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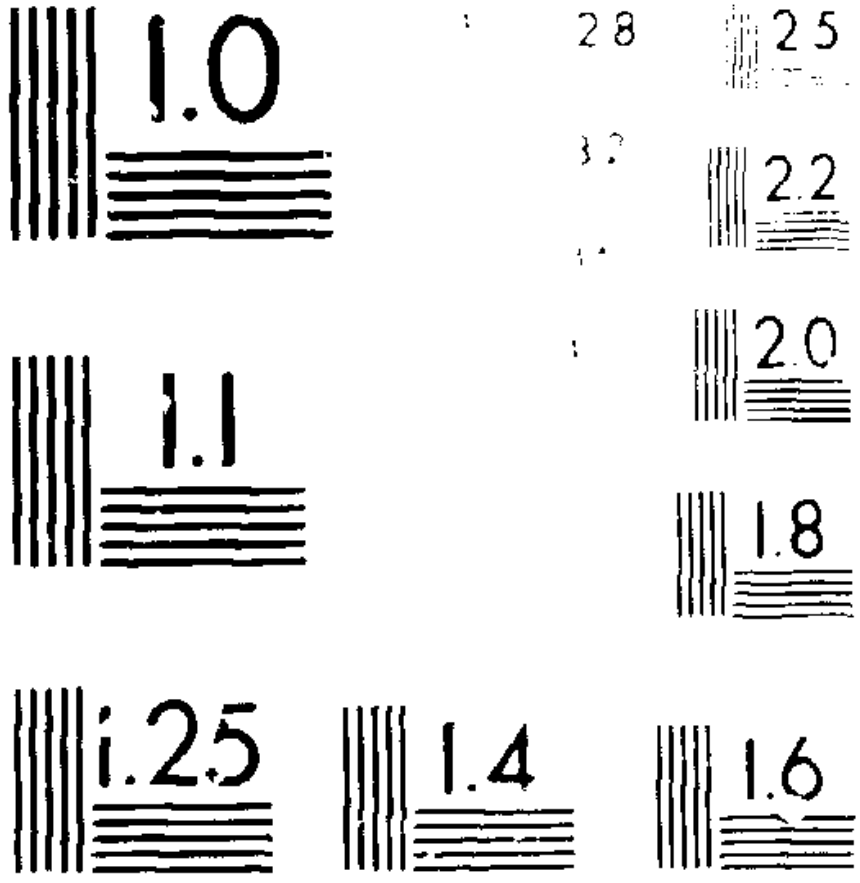

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THE FISHING INDUSTRY IN CHILE *

prepared by

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Introduction

The purpose of the following study is to provide information on the importance of fishing in Chile, and specifically on the size and performance of the industrial sector at the stages of catching and processing the fish.

Accordingly, the paper will not deal with the problems and characteristics of artisanal fishing, which is of great importance for our country, both because there are 35,000 fishermen engaged in it and because of the growing contribution they are making to the national product and to currency earnings through exports of their products.

Chile is a country which faces the Pacific Ocean along 4,200 km of coastline, excluding its Antarctic territory, with an exclusive economic zone of over 1.6 million km^2. These circumstances, together with the fertility of its waters, have made Chile today one of the world's leading fishing nations, in terms of the volume of resources extracted from the sea, and the future outlook is also promising if the country can successfully plan for the rational exploitation of its hydrobiological resources.

The year 1982 saw the extraction from the waters under the country's jurisdiction of about 3.9 million tonnes of marine resources of various kinds, of which 3.5 million tonnes was accounted for by industrial fishing, 370,000 tonnes by artisanal fishing and the rest by various lines of production, including artificial breeding.

Over the past decade, the amount of fish caught and processed has shown a notable increase of 487 per cent over the 1973 figure (table No. 1), a result which we consider to have been due to a combination of factors and efforts, such as the application of new techniques, higher labour productivity and greater specialization, efficient management and an appropriate national fishing policy, which has encouraged private industry to undertake almost all the work involved in production and in the development of new resources, which have been winning a place on international markets.

Because of the large amounts caught and the low level of domestic consumption, our fishing industry is highly dependent on international markets, a factor which, as we shall see later, has made it progressive and adaptable to new technology.

Provided there are no significant ecological fluctuations to affect the potential of our marine resources and provided that foreign markets remain relatively stable and develop normally, we believe that our fishing industry will continue to undergo vigorous development, pursuing new policies which will help to increase the value of our exportable production.

As stated above, the following paper will provide information on various points that are relevant to our national fishing industry and will give an overall picture of its structure and performance.

I. Importance of the fishing industry in the national economy

The activities of the fishing industry have developed to an extraordinary extent in Chile in recent years, and as a result its contribution to the national economy has also gained in importance, one of its salient characteristics being that it is a major source of foreign earnings, 50 per cent of the gross value of its output being intended for foreign markets.

In 1982, the value of exports of marine products rose to $404.9 million, representing 10.7 per cent of Chile's total foreign trade and an increase of 21.6 per cent over the 1981 figure.

Another notable characteristic of the fishing sector, particularly industrial fishing, is its vigorous expansion during the period 1977-1981, the rates of growth over the previous year being about 31 per cent, 22 per cent, 8 per cent and 14 per cent, all of which are higher figures than for the other sectors of the Chilean economy.

Table No. 2 shows the share of the national product accounted for by the fish catch. The figures do not include the value added by the processing sector, which, under the system used in Chile, is included in the total for the industrial sector in general. At all events, it has been estimated that during the period 1977-1981 the total share of the fishing sector in the gross national product fluctuated between 1.1 and 1.6 per cent.

To give an idea of the contribution the fishing sector can make to our economy, suffice it to say that if the average value of fish exports, instead of being US$423 a tonne (table No. 3) as in 1982, were US$1,480 a tonne, which was the average for frozen and tinned goods in the same year, the sector's importance and contribution to the economy and thus to the national product would double, or more than double, even assuming that the amounts caught and processed by the fishing sector remained at their present level.

II. Hydrobiological resources: Availability of raw materials for the processing industry

In the seas off our coasts there are about 135 marine species, of which 25 per cent constitute the basis for the present development of our fisheries.

During the past 10 years, the industrial sector has caught and processed about 90 per cent of the bio-resources taken from our coasts, the rest being accounted for by artisanal fishing.

The amounts caught or extracted in 1982, which amounted to 3,846,608 tonnes of marine products (table No. 1), show a breakdown by species which with some variations has remained constant over the past few years, as follows:

Species	Tonnes	%
Fish	3 576 955	93
Crustaceans	14 794	0.4
Molluscs	66 293	1.7
Algae	173 375	4.5
Others	15 191	0.4

Of the total volume of fish caught, the species which has been most prominent has been the Chilean pilchard (Sardinops sagax) with 50 per cent of the total tonnage, followed by the horse mackerel (Trachurus murphyi) with 40 per cent, the anchoveta (Engraulis ringens) with 2.5 per cent, the common sardine (Clupea bentincki) with 1.3 per cent and Spanish hake (Merluccius polylepis) with 1.2 per cent. The composition of the catch has been changing with conditions in the ecosystems and with the exploitation of new species. Some years ago the anchoveta was the main resource in pelagic fishing.

Among molluscs, the clam (Ameghinomya antiqua) accounted for 32 per cent of the total tonnage, followed by the seasnail (Concholepas concholepas) with 30 per cent, the cholga mussel (Aulacomya ater) with 9.3 per cent, the topshell (Thais chocolata) with 9 per cent, the chorito mussel (Mytilus chilensis) with 8.5 per cent and the hard clam (Mesodesma donacium) with 4.3 per cent.

Among the crustaceans, the yellow prawn (Cervimunida johni) is the most important, with 41.2 per cent of the total tonnage, followed by the nylon shrimp (Heterocarpus reedi) with 23.3 per cent, the crab (Cancer sp.) with 11.5 per cent and the spinous spider crab (Lithodes antarcticus).

In the case of crustaceans, the proportions of the different species have varied, it having been felt necessary to prohibit the catching of the red prawn (Pleuroncodes monodon) because of over-fishing of this species, which used to provide the largest catch.

The foregoing is intended to give an indication of the quantities, composition and main species involved in our hydrobiological resources. In order to proceed with this practical picture of our fishing resources, the supplies of them available and their future prospects, it will be necessary to give a general description, moving along our coast and identifying and analysing some of the most important fisheries, by which we mean the combination of factors formed by the resources, their distribution and the means of extracting them.

We can divide our fisheries into pelagic, demersal and benthic, depending on the chief characteristics of the biological resources they comprise.

The pelagic fisheries basically involve stocks that arise in the northern zone (regions I, II and III) and in the central southern zone (region VIII). The first zone yields 73 per cent of the total catch and the second 18.7 per cent.

As one moves southwards, the fisheries change from pelagic to benthodemersal communities, owing in part to the presence of the continental shelf as an important abiotic factor.

In the southern zone, environmental factors clearly distinguish two kinds of fisheries, one associated with estuaries and channels with benthodemersal species closely connected with the stratum, and the other located on the outer shelf and the slope further south, with demersal-pelagic species.

There follows a brief review of the present stocks and future outlook of the country's main fisheries.

1. Pelagic resources

1.1 Northern zone fishery (regions I, II and III)

Up to 1972 this fishery was based on the anchoveta, but owing to changes in the oceanographical conditions (1972-1973) produced by the phenomenon of the "El Niño" current, the supply collapsed and was gradually replaced by the Chilean pilchard, horse mackerel and mackerel, catches of these varieties reaching the level of 2.6 million tonnes a year.

Between 1978 and 1982 we find that the Chilean pilchard was the dominant species in the system, so that it is now thought necessary to apply measures to protect this species, because of the extent to which it has been fished, and because the situation with regard to the conditions existing in the zone is not clear, owing to a recurrence of the "El Niño" phenomenon.

According to the studies that have been made, in years of normal operation, the catch from this fishery should be about 2.5 million tonnes, made up of Chilean pilchard and horse mackerel, together with other species that accompany them.

Stocks of horse mackerel are hard to estimate because of its enormous range of distribution in the ocean. This species is also caught in large quantities in the waters adjacent to the 200-mile economic zone by fleets of factory ships of other nationalities.

1.2 Central southern zone fishery (region VIII)

This is a mixed fishery, which used to consist mainly of the common sardine and anchoveta but has been subject to fluctuations since 1965. The horse mackerel has emerged since 1972 as an important species, and during the last three years the Chilean pilchard has produced the highest catches.

The studies and estimates made of this fishery suggest that in years of normal operation it should be possible to catch an annual average of between 700,000 and 750,000 tonnes of fish without affecting the biomasses of the zone.

2. Demersal resources

2.1 Central zone fishery

This fishery is based mainly on the common hake, with annual variations in the catch, which studies indicate are due more to changes in the behaviour

of the species than to variations in the actual supply. Other species making up this fishery are the red prawn, the shrimp and the yellow prawn.

In 1976 the supply of red prawn began to decline, falling so low that it became necessary to forbid the catching of it from 1981 onwards. There has also been a drop (60 per cent) in catches of the nylon shrimp.

The studies made estimate a biomass of the order of 300,000 tonnes for hake, indicating a permissible catch of about 65,000 tonnes a year.

As regards demersal crustaceans, recent studies show that stocks have recovered, and it is hoped that within a reasonable period it will be possible to start catching them again on the basis of a plan for the management of this resource.

2.2 Southern zone fishery

This area began to be fished in 1978, the main species being Spanish hake, together with cola hake (Merluza de cola), golden eel, common hake and cojinova.

South of the parallel 43° S a fishing quota has been imposed and the operation of factory ships has been authorized. In 1981 the quota was fixed at 98,000 tonnes.

It has been possible to regulate this fishery, which is characterized by a wide variety of species, because it was possible to see its size and composition in its natural state, which meant that quotas could be set for catches.

In general it can be said that the situation here is stable and that it is possible to maintain the level of catches at between 75,000 and 100,000 tonnes a year of fat species, intended chiefly for freezing.

3. Benthic resources

This fishery is characterized both by the heterogeneity of the species composing it and of their distribution and by the extent to which knowledge of them varies.

Among these species we may pick out the seasnail, which has been the subject of protection measures, the hard clam, which is considered to be under-exploited, and the sea urchin, which has been over-exploited, so that studies have been undertaken with a view to protecting it. The cholga mussel

and the chorito mussel, which are widely distributed, are over-exploited in some regions and considered to be in equilibrium in others.

The spider crab is a protected species, as are the crawfish and algae.

As can be seen, serious efforts are being made to determine the best way of managing these species. It is estimated that in normal operation the annual amount taken should not exceed a total of 90,000 to 100,000 tonnes.

With the species at present being exploited, and provided that the resources continue to be managed appropriately so as to preserve their biomass, it is estimated that altogether Chile should be able to catch and harvest some 3.5 million tonnes of hydrobiological resources in years of normal operation from the waters it is fishing. We believe that the national fishing industry therefore has a good basis of raw materials for normal operation, even without taking into account the potential resources, which we shall now go on to consider.

Potential resources

The future of Chilean fishing will be assured by the systems of management that are being introduced for the resources fished at present and for a number of other resources which are starting to be developed.

Species considered to have potential commercial importance in the future are the garfish, which is widely distributed, the tuna and the Atlantic bonito, whose habits in Chilean waters are not known, the squid and the shark, whose potential is unknown.

Atlantic krill is also a potential resource of prime importance. Studies are being made on krill and the other species mentioned with a view to determining the feasibility of exploiting them.

Finally, we should mention that artificial fish farms are already in operation or being developed for various species, but they are not yet of any great importance in the industrial sphere. There are seven fish breeding centres and 63 fish farms in operation in the country. All this, together with the extraordinarily favourable conditions for this type of activity in regions X, XI and XII, which are incidentally recognized as unpolluted zones, guarantee a good future for our aquicultural activities.

III. Impact of the exclusive economic zone on the development of the fishing industry

About 30 years ago our country, displaying a great vision of the future for the seas, launched an international campaign, the result of which has been majority recognition for what today is an international institution, the exclusive economic zone.

The Santiago Declaration and the principles relating to a coastal State's sovereignty and exclusive jurisdiction over the zone adjacent to its shores imply a need for awareness of the duties and responsibilities involved in the use and enjoyment of this heritage.

One of the duties entailed by this new legal order is "management of the ocean", that is, the need for a policy and priorities for the utilization of the marine areas under national jurisdiction and the need to establish and improve co-ordination bodies and a legal framework to facilitate planning and management in this area.

Within this maritime planning process, which has been called the "marine dimension of development", there are three different areas of interest: the first is the coastal area, on which great emphasis has been placed, since on it the development of the country's fishing depends, and which is being exploited in a belt extending up to 80 miles from the coast; the second, to which special attention is being given, is the area of extended marine jurisdiction or exclusive economic zone; and the third is the seas beyond national jurisdiction.

As regards the fishing aspect, the exclusive economic zone represents potential hydrobiological resources, the real importance of which it will be possible to assess when studies and surveys have been completed to provide a full picture of the resources existing in the 200-mile zone.

The species of commercial importance that are known to exist in this zone are the tuna family, horse mackerel, garfish, ocean squid and other associated species. As an indication we may note that, according to FAO reports, within the 200-mile limit along the northern part of our coasts some 500,000 tonnes of horse mackerel are being caught every year by factory ships of various nationalities.

Coastal States such as our own bear a great responsibility for the development and management of their wide exclusive economic zones, because if the resources in these zones are to be exploited rationally, it will be necessary to apply a consistent body of legislation based both on the national fishing policy and objectives and on a knowledge of what hydrobiological resources are available, so that they can be fished at a rate which enables the stock to be maintained over time.

To this end it is considered that the following activities should be undertaken in order to arrive at an ocean planning policy in this zone:

(a) Determine the catches permissible in the exclusive economic zone (assessing resources, determining catch levels, etc.);

(b) Apply regulatory and conservation measures to avoid over-fishing of the hydrobiological resources;

(c) Provide scientific, statistical and other information and exchange it with organizations and States.

The results and benefits to be derived from the establishment of the exclusive economic zone may be summed up in part under the following points:

(a) Countries whose coastal waters used to be fished by the fleets of third parties will have to develop their fishing industries quickly, with extensive benefits for their economies;

(b) Countries with fishing resources off their coasts will be able to accept technological aid and foreign investment from developed countries which are interested in maintaining the flow of products they formerly obtained with their own fleets;

(c) Coastal States will find themselves obliged, owing to the great increase in the area under their jurisdiction, to plan its development, rationalizing and regulating access and exploitation, which few countries would probably have undertaken if it had not been for the 200-mile limit;

(d) It is considered that in view of what has been said in point (c) the food resources in the sea will be better preserved than in the situation before the 200-mile limit, which encouraged indiscriminate fishing and led to the exhaustion of fisheries;

(e) When they plan the development of their marine resources the coastal countries will take pains to fix catch quotas and take conservation measures which will result in the recovery of many fisheries, with consequent benefits for the world food supply;

(f) It is considered that in general this 200-mile limit will lead to a greater world-wide exchange of co-operation, in technology, in the flow of investment and in international trade;

(g) It is expected that this 200-mile limit will lead to an increase in the consumption of marine products in those developing countries that will now be in a position to start or expand fishing activities, which will help to ensure a better distribution of these protein foods;

(h) It is also expected that with the increase in fish consumption a range of species which have so far not won much acceptance on international markets will become profitable.

In short, the exclusive economic zone is bound to be of great importance in the future development of our fishing and industry, although it is difficult to evaluate the benefits at the present time for lack of reliable information which would enable us to quantify the economic implications as regards employment, food and resources.

IV. The fishing industry and its processing capacity

As has been said above, the following are the main industrial fisheries to be found in Chile:

1. The pelagic fishery in the northern zone, for which the main unloading ports are Arica, Iquique, Antofagasta and Caldera;

2. The demersal-pelagic fishery in the central-southern zone, for which the main ports are Coquimbo, Valparaíso, San Antonio and Talcahuano;

3. The demersal-benthic-pelagic fishery in the southern zone, with ports at Puerto Montt, Ancud and Punta Arenas.

The greatest concentrations of fishing industry installations are at the ports mentioned.

The decade 1960-1970 was the period of greatest growth in the fishing industry, growth which was based chiefly on the establishment of reducing plants in the northern zone of the country.

Recent years have seen the development of the large-scale canning industry and the freezing industry, the latter based on the development of demersal resources in the southern zone through the use of factory ships.

The processing of the fish catch is carried out by 123 firms, which possess 135 plants on land, distributed among the country's main ports, and 10 factory ships.

The industrial fishing fleet consists of 375 vessels, 244 trawlers and the remainder seine boats.

The volume of fish landed has grown steadily over the past five years, reaching a record of 3,830,000 tonnes in 1982 (table No. 1), which gives our country one of the world's four highest levels of catch.

Most of the volume of hydrobiological resources extracted comes from industrial fishing, the industrial fleet accounting for 89 per cent of the total catch, the remaining 11 per cent coming from artisanal fishing.

The catch landed consists of approximately 93 per cent fish, mostly pelagic species, 1.7 per cent shellfish, 4.5 per cent algae and the rest other species.

In 1982, 91 per cent of the catch landed was intended for the reducing industry, which produced 796,000 tonnes of fishmeal and 145,000 tonnes of fish oil, making it the world's leading fishmeal producer.

The types and amounts of products produced by the fishing industry in the last couple of years have been as follows:

Type of product	Production (tonnes) 1981	1982	Variation %
Fishmeal	688 318	795 765	15.6
Oil	127 270	144 979	13.9
Frozen products	51 216	59 858	16.9
Canned products	29 540	23 526	-20.3
Others	11 139	9 457	-15.1

Plants of very different size and capacity are to be found in the different sectors of the national fishing industry, depending on whether they produce mainly for the domestic market or for export.

Table No. 5 shows the installed capacity by regions for different types of processing with eight hours of production (one shift) and the rate of utilization achieved in 1982, which was in general a good period for production.

In the figures on the utilization of installed capacity, in order to give a realistic picture, we have taken 24 days per year as the average period of operation in regions I to IV and 180 days in regions V to XII, in line with the climatic conditions prevailing in these zones. For the country as a whole, we have put the figure at 220 days of operation a year.

We give below a brief analysis of the fishing industry by sectors of output.

Freezing industry

In 1982 the freezing industry had 61 plants in operation on land, most of them in regions VIII, X, XII and IV. The greatest freezing capacity is installed in region I (Iquique), with 360 tonnes of raw material per 8-hour shift.

If we assume that the average number of days actually worked in the freezing industry at the national level is 220, the capacity of the industry to process the raw material, excluding factory ships, will be 173,580 tonnes a year. In the light of this figure, and given that the volume sent for freezing in industrial plants in 1982 was 72,185 tonnes, it may be concluded that the industry was working at 42 per cent of its capacity for processing the material with an 8-hour shift, which shows that its actual capacity is considerably greater, considering that the working day can be increased to two or three shifts.

The factory ships, on the other hand, with a catch of 75,637 tonnes of raw material, will be working at 153.5 per cent of capacity with one shift or 77 per cent of capacity with two.

The systems used in the national freezing industry are as follows, with the proportion of installed capacity accounted for by each:

Air-blast freezing tunnel, 59 per cent

Plate freezer, 27 per cent

Continuous freezing tunnel, 14 per cent.

The storage capacity of the land installations for fish products has been estimated at 25 days' output of frozen goods, which means about 19,500 m^3 of storage space.

The frozen goods produced consist mainly of horse mackerel, common hake, mackerel and seasnail, and the most common types of products are fillets of hake, IQF for seasnail and HG for horse mackerel and mackerel.

Of the total of 60,827 tonnes of frozen goods produced in 1982, 2,921 tonnes were consumed by the domestic market and the rest, some 95 per cent, was exported.

Canning industry

The national canning industry has been developing gradually, both in the use of new production techniques and in the automation of its processing lines. There are at present 35 industrial plants, located mainly in regions X, IV and VIII, although region I has 45 per cent of the total installed capacity in one plant.

In 1982, 23,526 tonnes of canned goods were produced, of which 11,435 tonnes was consumed in the country and the remaining 51 per cent exported.

Assuming an average of 220 working days with one shift, the installed canning capacity is 280,940 tonnes, or 29.5 million standard cases (one standard case equals 18 containers with 198 cans in each). The rate of utilization in 1982 was 27 per cent, rather a low figure, if we consider that it is possible to work two or three shifts. There is thus surplus production capacity, which should be directed towards supplying foreign markets, because domestic consumption is low.

Most of the industrial plant is satisfactory from the sanitary point of view, being governed by the provisions of the food health code, as regards plant, workplaces, technology and products.

Fifty-six per cent of the production of canned goods is accounted for by the common sardine in 120-g tins.

Other important products are the Chilean pilchard and horse mackerel in 1-lb tins, sardines in oil and tomato sauce, and bonito. Among crustaceans and molluscs, the spider crab, the cholga mussel and the chorito mussel are prominent.

There is a great variety of sizes of packages in our canned goods production, a system which has been maintained in order not to upset consumer habits.

The canning industry is considered to be at present in a stage of transition, with a small and competitive domestic market and a realistic chance of entering international markets with large volumes of output and the range of products that those markets require.

Chile possesses a great variety of species, and in some of them the quantities are enough to satisfy specific markets, both sophisticated and popular.

Dry-salted and smoked industry

There are no industrial plants in existence for the production of dry-salted and smoked fish, the domestic market for these products being supplied by artisanal producers.

The population have not formed the habit of consuming these products, and as a result there is not enough of a domestic market to support constant production, and this situation has discouraged the development of industrial technology in this area.

Studies have been made of foreign markets which already have an interest in this type of product, and it is accordingly considered that these lines of production should be developed in the near future, because the greater durability and better quality of these products makes them appropriate for both production and consumption in developing countries.

Our country has species of white meat which are very suitable for obtaining products of the cod type, such as hake, tope, pejegallo (Callorrhynchus antarcticus), shark and eel.

Reducing industry

Chile is at present the world's leading producer and exporter of fish-meal, with a volume of 795,268 tonnes in 1982.

This industry is characterized by a high level of technological efficiency and by the large size of the reducing plants established in the northern zone (regions I and II), mainly in the ports of Arica and Iquique, in addition to other smaller ones in region VIII.

The country has a total of 37 reducing plants, ranging in capacity from 15 to 180 tonnes per hour of the raw material, which is mainly Chilean pilchard, horse mackerel and anchoveta.

The installed reduction capacity of 1,493 tonnes of raw material per hour has increased by 45 per cent since 1967.

Theoretically, with one production shift, the utilization of installed capacity would be 127 per cent and with two shifts (16 hours' work) 58 per cent. The actual fact is that the capacity of this industry is designed to absorb the catch in certain months when there is a peak in the supply of raw material, at which time the plants work 24 hours a day.

The Chilean reducing industry is technologically one of the most advanced in the world and has achieved a high degree of efficiency, both in catching the fish and in processing them, proof of which is the high yields (up to 29 per cent of meal and oil) and the uniformity and quality of the output.

As to the future of the fishmeal industry, we believe that the present level of development is more or less the limit, and that the industry will gradually lose importance as the resources it uses are transferred to products for direct human consumption, which are more profitable.

V. Fishery technology and research

The national fishing industry is at present at a high level of technological development as regards both the actual fishing and the processing of the products, and what is more important, it has the capacity to adapt quickly to the major requirements of domestic and foreign markets.

The techniques used by our industry are the traditional ones, such as canning, freezing and reduction, and efforts are being made to get consumers to accept semi-preserved products and others of a non-traditional nature, so that industry can apply these methods, some of which are used at present in artisanal production.

We give below a brief review of the industrial techniques.

(a) Canning

The advantage of canned fish is that the product remains in stable condition and can be easily stored at the consumer level. The techniques used in the country are the ones that are generally familiar and the quality is such that the products can enter the most demanding foreign markets.

Because of the high cost of the containers, the industry has been moving towards the production of canned goods with greater value added at more attractive prices. It has also set out to penetrate the mass consumer market, using semi-prepared products in cans of up to 5 kg, which minimize the effect of the high cost of the container and are aimed primarily at institutions, although they should also have a good consumer market in underdeveloped countries with protein problems in the diet of their populations.

As regards the containers, new techniques are being introduced which the industry will have to look into, including returnable plastic bags and containers made of aluminium, nikerlite, nickel-plated material and combinations of aluminium and plastic polymers.

(b) Freezing

The feature of this method of preservation is that after thawing it yields a product very similar to the fresh one.

In general it is considered that this technique is applied well in Chile; the equipment and machinery is modern and the plants are being expanded.

Frozen products have been gradually introduced on the domestic market in recent years. As far as foreign markets are concerned, the industry is exporting both quality products (spider crabs, seasnails, prawns and shrimps) and mass-consumption products such as frozen blocks of fish and fillets.

The fishing industry has developed lines of breaded and pre-fried frozen products with fat species of white meat, which have been well received on the domestic market (fish-sticks and fish-cake) and should also be successful on foreign markets because of their good quality and presentation.

In the production of frozen goods, it is necessary to improve the techniques of presentation, packaging and quality control, particularly when they are supplied to the consumer direct through markets, supermarkets and fish shops.

As regards the techniques of dry-salting and smoking, while they are known in Chile, they are applied only at the artisanal level, and studies are therefore being made of foreign markets and of product acceptability

in the hope of arousing the interest of industrialists in taking up these lines of production.

As far as non-traditional techniques are concerned research has been going on over the past 15 years in the laboratory, and even at the industrial pre-feasibility level, into the application of techniques for obtaining protein concentrates and fish pulp.

On protein concentrates, trials have been made with the extraction of lipids from fishmeal with different solvents, which yielded good products, but at high cost. These concentrates (ISESA, QUINTEROS) were used to make baby food, which yielded excellent results when applied (INTA, Dr. Monckberg). All these lines have been abandoned because of the high cost of the processes.

Fish pulp represents a processing technique which is gaining ground day by day. Various trials have been undertaken in Chile with the following lines of production:

Fish pulp as a meat extender in Vienna sausages, hamburgers, croquettes, pâté, etc.;

Hydrolysed and dehydrated fishmeal as a protein enricher in products for human consumption;

Fishmeal as a protein ingredient in breaded and pre-fried products (portions and fish-sticks);

Mixture of pulp with potatoes and/or cereals, dehydrated, as baby food.

Experiments have also been made with frozen and stabilized fish pulp, a product for which there is a great demand in Japan (Surimi) and which would offer a good way for Chile to use surplus white fish not absorbed by the domestic market.

Technological innovations are being accepted in our country to the extent that the markets permit and require it. Unquestionably, there ought to be substantial improvements in the sanitary aspects, in packaging and in transport, but these technological advances, while improving the quality of the product, also make it more expensive, a factor which often holds up this type of progress.

Regarding research in the field of fisheries, the greatest efforts are being made in the area of obtaining information which will make it possible to establish systems of management for the different hydrobiological resources

that will maintain stocks of the species and at the same time ensure their efficient economic exploitation.

The studies and research being carried on with the aim of establishing principles for the management and conservation of resources are as follows:

1. On the pelagic resources (monitoring by acoustical means to determine the biomass);
2. On the resources of prawns and shrimps (determination of biomass);
3. On the resources of seasnails (management plan);
4. Management of the fisheries in the southern zone (determination of age-size in southern hake (Merluza del sur) and cola hake (Merluza de cola));
5. On the resources of common hake (determination of the age-size key and state of this stock);
6. On the resources of northern oysters (harvesting of the oysters by means of artificial breeding);
7. Environmental fluctuations and their relationship with the abundance of pelagic resources in the north and centre of Chile;
8. On the resources of horse mackerel (determination of the age-size key);
9. On the resources of Chilean pilchard (fecundity and frequency of spawning, determination of reproductive potential);
10. On Chilean pilchard and horse mackerel (marking in order to monitor migratory behaviour);
11. On Chilean pilchard, horse mackerel, mackerel and anchoveta (preparation of age-size keys).

Similar studies are also being made on such resources as spider crabs (Centolla, Centollón), demersal fish in the south, clams, crawfish, etc., on foreign markets for pulp, dry-salted and smoked products, for the products of artificial breeding and other items connected with problems of marketing, packaging and processing technology.

These studies are carried on through 29 research centres, 23 of which are university establishments and the other six applied research institutions run by the Government in the field of processing technology as well as the extraction of marine resources.

The research facilities available also include six boats which periodically undertake cruises along our coast for purposes of research and surveying, on behalf of the universities and State bodies.

These various establishments employ 386 persons, 289 of them research workers, 40 technical specialists in different fields and the remaining 57 research assistants.

The national fishing industry has not made any contribution to research and development in new techniques, because the average enterprise is only medium-sized and there has been no stable pattern of markets and normal annual operations which would have enabled it to capitalize in such a way as to be able to invest resources in research and advanced training in the way that a modern industry requires.

VI. Availability of machinery and equipment for the processing industry

In our country there are two possible sources of supply of capital goods for the fishing industry - imports and domestic products.

1. Imported machinery and equipment

Most of the leading foreign and multinational firms producing and marketing equipment and machinery are represented, either directly or through Chilean firms.

Most of these firms, depending on the type of product, maintain stocks so that they can supply a wide range of capital goods immediately.

At the present time, there are no restrictions on the entry of machinery and equipment into the country, although customs duties representing 10 per cent of the value are levied.

2. Domestic products

The metalworking and engineering sector in our country is made up of factories, machine shops, foundries, shipyards, assembly shops and workshops, which cover a varied range of products from ironmongery to ships.

As regards supplies for the fishing industry, the capital goods produced in the country which compete with imported goods are components for reducing and canning plants, pressure cookers, heat exchanges, presses, concentrators, driers, automatic boilers and in general all boiler-making products, while it is necessary to import automatic control components, centrifuges, automatic filleting and packaging lines, refrigeration machinery and more sophisticated motors, machinery and equipment in the electronic field.

For the fishing fleet, the industry has three shipyards. They have produced most of our fleet, which at present has 340 vessels, the seine boats having holds with an average capacity of 200 tonnes and the trawlers 130 tonnes.

Seine boats are at present being built with a capacity of up to 500 tonnes and trawlers up to 200 tonnes.

It can be said that the national fishing industry has had no problems so far with the supply of equipment and machinery for normal operation on the basis of the present production techniques.

VII. Administration and technical specialization in the manpower field

As explained above, the national fishing industry and the sector in general have in recent years shown great growth and productive vigour, becoming a major source of currency earnings through their export activities, which have to a large extent provided the incentive for the efficient running of the industry, which is demonstrated by its management capacity and the specialized skills of its technical and office staff and manual workers.

The above statement is valid above all for the reducing industry in the northern zone, where there are firms and organizations of considerable size, with two or three industrial plants which work with modern techniques and equipment in the extractive and processing stages. Some of these firms take in up to 500,000 tonnes of fish a year at their different processing centres.

The firms in the centre and southern centre of the country are quite small, with a fairly low level of management and technical resources, but a large part of them are nevertheless subject to the requirements involved in supplying foreign markets.

In its fishing fleet and related services, the fishing industry employs about 6,000 persons, including harbour personnel, captains, engineers, crew members and mechanics and more than 10,000 persons in industrial plants and management offices, including executives, technical specialists, administrative staff and workers.

This labour force is for the most part skilled and semi-skilled, having been trained at various specialized schools and through practical instruction given by the industry itself.

Apart from the specialized schools along the coast for ship's crew, engineers, naval craftsmen, captains, etc., there are five university centres which give courses and award qualifications in matters relating to the sea and its resources.

These universities produce fishing engineers and technical specialists, technical specialists in marine matters, marine biologists, food engineers and specialists, and representatives of all the traditional technical and humanist disciplines that go to make up the technical, legal and commercial administration of this type of enterprise.

In addition there are training institutes which give short courses and advanced courses in various specialized fields such as engineering, electricity, technical drawing, marketing, organization and methods, etc.

From the foregoing, and although there is still a fair amount of work to be done on the training of craftsmen and workers, we can say that our country has an adequate degree of training and specialization for the technological levels and processes to be found in our fishing industry.

VIII. Marketing and sales

In recent years modern sales and marketing techniques have made noteworthy progress in Chile, owing largely to the opening up of our economy to the outside world, which has encouraged competition between domestic and imported goods.

For the purposes of this paper we will distinguish between domestic sales and foreign trade in fish products, so as to give a clearer picture of the processes involved.

1. Domestic market

Despite Chile's long coastline and narrow shape, which gives our people easy access to marine products, the consumption of such foodstuffs per head during the past decade has been 15.64 kg, including frozen, tinned and fresh products.

Comparison with other countries with less in the way of resources and seafaring experience suggests that consumption per head ought to be at least double in Chile, particularly if we have problems with protein in our diet.

It has to be recognized in this connection that our domestic sales channels and systems for fresh food suffer from structural deficiencies which restrict consumption, both because they make the goods more expensive and because they mean that its origin and freshness cannot be fully guaranteed.

The system for marketing fresh marine products is a chain which begins in fishing ports and coves, from which the goods are transported via warehouses, cold storage depots and processing plants to consumer centres, transactions between wholesalers and retailers taking place at a fish terminal in the big cities, where controls are also carried out on sanitary conditions, prohibited goods and other restrictions. Consumers can obtain these products from markets, fish shops, grocers and supermarkets.

At present, with a view to improving sales of the fresh products, attempts are being made to introduce pre-packaged fried fish - whole, filleted, cut into pieces, etc.

Frozen and canned products have well organized and specific sales channels, and marketing techniques have been used for the selection of products, design of packages and labels, mounting of publicity campaigns, use of consumer surveys, testing panels, etc., all of which has helped to develop the promotion of products and brands, the purpose being to meet the wishes of the consumer, increase sales, maximize profits and compete with imported goods.

2. Foreign trade

We have already mentioned the importance of the fishing sector in our foreign trade. In 1982 it exported products to an approximate value of $404.8 million, the main item being fishmeal, which alone accounted for 63 per cent of that figure. However, frozen goods constituted an important range of export products, earning altogether 11.3 per cent of the total value of exports.

Given these export figures, it will be necessary to deal with fishmeal and fish oil separately from the sector's other products.

Some 20 years ago the leading manufacturers formed a fishmeal producers' corporation, through which sales of about 90 per cent of the fishmeal and oil sent abroad are channelled. The result of the formation of the sales corporation has been that the quality of the product has become uniform, marketing costs have declined considerably, better freight rates have been obtained and transport has been easier to hire, better prices have been obtained for the meal and there have been other minor benefits, all of which together gives a clear indication of the advantages of this system of foreign marketing.

By contrast, most of the producers of frozen and canned goods are medium-sized or small firms, which if they want to export part of their output have to make their own contacts abroad or use the services of specialized trading firms or buyers' representatives.

To get commercial information on foreign markets, firms can apply to a special State body coming under the Ministry of Foreign Affairs, which operates through commercial representatives in different countries, and also through foreign embassies with commercial attachés who can supply information and through international organizations.

In general it is difficult for a medium-sized or small businessman to establish a good commercial relationship with foreign countries and to find out the real practical possibilities for placing his products or those he could process and export.

The main problems for our industry in its foreign trade are access to information about markets and the way they operate, the obstacles and legal requirements that other countries impose and the distance of our country from the main centres of consumption, which makes freight more expensive and creates difficulties in obtaining adequate and frequent transport services. The instability of world exchange rates, which results in dizzy fluctuations in access to markets, is a factor which causes various fishing products to appear and disappear from among our country's exports every year, sometimes leading to failure to fulfil contracts and other commercial shortcomings, which to a certain extent affect even well established firms that have managed to achieve a solid reputation in their relations with other countries over the years.

Export opportunities for Chilean fish products, in the form of canned goods, centre on goods based on the Chilean pilchard, horse mackerel and mackerel for marine consumption and canned crustaceans and molluscs, such as spider crabs, seasnails, clams, chorito and cholga mussels and other species, which are high-quality products consumed in highly demanding markets.

Among frozen goods, the species with better prospects are again the Chilean pilchard, horse mackerel, mackerel and hake. For the first species a high-capacity plant has been established in the northern zone, which hopes to start export operations on a large scale, opening up the way for other frozen goods.

Among crustaceans and molluscs, the spider crab, seasnail, clam, prawn and chorito mussel appear again as species with real chances of selling on foreign markets. It is hoped that in the future artificial breeding and rearing of fish will provide products for foreign trade.

The fishmeal market is considered to be stable, and there is quite an important sideline in feed for fish breeding centres, which are daily growing more important in the world.

IX. Investment in fishing fleet and plant

A detailed study is at present being made on investment in industrial fishing, so that the figures we give are merely approximate and should be taken as such.

Before supplying figures for investment, we will give a brief description of the fishing industry's assets, both for the extraction stage and for the processing stage:

1. Industrial fleet

In 1982 the fishing fleet consisted of 340 vessels with a hold capacity of 62,023 m^3, the size of the fleet having increased by 43 per cent over the period 1973-1982 and the hold capacity by 103 per cent.

There are also 10 factory ships operating south of the parallel 43° S, with a hold capacity of 21,368 m^3.

The pelagic or seine fleet consists of 247 vessels with a hold capacity of 49,967 m^3, and the average life of a boat is reckoned to be 8 years.

The demersal fleet has a total of 93 vessels, with a hold capacity of 12,050 m^3 and an average life of about 10 years.

2. Fish processing plants

The following table shows the number of plants and their total capacity in tonnes of raw material per 8-hour shift for the different lines of production.

Industrial plants

Type	Number of plants	Installed capacity (tonnes of raw material per 8-hour shift)
Frozen*	71	1 013
Canned	37	1 277
Smoked and dry salted		
Reducing	37	11 944
Total	145	

* Includes 10 factory ships.

Total investment in industrial fishing is estimated at about $700 million, which breaks down as follows:

Pelagic fleet: $133 million;

Demersal fleet: $84 million;

Canning: $112 million;

Refrigeration: $91 million;

Reducing plant: $280 million.

X. Institutional and physical infrastructure of the fishing sector

The institutional organization of the State fishing authorities is governed by decree law No. 2442, issued by the Ministry of Economic Affairs, Development and Reconstruction in 1978.

This decree establishes the Sub-secretariat of Fishing, coming under the Ministry of Economic Affairs, Development and Reconstruction, among whose tasks is to propose rules and regulations for proper management of the fishing industry, to encourage small-scale fishing, to propose and co-ordinate the research required in the sector and to prepare and disseminate information on it.

The same decree also establishes the National Fishing Service, coming under the Ministry of Economic Affairs, Development and Reconstruction, which is responsible for implementing the national fishing policy prepared by the Sub-secretariat of Fishing and for monitoring compliance with it.

The Production Development Corporation, a semi-autonomous body coming under the Ministry of Economic Affairs, Development and Reconstruction, is involved in the fishing sector, its main function being to undertake activities aimed at contributing directly to the development of the country's production sector by granting credit and/or technical assistance or by acting through its agencies, which include the Fishing Development Institute, a corporation in private law concerned with research and advice in the fishing sector.

There are also universities and professional institutions which are concerned with training specialists and which in addition carry out research and studies in the sector.

The fishing sector also gets close collaboration from the Chilean Navy, which is responsible for defending the coast and exercises control over the maritime territory, and the Corps of Carabineros, which is responsible for keeping a watch on activities on land, and thus helps to maintain prohibitions and other types of restrictions.

Physical infrastructure

The physical infrastructure available to the fishing industry along the length of the coast consists of the following installations:

Fishing quays: 14

*State quays: 24

Fishing jetties: 3

*State jetties: 6

Fishing wharf: 1

State wharves: 2

Fishing cranes: 19

*State cranes: 7

Quay suction pumps: 16

Pontoon suction pumps: 33

* These are unloading installations and systems belonging to the State which are used by the fishing industry.

This infrasturcture is distributed between regions I and XII, particularly in regions I, V, VIII and X.

In the ports of Arica, Iquique, Antofagasta, Valparaíso, San Antonio, Talcahuano, Valdivia, Puerto Montt and Punta Arenas, there are 13 shipyards in operation, two of them belonging to the State, for the construction, repair and maintenance of fishing vessels, of the deep-sea type in steel and wood, up to a length of 30 metres, and there is one shipyard which can build vessels up to 120 metres.

In general, owing to the fact that our coast has no indentations offering natural ports, building a port involves considerable investment, so that the existing facilities have to be used to the maximum and shared by various different activities.

XI. International, regional and subregional co-operation in the fishing sector

To supplement activities in the exclusive economic zone, it is coming to be felt necessary to establish better contacts for bilateral and regional co-operation as a substantial element in the management of the seas by the coastal States.

Over the years our country has played an active part in the international, interregional and regional organizations concerned with fishing matters, acting through the Ministry of External Relations, with the advice of the competent fishing bodies of the Ministry of Economic Affairs.

Chile has habitually maintained relations with a series of international bodies such as the Commission for Inland Fisheries of Latin America, an FAO body whose functions are to promote research, with the FAO Committee on Fisheries and with the Latin American Economic System (SELA), which co-ordinates the Latin American position in international bodies and is responsible for regional co-operation through its action committees.

Internationally, Chile also participates in the Permanent Commission for the South Pacific (CPPS), with the aim of conserving and improving the use of hydrobiological resources, in the Commission for the Conservation of Antarctic Marine Living Resources (CEAMLR) and in the International Whaling Commission (IWC).

In questions of international technical co-operation, it deals with the United Nations Development Programme (UNDP), UNESCO and FAO, bodies which finance technical and scientific measures and co-operation programmes for economic and social development.

Our country maintains bilateral technical co-operation relations governed by basic agreements on technical co-operation, which are later followed up by specific agreements in other areas. Chile has signed this type of agreement in the fishing sector with Brazil and Japan.

It also maintains exchanges on fishing matters with Korea, Spain, Portugal, Peru, Ecuador, Colombia, Canada, the United States, Uruguay, Kenya and other countries, which it promotes through technical co-operation, training fellowships, exchanges of experts, technical assistance and visiting missions.

On financial matters our country has on various occasions turned to United Nations bodies such as FAO and UNDP, the Inter-American Development Bank (IDB), the World Bank, the Japan International Co-operation Agency (JAICA) and other institutions concerned with development.

The foregoing brings out the importance our country attaches to international relations of this type, which allow developing nations to play an active part in matters of interest and importance to them, enabling information and experience to be exchanged in the various fields making up the international fishing sector.

An example of the effectiveness of the participation of developing countries in such activities and international bodies is the establishment of the exclusive economic zone.

Generally speaking, the results obtained from international co-operation are long-term, and in this connection we consider that the most urgent matters on which alternatives and positions should be put forward have to do with the transfer of technology and with tariff and non-tariff barriers to the international fishing trade of developing countries.

XII. Prospects and policies for the national fishing industry

The economic development strategy applied in Chile has meant that the role played by the State in fishing has been a subsidiary one, following the principle that it should only take on those functions which by reason of their social and/or strategic nature cannot be undertaken by private persons and intermediate groups, leaving it to individuals, associations and enterprises to carry out those tasks which they are by nature more efficient at.

One of the State's prime functions is to regulate extractive activities, because they directly affect resources, but it also follows the policy that processing activities in fishing should be undertaken freely by the private sector, being governed almost exclusively by market forces and requirements.

The hydrobiological resources making up our fisheries should constitute over time a stable source of food for our people and an important source of employment and foreign earnings.

To achieve these ends a system is being established for administering the fishing industry in such a way that through the development of management rules extractive activity will be regulated so as to maintain stocks and ensure economic efficiency. In order to establish a system for managing the stocks, it is considered essential to undertake research into fishing which will supply appropriate information at the right time in order to minimize the effects of the interference with the ecological equilibrium caused by man's activities and direct those activities in such a manner that the stocks are maintained and renewed.

As explained in the chapter on research, a series of studies and research projects are being undertaken with a view to arriving at a good system for managing extractive fisheries, leaving full freedom of action for the subsequent stages of processing and marketing the products, which does not mean that the country cannot provide incentives to promote greater yields and more efficient allocation of fishing resources.

The State is also applying a special policy for artisanal fishing, the main aim of which is to raise the standard of living of this important section of the labour force by making its productive operations more efficient.

Table No. 1

Tonnage of fish and shellfish unloaded in 1973-1982

Year	Fish	Shellfish	Total
1973	581 417	82 593	664 010
1974	1 046 076	81 696	1 127 772
1975	804 222	95 236	899 458
1976	1 237 053	144 546	1 378 599
1977	1 204 958	113 991	1 318 949
1978	1 812 948	116 140	1 929 088
1979	2 428 196	131 278	2 559 474
1980	2 699 853	116 853	2 891 299 (1)
1981	3 290 670	102 786	3 503 087 (2)
1982	3 576 955	96 278	3 846 608 (3)

(1) Includes 74,523 tonnes of algae.

(2) Includes 109,631 tonnes of algae.

(3) Includes 173,375 tonnes of algae.

Source: National Fishing Service
Statistical Yearbook 1982
Santiago, Chile

Table No. 2

Share of the fishing sector in exports

Year	Per cent	Exports	
		Tonnes	Thousands of US$
1976	5.1	2 116	107 210
1977	6.6	2 185	144 033
1978	7.5	2 460	183 361
1979	6.2	3 835	236 334
1980	8.0	4 705	378 800
1981	10.6	3 821	404 859

Source: Central Bank of Chile, Santiago, Chile.

Table No. 3

Gross National Product

Millions of 1977 $

Year	Total	Fishing sector	Percentage
1976	261 945	1 259	0.48
1977	287 770	1 453	0.50
1978	183 361	1 712	0.55
1979	337 207	1 956	0.58
1980	363 446	2 104	0.58
1981	384 232	2 485	0.64
1982	329 155	2 704	0.82

Source: Central Bank of Chile, Santiago, Chile.

Table No. 4

Products exported in 1982

Product	Tonnes	Thousands of US$
Frozen	57 906	86 318
Canned	12 091	17 171
Smoked	2	18
Meal	770 563	254 554
Oil	89 232	26 879
Seaweed	25 715	18 794
Fresh	41	115
Eggs	832	1 010
Total	956 382	404 859

Source: National Fishing Serivce (SERNAP).
Reseña Evolución del Sector Pesquero en Chile en 1973-1982, Santiago, Chile, 1983.

Table No. 5

Production capacity by region

1982

Region	Frozen			Canned			Smoked			Reduction		
	Tonnes of raw material	Tonnes per 8 hours	Rate of utilization Per cent	Tonnes of raw material	Tonnes per 8 hours	Rate of utilization Per cent						
I	15 594	360	18	15 794	568	12				228 241	7 440	130
II	1 515	18	35	483	126	2				265 203	976	113
III	2 325	24	40	444	9	21				57 734	224	107
IV	1 567	18	36	35 123	112	131				77 692	352	92
V	3 610	28	72	541	6	50	47	1	26	575	8	40
VIII	30 046	125	134	13 821	260	30	25	2	7	657 639	2 856	128
X	15 420	83	103	8 249	131	35	6	25		73	8	5
XII	1 712	124	8	460	63	4						
Factory ships												
Country total	147 822	1 013	66	75 003	1 277	27	103	30	2	3 341 327	11 944	127

Reseña de la evolución del Sector Pesquero en el decenio 1973-1982

National Fishing Service 1983

Santiago, Chile