal fishery includes several species of hake, sea bass, kingclip, and other white lean fleshed fish. In 1988 this fishery grew a whopping 53 % over 1987, but it does not represent over 4% of the total landing in the country. The species caught are well suited for processing into human consumable products, in other words, they are species of high value. In fact, most of the fish is exported. Among the main importers of fresh and frozen Chilean demersal fish are Spain, Japan and USA.

Located mostly from the VIII Region southward, this industry employs a large share of the fishing industry's labor force. As an example, in the X th Region alone, there are more than 30,000 workers involved with fishing or fish processing activities. Industrial and artisanal activities are very intensive between the X and the XII Region.

II. 4. 2. Situation of the Resources

Demersal resources include some 10 different fish species, alongside with three marginal crustacean species. This fishery stretches from the IV Region to the XII. However, 80% of demersal landings include four types of hake; with the most important landings from the south-austral fishery.

In the south-austral fishery the other important specie is the kinglip (*Genypterus blacodes* or *congriso dorado*). Hake and kinglip are in very delicate situation, due to the high exploitation in the last six years. There have been an excessive growth of both, the industrial and the artisanal fleet. The damage on the stocks could be explained by the fact of the longevity of these species, having low rates of renewal.

The industry based or associated to this fishery has been weakened by the availability of raw materials, therefore pushing up the prices. This situation could end in a crisis, already present to certain degree in the "factory trawlers". These boats are facing a continuous lowering in their yields.

The common hake (*Merluccius gayi* or *merluza comun*) of the central zone of Chile, is the second most important landed demersal fish. The main area of fishing is the centre-south (VIII Region), and represented 51,000 tones in 1990, or a 9.2 percent increase over the landing in 1989.

This is related to the fact of opening on the external market for this fish, giving more dynamism to this activity, even though it will be moderated, because the landing cannot go over 54,000 tones.

The landing of deep cod, represented some 6,000 tones, captured by a semi-industrial fleet. This activity is undergoing a development, and is expanding to the south-austral area just recently, area where it could possibly be found more biomass of cod, considering the circunantartic distribution of this resource. Preliminary fishing souther 56° showed good results.

11. 4. 3. Management

With the expansion of the fishery within the fjords and the channels, from the X Region southward, has pushed the resources to their biologically renewable limits.

There are complaints from the industrial fleet and artisanal fishermen alike. The latter complain that they are being "robbed" by the industrial fishing vessels. Chilean industrial investors have complained that "foreign investors" are taking the country's fish wealth and giving practically nothing in return. It has to be established here, that Chilean Laws do not allow foreign countries to fish in the Chilean Economic Zone. However, according to Decree Law 600 (Chilean Foreign Investment Statute) any foreign investor can establish in Chile a wholly owned concern and place their fishing vessels under Chilean registry. This means, that foreign interests registered in Chile can obtain concessions and establish fishing property rights.

When the new legislation is enacted, the new players in the fishing game, will have to buy the fishing right from players willing to exit. Currently though, the landing of the demersal resources are close to the allowable biological maximum for renewal.

Whatever the situation, current and future regulations will limit the landings growth of this resource. Those already fishing, will have to increase the value of their catch.

II. 5. Benthonic Fishery.

II. 5. 1. General Considerations

By definition, benthonic species are, living organisms that during their adulthood live attached to the ocean bottom and depend upon it to carry out their vital processes over their entire life.

The benthic resources, by their sedentary characteristics, are highly vulnerable to the fishing activity. The industry relies completely on landings of crabs, mussels, clams, oysters, scallops, sea urchins, seaweeds. The latter represent the most spectacular growth. To September 1990, the landing was 33 percent larger than in 1989, to same period. The most important species by their contribution are: chascon (*Lessonia*) 37%; pelillo (*Gracilaria*) 30% and luga (*Luga* sp.) with 22%.

Other important resources, mainly in the X Region, are the "culengue" mollusk, the clams and the sea urchins. The "culengue" has shown an important growth during the last two years. To September 1990, the landing of "culengue" was of 25,000 tones (+197%); the clam and sea urchin

showed a decrease of 37 percent, indicating the state of overexploitation of these resources.

The "loco" (abalone-like) mollusk had a very special position of exploitation. At present it is a "closed" fishery due to indiscriminate overfishing. However, the illegal activity of fishing continues underground.

The primary activities of this type of fishing and gathering, are carried out by artisanal fishermen all along the coast, however, 80% of the activities are concentrated in Chile's three southernmost regions. Most of the processing of the benthic resources takes place in the same processing facilities used by the demersal industry.

It is necessary to indicate here, that the Japanese Government donated an artisanal and semi-industrial fishing port in Puerto Montt (Chiniquihue), X Region, dedicated to serve a large number of small fishing boats. Throughout this port, the artisanal fishermen supply the local industry with a variety of different species, which are mostly exported. The port also has facilities that help to preserve the quality of the fishery products, improving the possibilities to explore external markets.

Recently, an important authorization was granted to Chile by the USA, allowing the export of fresh mussels, clams, scallops and oysters to the US market. This was the result of long years of bilateral negotiations between both countries. This agreement has opened the US market to Chilean mollusks, and will help open other markets, including Canada; since the Chilean products are meeting US standards, which are similar to the standards of other countries.

II. 5. 2. Situation of the Resources and Management.

Most of the species which are supporting the benthonic industry show a certain degree of overfishing. As said elsewhere, these species are sedentary, plus the lack of proper management, has put some of these species in a very difficult situation. A number of actions have been put into effect aimed at improving the overall situation. The resource loco is under permanent ban until 1991, the same is happening with the scallops. The Government lacks the capability to enforce the law, as they do not have the personnel, and the necessary equipment for controlling harvesting and monitoring trade. On the other side, the international price for these species are so attractive, that contravening the regulations outweighs the risk of getting caught.

II. 5. Benthonic Fishery.

It is necessary to point out, that there is an effort to revitalize the depleted benthonic species. The Government and private Organizations, Chilean and International alike, are funding basic and applied research projects aimed to those objectives. Some of the benthonic species are good candidates for aquaculture activities, and a tremendous effort has been put to the research of the "loco" (*Concholepas concholepas*). The Fisheries Development Institute is moving most of its aquaculture unit to the X Region to precisely attain those objectives. There are different entities carrying out research aimed to improve the possibilities of the endangered benthic species.

II. 6. Aquaculture

II. 6. 1. General Considerations

Aquaculture shows the fastest growth rate in the fishery sector. There are several fish, shellfish, and algae species being cultured, such as salmon (coho, atlantic, chinook, sakura), trout, algae (*Gracilaria* sp., mussels, oysters (Chilean and Japanese), scallops. There is also a tremendous effort to acclimatize species such as turbot, and California abalone.

The salmon industry has grown from 1 ton in 1981 to around 28,000 tones in 1990-91. The industry is a strong position, even though there have been algae blooms that threatened the salmon harvest in 1988, and most recently a very peculiar intracellular disease, limited until now to salmon coho, which is produced by a rickettsia.

The aquaculture industry has shown a great dynamism and very good possibilities throughout the country. Of the total tonnage, 51% is contributed by algae, such as *Gracilaria* sp.

Industry analysts forecast that by the end of the decade, Chile will be selling more than 50,000 tones of salmon to foreign markets, which implies a growth of more than 100%. However, there are even more optimistic forecasts, indicating the output close to 70,000 tones by the end of the century, which means to produce over 45,000 new tones of salmon. The industry continues its expansion through the enlarging of existing facilities, or the newly initiated operations.

The last four years have marked the beginning of large scale investments in salmon production by a large number of foreign producers. Currently, there are several internationally recognized salmon producers such as the Japanese Nichiro Guogo Kaisha and Nippon Suisan Kaisha, the

British Marine Harvest (Lever), the Dutch Trow International. With the advent of the new born democracy, there are other big players interested in a piece of the action. There are also investments from New Zealand, and Norway, and naturally from very large Chilean concerns.

The aquaculture industry is increasingly improving the quality of its production. It also shows an increasing interest in adding value to their products. The quality controls are very strict and conscientious.

II. 6. 2. Resources.

No doubt the salmon culture has given Chile dynamism and tremendous growth. The salmonid species are not native to Chile. There was never a natural population, even though, there have been efforts throughout the present century to attain precisely that. As a consequence, Chile has been relying almost completely on imported eggs, but Chilean aquaculturists have been developing their own national production of eggs in order to reduce their dependence on imports. There are even a few successful experiences of "exporting Chilean eggs", which is showing the great dynamism of this industry. Nevertheless, to become totally self-sufficient in egg production will require a number of years, especially considering the growth that is taking place. There is also a small natural population of salmon in the XI Region as a product of a large project developed jointly between the Japanese and the Chilean Governments since 1972. The results of that project have been mixed, but today there are returns of coho salmon and sakura (the latter reduced to fresh-water only).

Among the salmonids, the coho or silver salmon is the most important in the total output with 12945 tones during the last harvesting season 1990-91. See table below:

Salmonid Production

	Tones		
	1988	1989	1990
Cherry or Sakura	--	--	2
Atlantic	165	1860	9498
King or Chinook	3	11	398
Silver or Coho	4040	6933	13413
Rainbow Trout	1267	2871	5481
Total	5475	11675	28792

(Source: Fisheries Development Institute , IFOP)

The species with the largest growth are the atlantic salmon and rainbow trout. The success obtained by the rainbow trout can be appreciated in the import of eggs, which in the period January-September 1990 had an increase of 60% in comparison to the same period in 1989.

There is a need to determine the environmental impact due to the growing activity of salmon culture. A naturally reproducing population of salmon is developing due to fish escaped from the pen facilities,

population that will have an impact on the native species, but it is unstudied until now.

In relation to the algae culture, the preliminary estimations reveal a harvesting similar to that of 1989, even though the activity continued its expansion. In 1990, the production of cultured algae (*Gracilaria* sp.) represented 48% of the total landing, indicating an over exploitation of the natural prairies. The major production came from the X Region with 54% of the landing, the the III Region with 17% and the VIII Region with 15 %.

II. 6. 3. Situation of the Resources and Management.

Prime locations for aquaculture are getting hard to obtain. The new legislation under discussion in the Parliament, will regulate concessions and other aspects of interest to the aquaculturists. There will be a fixed time to develop an aquaculture activity after the concession is granted, in order to avoid abuse. The intention is to have a wide open access to the industry as possible. There are already regulations about minimum distances between grow-out sites, or hatcheries, etc... The use of lakes in aquaculture activities have become an issue, as there are environmental and tourist groups concerned about that type of activity.

II. 7. Market for Chilean Fishery Products

II. 7. 1. Domestic

Demand for fish in the Chilean market has leveled off in the last few years. The total consumption has fallen to 5 kilos per capita. It used to be around 15 kilos per capita. Although it is expected the Government will stimulate the domestic demand for fish, Chile's large production compared to its relatively small population, suggest that just a marginal percentage of the production will be absorbed locally. There are certain areas of production which are very important to Chile. Fish meal, representing most of the fishery industrial output, used traditionally as the main ingredient for animal feed (chicken, pig), is now in great demand by the aquaculture industry, which requires a higher quality of fish meal. This fact has stimulated new investments in the industry, to produce that higher quality fishmeal. However, the local salmon industry only needs a small part of that production. The most important increase in local consumption is in frozen products, consumption which is expected to grow, as the quality of living is increased. Other aquaculture products, such as oysters and mussels are almost totally consumed in the country. There is a small aquaculture production of pacific oyster in the north of the country which is almost 100% exported to Tahiti. The local consumption of cultured salmon is limited to a small layer of the society, with the highest income, but that demand is practically negligible. Other products are also marginally consumed in Chile, such as agar produced from algae, which are exported as dried algae and also as agar.

11. 7. 2. Export Market for Fishery Products

Chile is one the largest fish meal exporter in the world. During 1990, the exports in fishery products reached 917 million dollars, which is

the first decreased in the last 9 years. This is reflecting the decrease in the landing, mainly in the norther part of the country, however the total value of the export represents only a marginal 1.9% less than in 1989 (Fig.6). This is a clear indication of the value added to the final products. There was less production of fish meal, but an increase in the frozen products which are for direct human consumption. Chile has a very well developed infrastructure industry. It has been mentioned elsewhere, that the fish meal industry has diversified its production to a fish meal of higher quality with more content of proteins.

Fish oil is also an important product mainly for export, after the local needs are met. Canned fish products reached a record export level of 50,000 tones in 1988. This fact showed the increase of the consumption by the regular markets as well the opening of new ones. It is clear that the tendency is towards products for direct human consumption. In 1990, this type of product represented 41% of the value, compared to 19% in the period 1980-85. This is a reflection of the development reached by the demersal fishery of the south-austral zone of the country, and to the spectacular growth of the aquaculture activity, mainly salmonids, as it was mentioned represented 114 millions US in exports in 1990.

It should also be mentioned that the export activity of fishery products was also favoured by other factors, such as keeping the high demand in the international market, the reduction of the available cod in the European and American markets, the closing of areas to the Spanish fleet, for hake capture, off the Namibia coast.

The exports of frozen and fresh-refrigerated products also had strong growth. The first with a 24.5% and the latter with a 91.7% respectively. The main resources in the fresh-refrigerated group are represented by the southern hake (*Merluccius australis*) and the atlantic salmon (*Salmo salar*). The export of the hake grew by 310.4%, due to the

acceptance by the Spanish consumer, together with a more attractive price. A key to Chile's salmon export success has to do with its self-imposed high quality control standards.

The frozen products showed a consolidation of the target markets, represented by Japan and Spain. The main products were the silver or coho salmon and the hake.

The dried-salted, smoked and live products, even though representing only a 1% of the total marketed, indicated a growing tendency. This consideration is important, because the fishery sector needs a diversification of the production in order to keep the highly competitive markets.

In relation to the products for industrial use, the exportation of agar continued its expansion. The growth for 1990 was 45.4% in relation to 1989. The world offer has shrunk, bringing an important increase in the prices of this product during the last years. The export of dried algae has also shown an important increase, by 52 %.

The main markets for the Chilean products are the traditional ones (Japan, Spain, USA, Germany, and lately South Africa). These markets concentrated 67.4% of the total exported.

During 1990, the companies involved in the marketing of sea products for animal consumption had decreases in the value of their exports. However, due to the great quantities they export, they are still in privilege positions, even though their participation is considerably less. The main companies in the export of fishery products are Pesquera Guanaye (4.5%), Pesquera Iquique (4.5%), Sociedad Pesquera Coloso (3.0%) y Pesquera Indo and El Golfo with 2.5%.

III. Possible areas of interest for Canadian Products/Services

III. 1. General Considerations.

The future of the fishery activity will depend greatly on the investments made today. What are the areas of investment required in the fishery sector? The investment require clear rules in the "legislation" related to the fishing activity, as well as in the general rules related to investment.

The present Government has given clear indication about its economic policies, therefore, the investors can be assured that the rules are here to stay. It could even mentioned that the "Chapter XIX" or the "Debt Equity Swap" mechanism of investment has been made more flexible, just to mention an example. On the other hand, as mentioned above, the new "Fishing Act" will have clear rules for the players in the fishery sector. After these considerations in place, an evaluation for possible areas of investment will be intended.

Four large sectors could be identified: Industrial Installations (Such as fish meal and oil production); Fleet; Aquaculture and Other activities.

III. 2. Industrial Equipment

III. 2. 1. Dryers.

The tendency is towards a better control of the temperature and the pollution control (partial or total), thus permitting the use of hot air or indirect vapours.

At present, it is estimated that 50% of the dryers have to be replaced or modified. That means to install some 70 new dryers of 20 metric tones capacity each, reaching a value of US \$40 millions.

III. 2. 2. Evaporators.

The evaporator (by descending plate) allows a better use of energy and produces a better final product, making very convenient the installation of such an equipment in the fish meal plants. However, there is pre-requisite to install this type of evaporators, and that is the previous existence of indirect vapour dryers, because the energy comes from that type of dryer.

Most fish meal plants do not have that kind of equipment yet, but they will buy them during the next five years, because it is a "must", in order to improve the quality of the fishmeal, and to improve the efficiency.

III. 2. 3. Processing Control.

The automatic control of processing aims to increase the quality of the end product, shortening the processing time and decreasing the processing temperature.

The control system involves three basic factors: the hardware, the software and the signaling. Currently, around 20% of the plants have some kind of automatic control. There are 52 plants (reduction to fishmeal and oil) in the country with 80 productive lines of 30 MTP/h average. Of those productive lines, 64 do not have any type of automatic control. Therefore, it is very probable that most plants will acquire some type of automation. It is expected to have an investment of around US \$13 million for this type of equipment during the next four years.

III. 2. 4. Centrifuges and Decanters.

The information gathered is indicating that around 40% of the equipment is old. If only 10 % is replaced, it would be necessary to invest US \$ 2 millions.

III. 2. 5. Other Equipment.

Probably the capacity of the fish meal plants will not be increased, however some machinery will be replaced, as they are in use for more than 30 years, such as boilers and mills. Therefore, during the next four years, 15 new mills will be needed. They usually have a 20 MTP/h capacity, costing around US \$ 250,000 each; in other words the plants will need to invest US \$ 3.75 millions.

Some 30 new boilers will be required. They cost around US \$ 250,000 each, representing an investment of US \$ 7.5 millions.

III. 3. Fleet.

The tendency is to replace the old vessels, for bigger boats with larger capacities and more navigation autonomy.

According to the historic demand, it could be estimated that probably 36 new fishing boats will be replacing some of the old tonnage. If the average vessel costs around US \$ 3 millions, then US \$ 108 millions will be invested during the next four years.

III. 3. 1. Careen (Boat Maintenance and Repairs).

By law, the maintenance or careening of a vessel, has to be done every 18 months. If the boat is older than 20 years, then it has to be maintained every 12 months. The cost of careening goes from US \$ 10,000 to US \$ 50,000.

The Chilean fleet is composed of approximately 325 fishing vessels; 142 are over 20 years of age. Therefore, for the period 90-94 there will be 183 boats with an average of 3.3 careens and 142 will have 5 careens each.

$$\text{Total} = 183 \times 3.3 + 142 \times 5$$

$$\text{Average cost} = \text{US } \$ 25,000$$

$$\text{Total cost} = \text{US } \$ 32,850,000$$

III. 3. 2. Nets.

A new net is costing around US \$ 300,000, and 1/6 th is replaced annually. There are 325 boats with 325 nets, therefore 54 nets per year will be replaced. If only 60% of the potential need is attained, then:

54 nets/year x 60% x US \$ 300,000 = US \$ 9,600,000 per year;
or
= US \$ 48,000,000 for 5
years.

III. 3. 3. Motors.

It is considered among specialists that 25 new motors at an average of US \$ 112,500 each will be replaced during the period 90-94, representing an investment of around US \$3 millions. To that figure should be added the overhauling of older motors.

III. 3. 4. Electronic Equipment.

The estimations for the acquisition of electronic equipment reach to over US \$ 8 millions for the period 90-94.

III. 3. 5. Other Equipment.

It has been estimated that the industrial fleet could need up to US \$ 27 millions for other miscellaneous equipment. There are also predictions that some US \$ 40 millions will be invested by the trawlers and long-liners, but details are not available at present.

III. 4. Aquaculture

There is an investment of US \$ 100 millions to produce 20,000 M. T. of salmonids, or US \$ 5000 per M. T. The most pessimistic forecast is to duplicate the output of M. T. of salmonids. That figure represent the need for new investment of US \$ 100 millions , however it is expected to have a

greater production, as there are also other species cultured, as it was mentioned elsewhere.

III. 5. Miscellaneous.

It is considered that the investment in other lines of production, such as dehydrating equipment, fresh- frozen, and canneries, the investment will not be very significant, with an estimation of US \$ 3.5 millions.

III. 6. Artisanal Subsector.

As it was indicated, there are 16,000 small boats, considered artisanal. 84 % of those boats have less than 10 meters (33 feet). Considering the needs for new motors, fishing gear, smaller processing facilities, the investment needed in this subsector could be estimated at US \$ 8 millions for the period 90-94.

IV. Conclusions.

As a consequence of the analysis just made, it could be concluded that Canadian companies, independent of the new "Fishing Act", still under consideration at the Parliament, have a great opportunity to participate in the sale of equipment and expertise to the Chilean fishery sector.

Canadian companies could also set up their own businesses, throughout joint ventures or on their own. The investment rules are clear and very straight forward. The Chilean Government is encouraging the formation of joint ventures, and there is a bank of projects for that purpose at the Development Corporation (Corfo).

As the country keeps its pace toward development, there are areas where Canadian services could also be offered, directly or indirectly related to the fishery sector. A listing of those possible different areas will be intended below.

Services, Business Development and Equipment:

- Sale of equipment and training in various areas of water pollution control, treatment, etc...
- Environmental impact studies in the lakes, in the rivers, and the sea in general.
- Training programs in stock evaluation and oceanographic surveys in general.
- Participation in repopulation programs of benthic species.
- Participation in aquatic research, management of resources and training in general.
- Joint venture opportunity in consulting services, particularly in the aquaculture industry (Such as managing, disease control, new technologies, etc...).
- Design and construction of fishing port and related facilities.
- Opportunities for Investment in the Fishery Processing Industry (value added products, such as smoking, steaks, fillets, cannery).
Sale of equipment to the processing industry.

- Opportunities for the sale of boats, motors and navigation equipment in general.
- Participation in the Trading and Brokerage of Fishery Products, both nationally and internationally.
- Opportunities in the sale of Fishing Gear in General.
- Investment in the Aquaculture Industry. There are opportunities in all areas of the aquaculture, from the set up of hatcheries, the set up of grow out sites, the processing and the marketing of products.
- Opportunities of Joint Ventures.
- There are opportunities in the sale of computers and software to the fishery industry in general, as well as computerized services.

V. Directory

V. I. Institutions

Armada de Chile:

Dirección General del
Territorio Marítimo y Marina Mercante.
Errázuriz 537, Playa Ancha
Valparaíso

Ph: (5632) 258091

Dirección General del
Instituto Hidrográfico de la Armada
Comite Oceanográfico (CONA)
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Valparaíso

Ph: (5632) 251056

Ministerio de Bienes Nacionales:

Secretaría Ejecutiva
Comisión Nacional del Medio Ambiente (CONAMA)
Av. B. O' Higgins 280
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Ph:(562) 222-2256

Ministerio de Economía, Fomento y Reconstrucción:

Sub-Secretaría de Pesca
Bellavista 168, Piso 17
Valparaíso

Ph:(5632) 212187

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Servicio Nacional de Pesca (Sernap)
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Fundacion de Pescadores Artesanales (Funcap)

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Santiago

Ph:(562) 698-0543

Comision Nacional de Investigación Científica y Tecnológica
(Conicyt):

Direccion General

Canadá 308

Santiago

Ph:(562) 274-4537

Ministerio de Planificación y Cooperación (Mideplan):

Ahumada 48

Santiago

Ph:(562) 722033

Ministerio de Relaciones Exteriores

Dirección de Política Especial

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Instituto Antartico Chileno

Dirección General

Luis Thayer Ojeda 814, Providencia

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Ministerio de Salud:

V. Directory

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Programa Sobre el Medio Ambiente
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Instituto de Normalización (INN):
División de Normas
Matías Cousiño 64- Piso 6
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Centro de Educación, Desarrollo e Investigaciones de la Pesca
Artesanal de Chile (CEDIPAC)
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Orden de Malta 1467-A
Santiago Ph:(562) 225-7921

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Santiago Ph:(562) 223-9627

Fundación Chile
Parque Antonio Rabat 6165
Santiago Ph:(562) 228-1446

Instituto de Investigacion Pesquera VIII Region S.A.
Casilla 350
Talcahuano Ph:(5641) 541540

Prochile (Fishery Area)
Av. B. O'Higgins 1315, Piso
Santiago Ph:(562) 696-0043, Fax: 696-0639

V. 2. Fishing Companies (Main Private Companies)

Eperva- Indo Fishmeal, oil
Huerfanos 863, Piso 3
Santiago Ph:(562) 331 155

Pesca Chile S. A. Frozen Demersal, Salmon
Estado 10, Piso 8
Santiago Ph:(562) 398 139, Fax: 394527

Pesquera Indo Fishmeal, oil
Huerfanos 863, Piso 3
Santiago Ph:(562) 331 155, Fax: 393436

Pesquera San Jose de Coquimbo Frozen, Canning
Av. A. Vespucio 80, Piso 4
Las Condes, Santiago Ph:(562) 228-1262, Fax: 228-5975

Soc. Pesquera Coloso
Av. Providencia 2653, Piso 14
Santiago

Fishmeal, oil

Ph:(562) 232-3435, Fax: 232-6726

Soc. Pesquera Guanaye
Av. Pedro de Valdivia 1219
Santiago

Fishmeal, oil

Ph:(562) 223-8027

Pesquera del Norte Ltda
Huerfanos 801, of. 550
Santiago

Fishmeal, oil

Ph:(562) 381497

Pesquera Eicomar Ltda.
Av. P. de Valdivia 478
Santiago

Frozen, Fresh, Fishmeal

Ph:(562) 274-4299; Fax: 274-0649

Pesquera Loa Sur S.A.
Paseo P.Errazuriz 2631
Santiago

Frozen, Fishmeal, oil, salmon

Ph:(562) 231-6199

Pesquera Fitz-Roy
LAs Urbinas 53, of.44
Santiago

Salmon, canning, frozen, smoked

Ph:(562) 231-5145

Pesquera El Golfo S.A.
Las Urbinas 53, of. 151
Santiago

Fishmeal, oil, frozen, fresh

Ph:(562) 231-8036

Pesquera Friosur S.A.
Av. B. O'Higgins 1980, Piso 6
Santiago

Frozen, fresh, salmon

Ph:(562) 727064

Pesquera Guafo S. A.

Frozen

- Agustinas 1070, of. 123
Santiago Ph:(562): 698-5077
- Pesquera Yadrán
Fco. Bilbao 2162
Santiago Ph:(562) 223-3737
- Alimentos Marinos S. A.
Mar del Plata 2154
Santiago Ph:(562) 251-3827
- Corporación de Productores de Harina y Aceite
de Pescado (CORPESCA)(Fish and oil producers Association)
Ahumada 370, Piso 3
Santiago Ph:(562): 714083
- Empresa Pesquera Nishiro Chile Ltda. Salmon, Frozen.
La Pastora 138, Of. 3
Santiago Ph:(562): 231-1904
- Aguas Claras Ltda.
Agustinas 1151, Piso 2
Santiago Ph:(562): 698-2973
- Salmones Mainstream
Av. Zañartu 1300
Santiago Ph:(562): 225-7312
- Salmones Antartica
Monseñor Sotero Sanz 55, Piso 6
Santiago Ph:(562): 232-1877
- Lefersa Alimentos S. A.
Santiago Salmon

Casilla 46-D Santiago	Ph:(562): 367880
Lever Chile S. A. Carrascal 3551 Santiago	Feed, Salmon, Trout Ph:(562): 734112
Cooperalgas Erasmus Escala 2117, Piso 2D Santiago	Algae Ph:(562): 699-8078
Salmones Aucar Amunategui 72, Piso 2 Santiago	Salmon, Trout Ph:(562): 698-8963
Aquacultivos Ltda. El Teniente 16 Puerto Montt	Trout, Salmon, Feed, Frozen Ph: (5665) 254474
Algas Marinas S. A. Fidel Oteiza 1956, Piso 14 Santiago	Algae Ph:(562): 465086
Aquasur Fisheries Ltda Hdo. de Aguirre 391 Santiago	Canned, Frozen, Salmon Ph:(562): 231-0114
Compañía Pesquera Sn. Pedro Av. 11 de Septiembre 1480, Piso 14 Santiago	Fishmeal, oil Ph:(562): 274-8616
Conservas Multiexport Coronel	Canned Ph: (5641) 711633
Conserversa Corral O'Higgins 300	Canned

Calbuco	Ph: (%665) 921-6329
Conservera de Mariscos Melgarejo 720, Piso 4 Coquimbo	Canned Ph: (5651) 315260
Conservas Dalcahue S. A. Av. Italia 1616 Santiago	Canned Ph:(562): 461276
Cultivos Marinos Tongoy Las Gaviotas s/n Tongoy	Oysters, Scallops Ph:(5651) 391260
Empresa Pesquera Tarapaca Mac Iver 125, Piso 15 Santiago	Fishmeal, oil Ph:(562): 396940
Fischer Llop y Cia Antonio Varas 647 Puerto Montt	Salmon Ph:(5665) 254422
Industria Pesquera Francis Drake Estado 10, of. 1072 Santiago	Canned Ph:(562): 380878
Pacific Star Huerfanos 979, of. 204 Santiago	Salmon Ph:(562): 696-8133
American Seafoods Ltda. Carmen Sylva 2370 Santiago	Fresh, Frozen, Canned Ph:(562): 231-8690

Pesquera Cantábrico Perez Valenzuela 1225 Santiago	Fresh, Frozen, Canned Ph:(562): 225-2510
Pesquera Catalina Ltda. Av. Barros Luco San Antonio	Fresh, Frozen Ph:(5635) 32856
Pesquera del Sur Agustinas 715 Santiago	Fishmeal, oil Ph:(562): 396031
Pesquera Mar Azul Av. San Martin Mejillones	Fishmeal, Canned, oil Ph:(5683) 621525
Pesquera Sn. Jose de Coquimbo Av. A. Vespucio 80, Piso 2 Santiago	Frozen, Canned, oil, Fishmeal Ph:(562): 228-4655
Pesquera Cabo de Hornos S. A. Casilla 837 Punta Arenas	Canned, Frozen Ph: (5661) 227-388
Pesquera Mares Australes Lota 187 Puerto Montt	Feed, Salmon Ph: (5665) 254378
Robinson Crusoe Hdo. de Aguirre 391 Santiago	Canned, Frozen Ph:(562): 231-2953
Salmones Tecmar Blanco 38-Piso 3 Castro	Salmon Ph: (56657) 2435

Soc. Pesquera Bio-Bio
Maturana 1296
Santiago

Fishmeal, oil, Canned, Salmon

Ph:(562): 699-1059

Soc. Pesquera Ralun
Sta. Magdalena 109, piso 2
Santiago

Canned, Frozen

Ph:(562): 231-5950

Soc. Pesquera Unimarc S.A.
Bandera 341 Piso 4
Santiago

Salmon, Frozen

Ph:(562): 727643

Ventisqueros S. A.
Av. 11 de Septiembre 1860
Santiago

Salmon

Ph:(562): 232-5536

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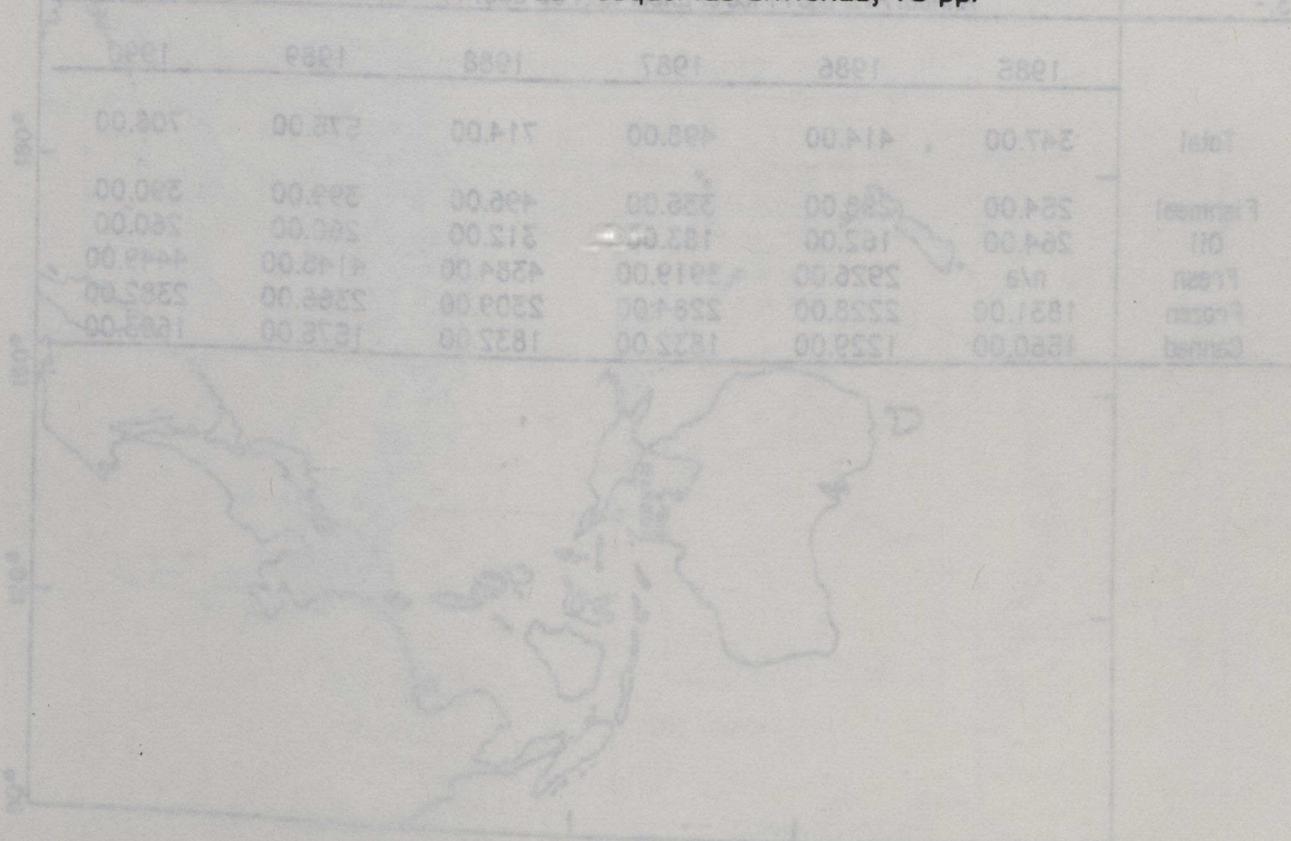


Table Nº 1

1.- Industrial Production, 1985-90. (Tones x E3)						
	1985	1986	1987	1988	1989	1990
Total	1389.6	1628.3	1448.4	1472	1833.2	1400
Fishmeal	1111.6	1282.2	1081.1	1112.2	1381.2	1377.6
Oil	184.1	224.9	224.9	188	260	260.1
Fresh-Frozen	48.7	58.1	70.5	95.7	103.6	123.6
Canning	44.7	62.2	69.5	72.9	84	n/a
Others	0.5	0.9	2.4	3.2	4.4	n/a

2.- Exportation of Fishery Products, 1985-90 (Tones)						
	1985	1986	1987	1988	1989	1990
Total	1335319.00	1312715.00	1317176.00	1171417.00	1625221.00	1298684.00
Fishmeal	1109025.00	1081614.00	1088548.00	925419.00	1292773.00	986894.00
Oil	135026.00	114022.00	91110.00	75469.00	141858.00	83919.00
Fresh-Frozen	51074.00	58085.00	69334.00	90112.00	104730.00	136531.00
Canning	17014.00	40060.00	44538.00	50269.00	55282.00	52134.00
Others	23180.00	18934.00	23646.00	30148.00	30578.00	39206.00

3.- Annual Average Price of Exports (FOB US\$/T)						
	1985	1986	1987	1988	1989	1990
Total	347.00	414.00	498.00	714.00	575.00	706.00
Fishmeal	254.00	298.00	335.00	496.00	399.00	390.00
Oil	264.00	162.00	183.00	312.00	260.00	260.00
Fresh	n/a	2926.00	3919.00	4384.00	4145.00	4449.00
Frozen	1831.00	2228.00	2284.00	2309.00	2366.00	2382.00
Canned	1560.00	1229.00	1832.00	1832.00	1575.00	1693.00

Fig. 1

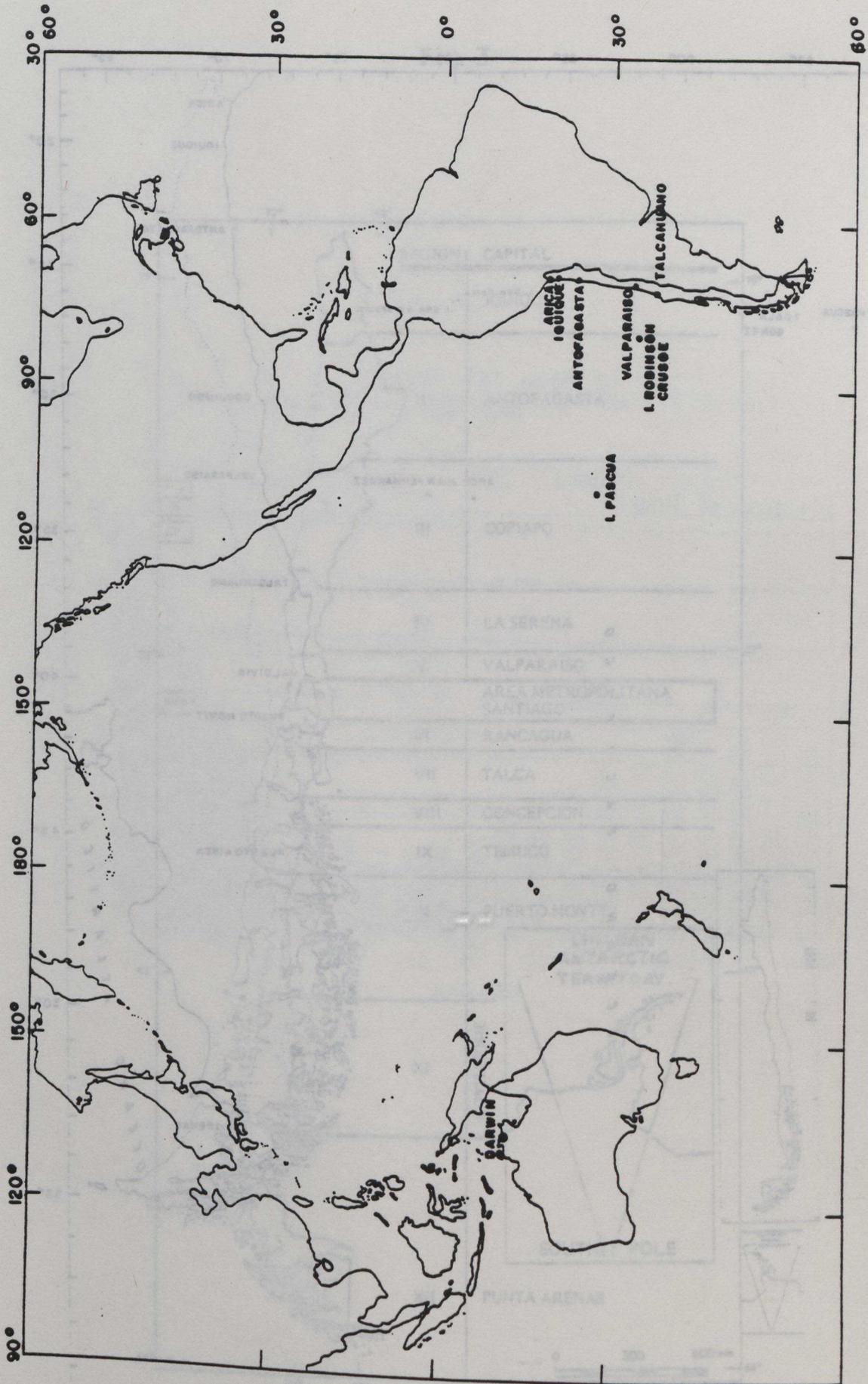


Fig. 2

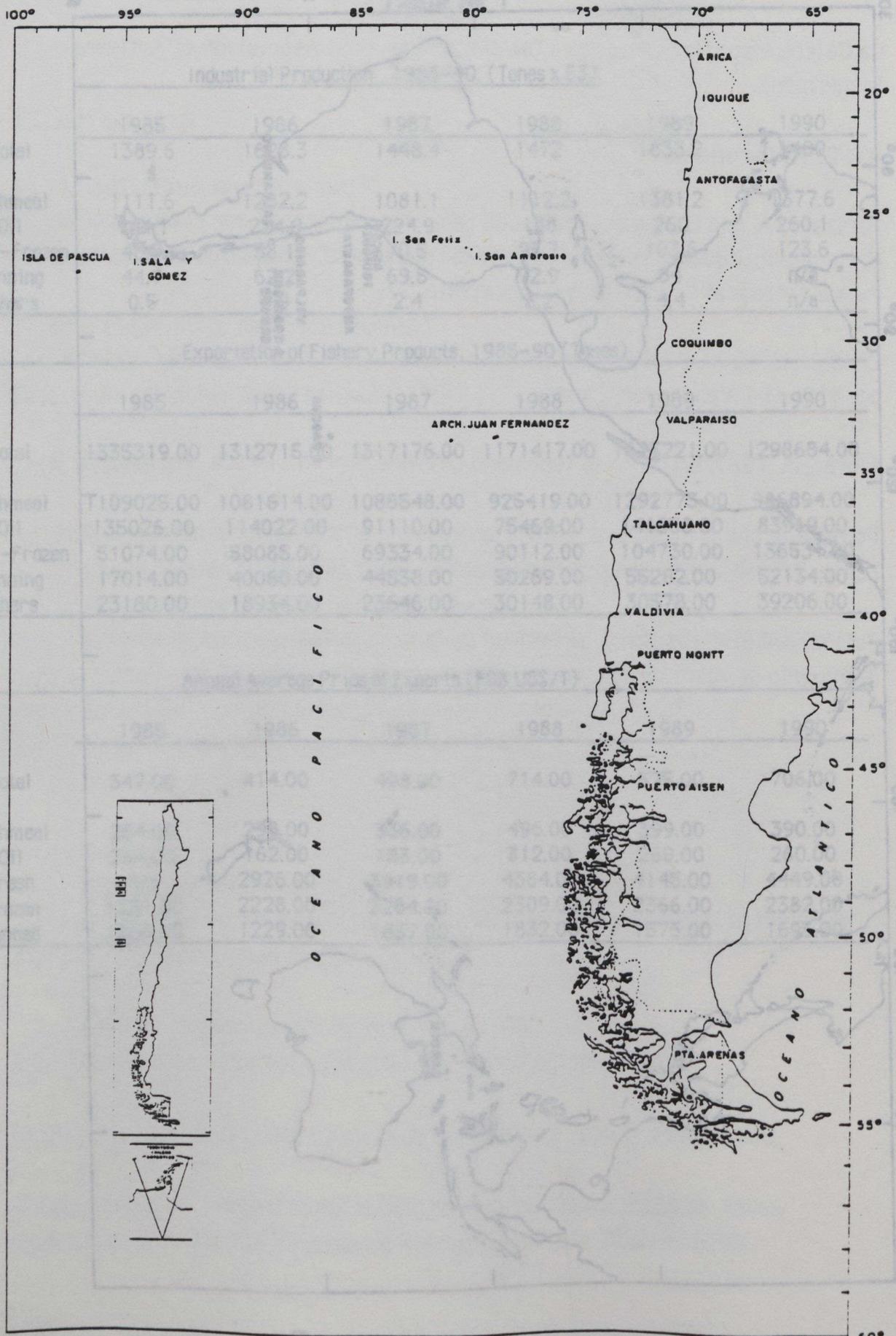


Fig. 3

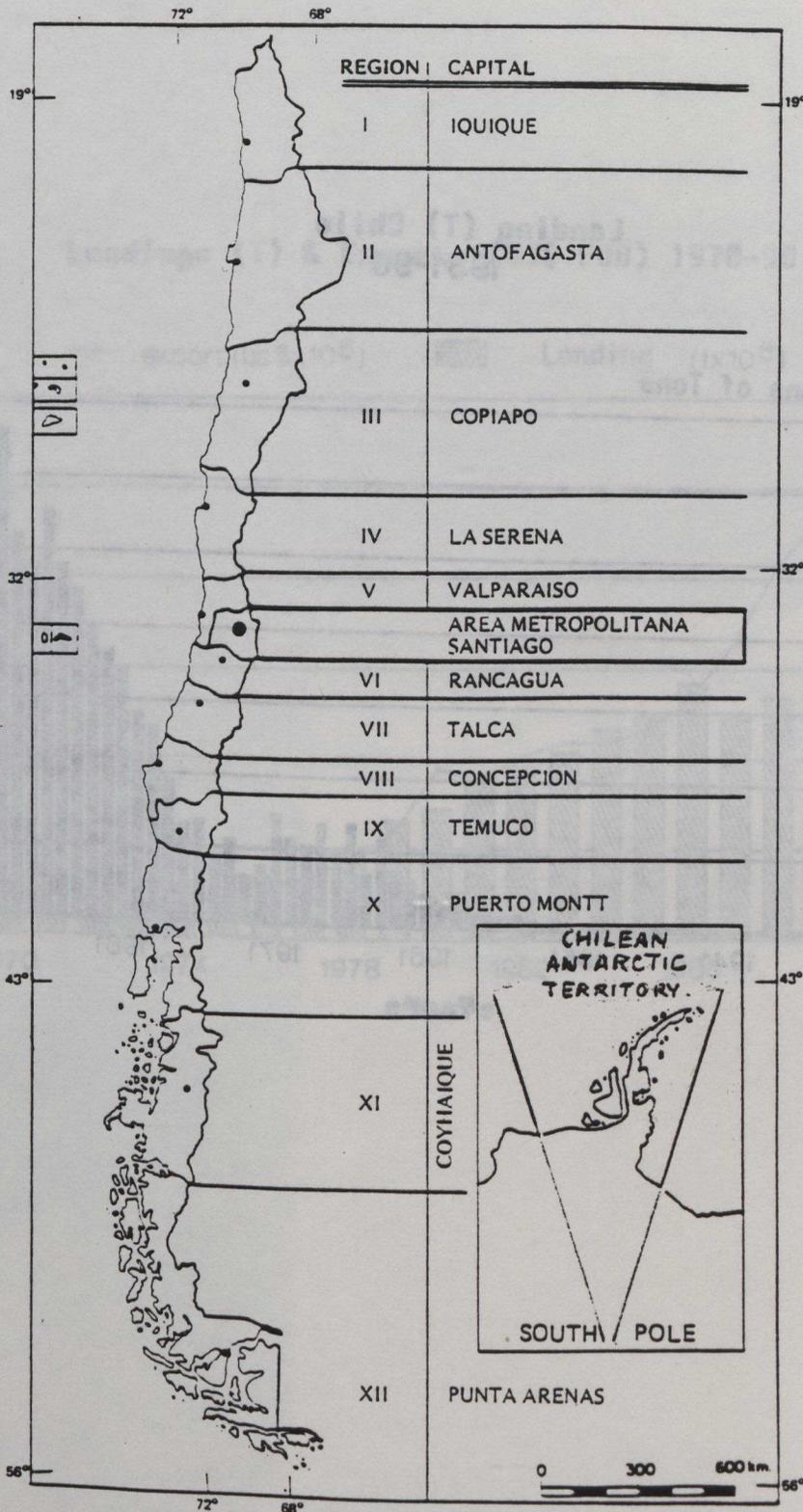


Fig. 2

Fig. 4

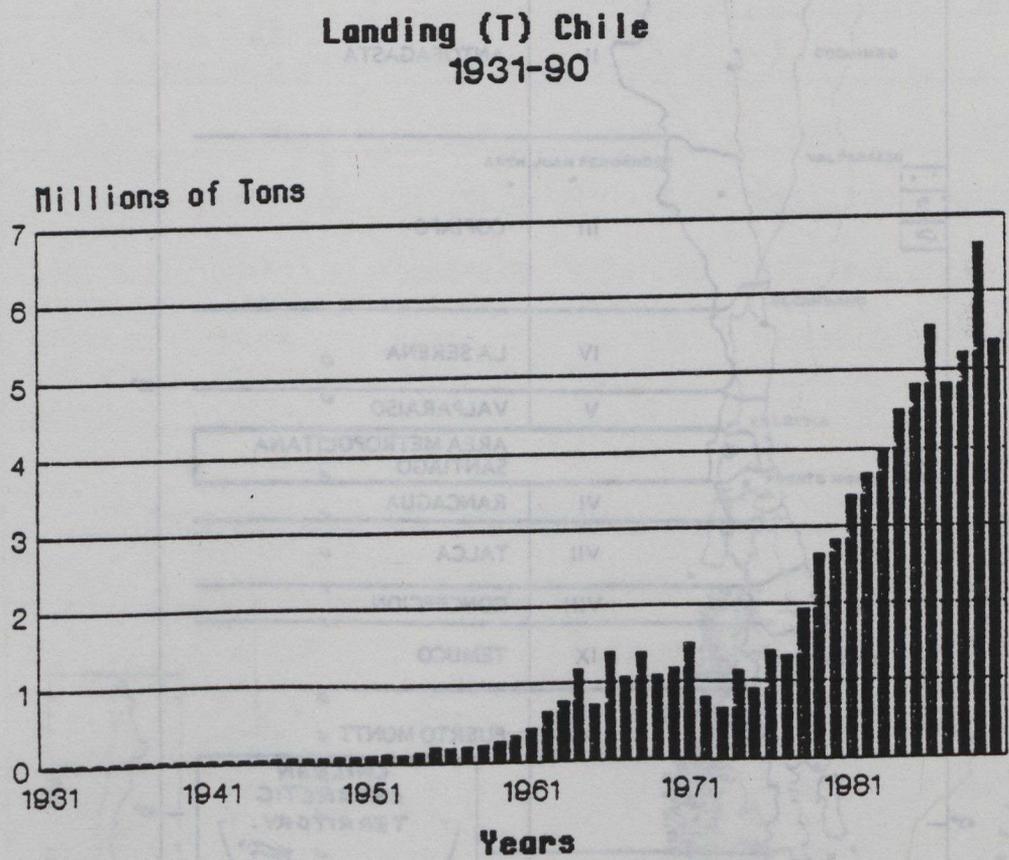


Fig. 5

Landings (T) & Exports (US\$ FOB) 1970-90

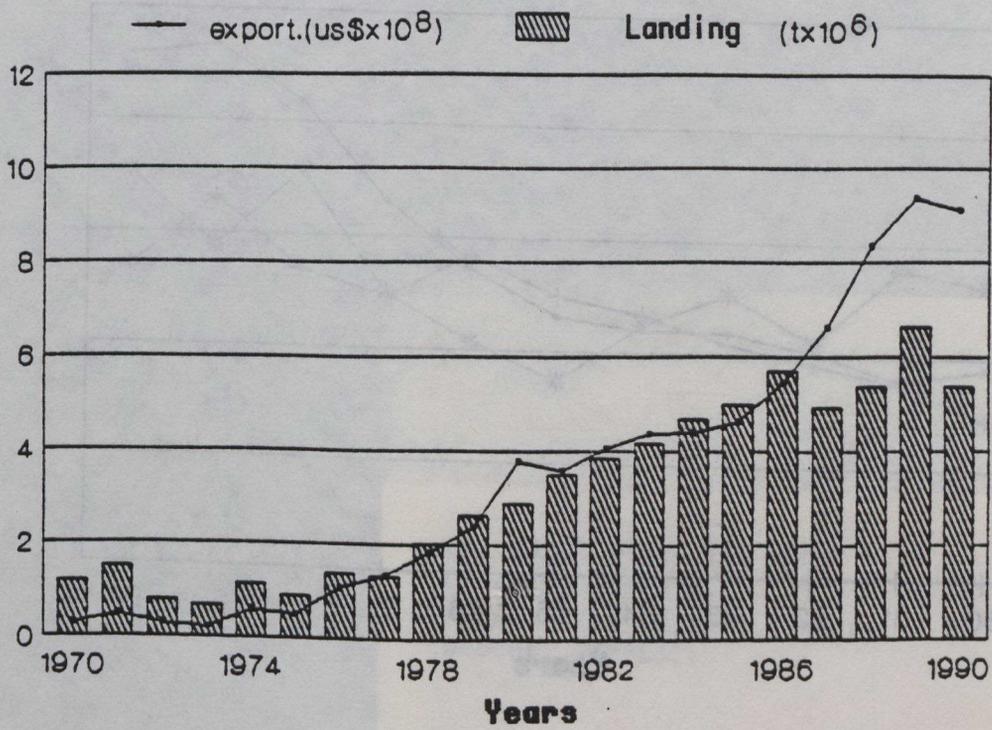
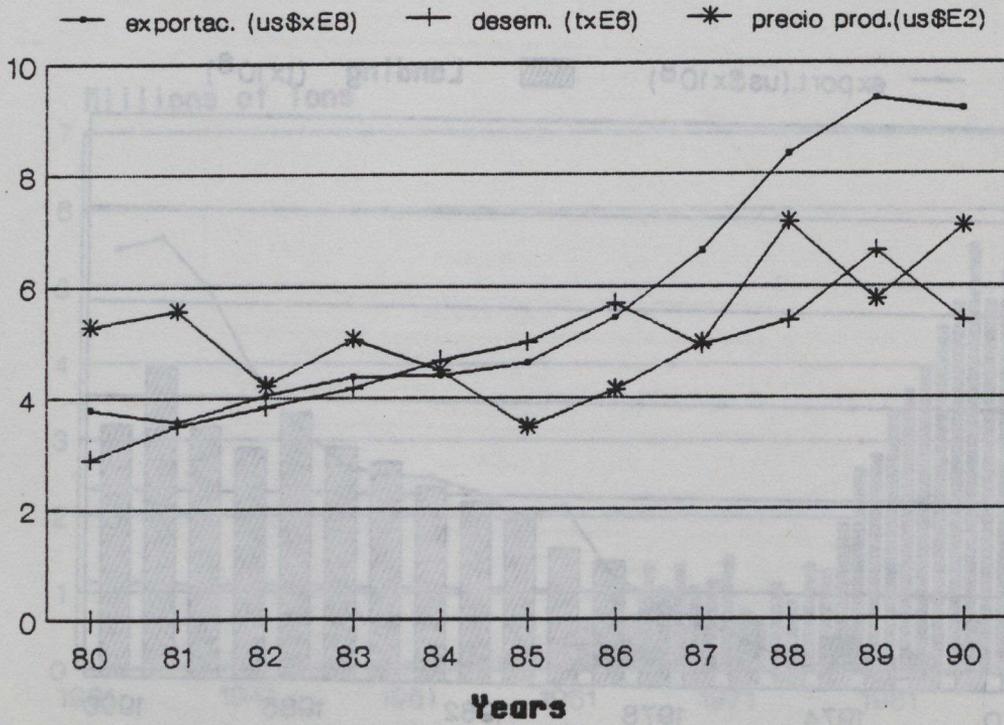


Fig. 6

Landings, Exports & Prices, 1980-90



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