The South American Centolla Fishery

Introduction

Chilean and Argentine fishermen caught nearly 2,950 metric tons (t) of centolla, *Lithodes antarcticus* (Fig. 1) in 1984, about the same as in 1983 (Table 1). The species is also known as southern or South American king crab[1]. Most of that catch (almost 2,750 t) was taken by Chilean fishermen, although continued growth of the Chilean catch will be limited by the size of the resource.

While no definitive Chilean stock assessment estimates exist for the whole range of the fishery, most observers do not believe the resource will support significantly expanded fishing. The potential for increased centolla catches, however, may be greater off the coast of Argentina because of the country's broad Patagonian shelf which may provide excellent habitat for the crab. The Argentine Government, however, has not yet assessed the centolla stock on that shelf.

Argintine stock assessments conducted in the Beagle Channel where the current fishery is based suggest a very limited stock. Developments in the centolla fishery are of interest to the United States because some observers view centolla as a possible competitor for Alaskan king crab, *Paralithodes camtschatica*. U.S. imports of Chilean crab (primarily centolla) increased significantly from 190 t in 1977 to 550 t in 1984.

Species

The South American centolla fishery is conducted primarily for *L. antarcticus*. Smaller catches are also taken of a related species, centollon, *Paralomis granulosa* (Table 2), also called false southern king crab. Another related species, centolla espinuda, *L. murrayi*, also called Murray king crab, reportedly occurs in the southeastern Pacific, but no resource estimates have yet been compiled on it.

The centolla is closely related to the Alaskan golden king crab, *L. aequispina*, and its outward appearance is very similar except for size and coloration. Sexually mature male centolla average about 10 cm (shell length), and weigh about 0.7 kg, which is somewhat smaller than Alaskan king crab whose average weight is about 2.5 kg. The average size, however, varies with the grounds. In Chile, the average weight in the major commercial grounds located in the south is about 1.5-1.8 kg. No data are available on weight variation along the Argentine coast. In coloration, the centolla is similar to its more distant cousin the Alaskan red king crab, *Paralithodes camtschatica*, but the shade varies by depth, age, and stage of the spawning cycle. The bright red color of centolla and Alaskan red king crab gives the animals a special appeal in the marketplace. Centolla differs from the Alaskan red king crab, however, in that its body and legs are covered with sharp spines up to 1 cm long.

Table 1.—South American centolla catch, 1975-84, in metric tons.

Year	Chile	Argentina	Uruguay	Total
1970	400	200		600
1971	400			400
1972	400			400
1973	400			400
1974	511			511
1975	609	362	3	974
1976	1,028	279	2	1,309
1977	1,306	322	10	1,638
1978	1,908	370	4	2,282
1979	2,265	62	21	2,348
1980	1,351	77	5	1,433
1981	1,280	174	8	1,462
1982	1,473	203	1	1,677
1983	2,755	179	2	2,936
1984	2,746	200	NA	2,946

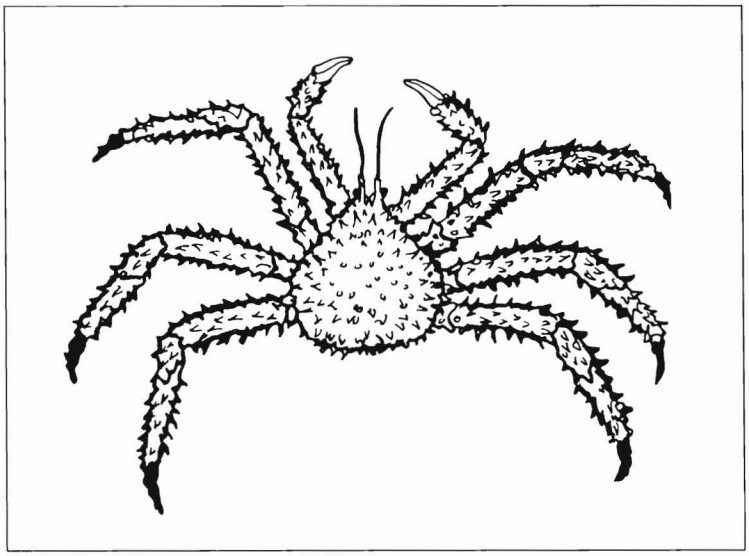
Source: FAO "Yearbook of Fishery Statistics" (1970-83 data); Servicio Nacional de Pesca, "Anuario Estadistico Pesquero" (1984 Chilean data); Instituto Nacional de Investigacion y Desarrollo Pesquero, unpubl. (1984 Argentine data).

Table 2.—Chile's centollon catch, 1978-84, in metric tons.

Year	Catch	Year	Catch
1978	637	1982	309
1979	952	1983	831
1980	429	1984	851
1981	310		

Source: Servicio Nacional de Pesca, "Anuario Estadistico de Pesca," 1978-84.

Figure 1.—South American centolla.



[1]The U.S. Food and Drug Administration has ruled that centolla cannot be labeled as "king crab" in the United States.

Habitat

The centolla is found along both the Pacific and Atlantic coasts of southern South America (Fig. 2). The crab primarily inhabits shallow water, usually in areas extending from the intertidal zone to depths of 150-200 m, although in some areas off northern Chile specimens have been found as deep as 600 m. The primary determining factor appears to be water temperature which is why the crab occurs in deeper water at the more northerly latitudes. The crab is found in areas with both rocky and sandy bottoms, but restricts itself primarily to the former during the molting period when it is most vulnerable to predators and tends to remain well hidden in the rocks and crevices.

Life History

Female centolla move into shallow water to molt and spawn during the southern hemisphere's spring and early summer seasons (December and January). Chilean tagging studies in the straits of Magellan and Argentine studies in the Beagle Channel have demonstrated that the crabs make no significant lateral migrations, but that they do move vertically in the water column, primarily for reproductive purposes. After mating they return to deeper water. The females carry the fertilized eggs for about 280-300 days before the larvae hatch the following spring (mid-September to early November). Young females produce about 5,000 eggs annually, while older females can produce 30,000 or more eggs. Females have been observed carrying from 2,000 to 60,000 eggs. Larval development comprises three stages of zoea and one of megalopa. The planctonic/zoeal life cycle lasts less than a month, with the actual time depending primarily on water temperature.

Male centolla molt later than the females, usually in March or April. The crabs move into shallow waters to molt and, because they are vulnerable to predators while their shells regenerate, they become less active and rarely venture from their hiding places among the rocks. As a result, catches are usually low during this period. Immature males usually molt twice a year, but this is reduced to a yearly molt long before the males reach legal size. Large males of 15 cm or more may go up to 2 years without molting. Centolla grow slowly. Studies conducted by the Argentine Instituto Nacional de Investigacion y Desarrollo Pesquero (INIDEP) determined that by the time the crab reaches a size large enough to be vulnerable to the traps, the growth rate of the carapace was an average of 9.3 mm per molt for males and 4.2 mm for females.

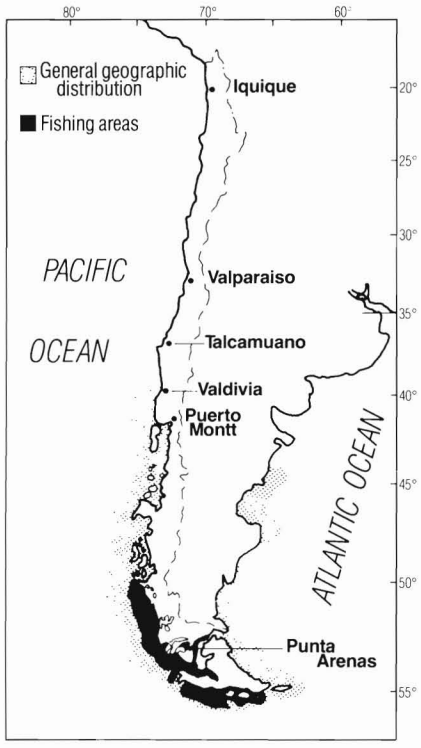


Figure 2.—Centolla distribution.

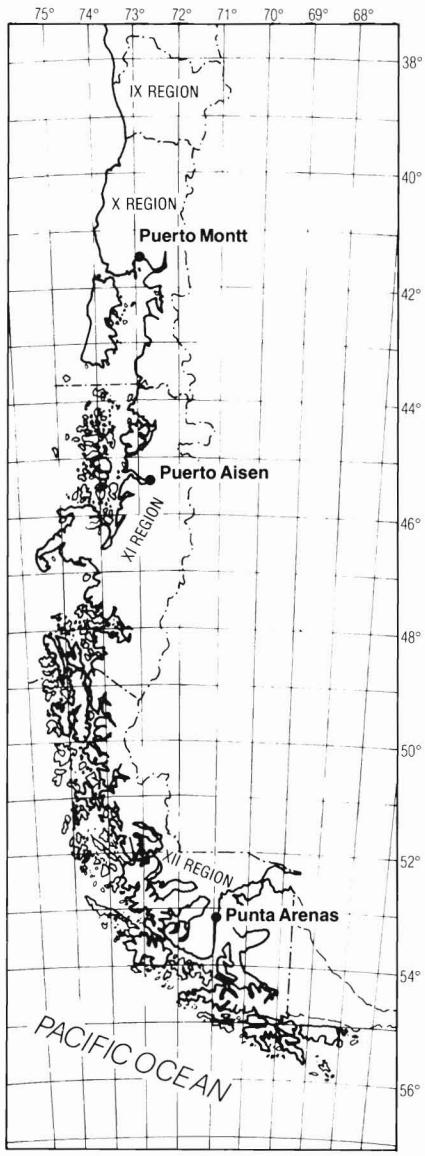


Figure 3.—Chile's southern administrative regions (IX-XII).

Fishing Grounds

Chile

Centolla is found from Cape Horn (lat. 55°5′S) north to Valdivia (lat. 38°48′S), although it has occasionally been observed as far north as Talcahuano. The primary Chilean fishery is located off the extreme southern coast from Canal Trinidad/Isla Wellington (lat. 50°S) to Cape Horn (lat. 55°40′S), a range of about 650 km, which covers an area of about 132,000 km (Fig. 2). The greatest known resource concentration is off southern Chile in the Straits of Magellan and surrounding area[2] and it is there where most of the commercial catch is taken. Until 1974, the fishery was limited almost exclusively to the Straits of Magellan, but has since been extended to several new grounds in Region XII.

Chile's southern administrative regions are shown in Figure 3. A much smaller and less productive fishery is centered around Puerto Montt in Region

[2]The grounds are located in Magallanes, Chile's XII Region, where almost all of the catch is taken.

X, about 2,000 km to the north (Table 3). Between those two areas are hundreds of kilometers of rugged coastline. There are no roads linking southern Chile with the more populated central area of the country. The south is isolated by 400 miles of mountains, glaciers, and deeply indented coastline. Chilean biologists believe that crabs occur along the entire coast south of Puerto Montt, but the size of the resource does not warrant the investment necessary to conduct fishing operations in the central area.

Argentina

There is a small traditional centolla fishery located on the Argentine side of the Beagle Channel on the southern edge of Tierra del Fuego. The growth potential of this fishery is minimal because of the limited stocks there. In August 1979 the Argentine Government imposed an 18-month ban on the taking of centolla in the Beagle and Moat Channels to allow stocks to recover. The ban was lifted in early 1981 but activity in the region was still strictly regulated and limited to artisanal fishermen. No centolla fishing is currently conducted on Argentina's broad Patagonian shelf, although some observers suggest that such an enterprise might be possible.

Table 3.—Chile's centolla catch by administrative region, 1982-84, in metric tons.

	Catch (t)		
Region	1982	1983	1984
I-IX			
X	30	21	47
XI	2	46	17
XII	1,441	2,688	2,682
Total	1,473	2,755	2,746

Source: Servicio Nacional de Pesca. "Anuario Estadistico de Pesca," 1982-84.

Table 4.—Chile's centolla catch per unit of effort in Region XII during the main fishing seasons (July to January) 1979-84[1].

	CPUE (crabs/trap)				
Area of Region XII	1979-1980	1980-1981	1981-1982	1982-1983	1983-1984
1	0.62	0.86	0.83	NA[2]	NA
2	0.55	0.48	0.60	0.62	0.82
3	0.55	NA	NA	0.99	1.73
4[3]	0.56	0.69	0.80	NA	1.10
4A	NA	NA	1.06	1.02	NA
5[3]	0.90	0.89	1.23	1.07	1.34
6[3]	1.36	2.15	1.54	1.68	1.91
7[3]	1.13	NA	1.07	0.97	1.17
8	0.98	1.34	0.81	1.01	0.96
9[3]	NA	1.39	1.33	1.19	1.23
10	NA	NA	NA	1.12	1.16

[1]Source: Beatriz Hernandez, "Southern King Crab (*Lithodes antarcticus*) of the Magellan Region, Chile," Instituto de Fomento Pesquero, 1985.
[2]NA = Not available.
[3]Primary fishing areas.

Stocks

Chile

No comprehensive study has been conducted to assess the centolla stocks. Most observers, however, believe that Chilean stocks of centolla are probably not sufficient to support greatly expanded commercial operations. The resource is thinly distributed in most areas and past attempts to establish such operations have resulted in depletion of the stocks in the target areas. One factor limiting the stocks is the extent of the habitat along the Chilean coast. Unlike the broad continental shelf which supports the Alaska's larger king crab fishery, the western coast of South America plunges steeply into the Pacific, thus limiting the potential habitat to a narrow band along the continental slope. Available data suggests that, except in a few specific areas, the resource is not yet being overfished. Available catch per unit of effort data, for example, has shown a slight increase in catch rates during recent years (Table 4).

Argentina

Argentine centolla stocks have not been fully assessed either. INIDEP has conducted some research in the Beagle Channel where the small Argentine fishery is currently based, much with the cooperation of the three Argentine companies which process centolla. Based on their research, INIDEP believes that the Beagle stock could yield about 136,000 crabs per year or, roughly, perhaps 315 t. INIDEP officials caution, however, that because of fluctuations in effort due to catch limitations during recent years, historical data is not sufficient to base a reliable maximum sustainable yield estimate.

Argentine stocks could eventually be proven larger, although no studies have yet substantiated this hypothesis. The Patagonian continental shelf off Argentina extends for hundreds of kilometers into the Atlantic, beyond the Falkland Islands. That broad shelf would appear to offer an excellent habitat for centolla and other crabs. Test fishing conducted so far, however, has found no large, commercially exploitable stocks. The Argentine Government has not made centolla a priority research subject, but plans do exist for more frequent research. The only indications of the size of the resource on the Patagonian shelf off Argentina comes from trawl fishermen who have reported incidental catches of centolla while fishing for hake and other demersal species.

Vessels

Centolla fishermen use several types of vessels ranging from small nonmotorized wooden vessels less than 7 m long to modern steel-hulled vessels of over 20 m. About 50 percent run 8-17 m. Most of the fishermen use wooden vessels that are built locally and average about 10 m in length. Fishermen using the larger steel-hulled vessels generally report the best catches. The smaller boats (<8 m) are not capable of deploying traps efficiently and some are allegedly involved in the illegal tangle net fishery.

One recently formed Chilean company has requested and received funds from the Chilean Development Corporation (CORFO) and the Inter-American Development Bank (IDB) for the construction of 45 vessels especially designed for the capture of centolla and other crustaceans. The vessels will be steel-hulled but smaller than those steel-hulled commercial vessels currently operating in the fishery. The 14 m vessels will be small enough to maneuver among the narrow fjords and channels of southern Chile, but also sturdy enough to operate in the open ocean. Each vessel will carry between 300 and 400 traps which will be raised and lowered with the aid of hydraulic winches. In addition to the 45 capture vessels, the company also has contracted to purchase 10 vessels to transport the catch from the grounds to the processing plant.

Fishing Methods

For many years tangle nets were the primary means of catching centolla. This method proved counterproductive, however, because the nets were not selective in their catch and centolla of all sizes became entangled. Many juvenile crabs were thus lost to the fishery because they died before they could be freed from the nets or were injured so badly that they had little chance of surviving. Argentina banned the use of nets to capture centolla in 1975 and Chile issued similar regulations in 1980. Thus, the crabs can be legally harvested with traps only. The traps are generally conical with a base diameter of 1.6 m and a height of about 0.6 m. They are deployed in sets of 10-20 traps and baited with fish, although some other baits such as marine mammals and birds are allegedly used illegally at times. Most of the vessels are equipped with mechanical winches to raise the traps.

The success of the fishermen depends on many factors, most importantly their knowledge and experience. The areas of highest concentration of the resource vary during the year according to the reproductive cycle, water temperature, and the strength and direction of currents. A knowledge of the area and the habits of the centolla permit the fishermen to place their traps in the best places for harvest. The steep underwater terrain in many places is also a factor which must be considered. If the traps are not set carefully on a relatively level site, many of them will land upside-down or on their sides, resulting in little or no catch. The traps are usually left in place for 2 days and then retrieved. If the catch is good, the traps are rebaited and set in the same place; if the catch is small, they are relocated. Fishermen consider three or four crabs in a pot after 2 days to be a good catch.

Regulations

Chile

Chilean officials first set fishing regulations for centolla in 1934, although these apparently were not based on any scientific investigation of the species' life cycle. Since those early regulations, the species has been more carefully studied. The Servicio Nacional de Pesca (SERNAP) has conducted a research program since 1979. The primary management regime is based on a prohibition on the take of juvenile crabs (<12 cm carapace[3]) and on all female crabs. Originally only the harvesting of berried females was prohibited, but because females carry eggs for a substantial part of the year and because the ban on taking berried females was being constantly violated, the capture, transportation, and marketing of all females was prohibited in 1973.

Table 5.—Chile's centolla catch in the major fishing area of Magallanes (Region XII) 1982-84[1].

Month	Catch (t) 1982	1983	1984
January	208	278	244
February	58	121	202
March	26	67	135
April	23	53	54
May	33	97	107
June	48	123	113
July	62	162	157
August	87	208	255
September	113	287	369
October	145	389	328
November	289	488	402
December	349	415	316
Total	1,441	2,688	2,682

[1]Source: SERNAP, "Anuario Estadistico de Pesca," 1982-84.

The only other major fishing restriction is that the crabs can only be caught by traps. Since 1980, the use of tangle nets has been prohibited. Chilean officials, however, are concerned about the enforcement of these regulations, especially in the more remote areas. Officials believe, for example, that a large number of tangle nets are still illegally employed. Other restrictions are occasionally enforced such as area closures. Fishing in the Porvenir area, for example, was closed from October 1981 to October 1985 because of the heavy fishing effort there since the beginning of the fishery.

The Chilean Government is currently preparing a new management plan for centolla. The major objectives of the proposed plan are to: 1) Reduce the risk of overfishing, 2) better utilize the resource, and 3) establish a permanent data base. The proposed plan would maintain the current regulations concerning minimum sizes, gear restrictions, and prohibition on taking females. The plan includes an additional regulation establishing a closed season from 1 December to 15 January to protect the crabs during the mating season.

The cost of conducting research precludes a regular program of stock evaluation and, as a result, the proposed plan does not entail the establishment of an overall quota based on an estimation of a maximum sustainable yield. The plan does make provision, however, for temporary area closures if officials believe that stocks are being depleted in small areas. Officials are particularly concerned, for example, about the status of stocks in some of the new fishing areas recently opened and for which little data on catch, size frequency, and effort are available.

The Chilean centolla fishery is highly seasonal. Fishing effort in the southern fishery tends to be at low levels during February to March, but begins to increase in June and is at its peak during November and December (Table 5). Full-scale commercial crabbing begins in August or September and most of the catch is landed between August and February. During 1984, for example, about 80 percent of the catch was landed in those months. In recent years the fishermen have been fishing more during the off season (February to May). While still low, catches during this period have been increasing (Table 5). Many fishermen, however, report that the condition of the crabs, especially during April is inferior and meat yields are lower.

Argentina

The Argentine Government changed the legal season and other regulations repeatedly throughout the 1970's. The continued changes reportedly confused fishermen, many of whom allegedly ignored the regulations, as well as enforcement agents who were hesitant to take action against violators. The result was that by 1979 the traditional fishery in the Beagle Channel showed signs of overfishing and the area was closed

[3]Measured from the orbit of the eye to the extreme lower half of the thorax.

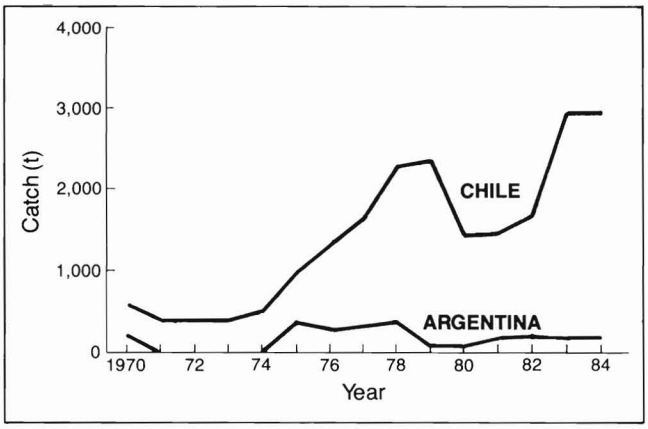


Figure 4.—The South American centolla catch, 1970-84, in metric tons.

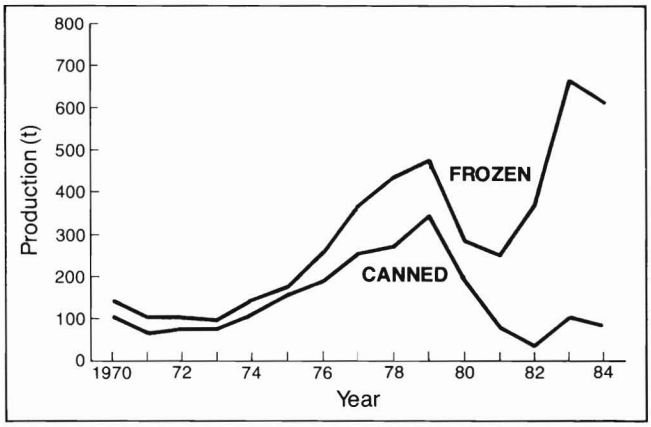


Figure 5.—Chilean centolla processing, 1970-84.

from August 1979 to January 1981. The Government passed a new resolution in 1981, based on a 2-year study by INIDEP, which prohibited the taking of centolla in the Beagle and Moat Channels from 1 October to 31 December each year. The resolution also limited the number of traps allowed in the area at any one time to 1,000. Argentina, like Chile, also totally prohibited the taking of females and set 12 cm as the minimum legal size for males.

Catch

Chile

Chilean centolla catches are at near record-high levels. Chilean fishermen harvested about 2,750 t of centolla in 1984, about the same quantity harvested in 1983 (Fig. 4), but substantially more than in 1982 and earlier years. The Chilean catch began expanding in 1974, reaching a peak of 2,300 t (the previous record) in 1979. Catches increased as fishermen intensified fishing efforts and expanded into new grounds. Initially, the fishery had been conducted almost exclusively in the Straits of Magellan. Beginning in 1974, fishermen also began to deploy traps in several new areas: Beagle Channel, 1974; Cape Horn Archipelago, 1976; Ano Nuevo Inlet, 1979; Nelson Strait, 1980; and the Trinidad Channel, 1982.

Even though fishermen expanded fishing to new grounds, the catch dropped sharply in 1980 (Table 1). Chilean sources report that the catch declines from 1980 to 1982 are the result of a combination of factors, primarily the fishermen reducing their effort as listed below[4], as demand and prices declined.

Chile's centolla fishing effort, 1979-1984.

Season	Thousand traps
1979-1980	1,444
1980-1981	649
1981-1982	734
1982-1983	824
1983-1984	1,172

In 1980 the catch was primarily marketed canned in Europe and the Chilean fishermen reduced their effort when the European market collapsed in 1980. The opening of a new market for frozen product in the United States has enabled fishermen to resume extensive fishing and set new records since 1982.

Argentina

The Argentine catch historically has been low compared with Chile's. In 1978, Argentina landed a record 370 t, but the catch has subsequently declined. The 1984 Argentine catch was 200 t, a 10 percent increase over the 180 t taken in 1983. Much of the Argentine total is actually caught by Chilean fishermen working aboard Argentine vessels.

Processing

The Chilean commercial centolla fishery began in 1928. Initially, the processing plants operated only from October to December and were closed the rest of the year. The industry developed slowly until the 1950's. Most of the catch was initially canned and marketed domestically. During the 1960's, freezing plants were opened. Today most of the plants operate all year. The major processing center is located at Punta Arenas in the Strait of Magellan. A smaller processing center is also located at Puerto Chacabuco for the small northern fishery. Processors report a meat recovery rate of about 22 percent of live weight (about the same as Alaskan king crab). Most of the meat is packed by hand to take advantage of the low labor rates. The meat is either frozen or packed in cans that vary from 110 to 240 g net weight. The frozen product is available as mixed meat, white meat, legs, claws, clawmeat, and whole.

There have been sharp fluctuations in processing patterns. Almost all of the catch was canned until 1976 (Fig. 5). Frozen production exceeded 100 t for the first time in 1977. After a collapse

[4]Source: Beatriz Hernandez, "Southern King Crab, *Lithodes antarcticus*, of the Magellan Region, Chile," Instituto de Fomento Pesquero, 1985.

in the traditional European market for canned Chilean centolla in 1980, Chilean companies turned to the U.S. market and as a result increased production of frozen centolla. Frozen production exceeded canned production for the first time in 1981. In 1984, frozen production totaled almost 530 t, about 90 percent of total Chilean centolla production.

Quality standards in Chile can vary widely. Chilean seafood companies have had more difficulty meeting U.S. standards than companies of any other Latin American country. However, most of the major companies packing centolla are now producing a good quality product and today very little centolla is detained by U.S. customs authorities. Some U.S. importers have helped the Chilean companies to improve their quality standards. In recent years, however, Chilean officials have expressed concern over the proliferation of small new companies created to process the increasing catch of centolla. Officials are concerned that the processing facilities of these companies are often relatively primitive and that quality standards are virtually nonexistent. Most buyers overcome this problem by inspecting both the product and the processing plant before making purchases.

Several major companies process and market centolla in Chile, and only a few operate their own fishing vessels. Instead, most have large vessels that travel throughout the major fishing areas and purchase the catch of artisanal fishermen who keep their catch alive in holding cages until they can be sold. The largest company dedicated to the capture and processing of centolla appears to be a newly formed enterprise, Pesquera Esmeralda[5], which was founded in 1984. The company claims that its processing plant, near Punta Arenas, is the most modern in South America. The plant includes a complete factory transported from Alaska for the processing of centolla, as well as other crabs. As mentioned, the company has received funds from CORFU and the IDB to purchase 55 vessels to supply its processing operations.

The Argentine centolla fishery is strictly artisanal, and virtually no information is available on its centolla processing facilities. Three companies located in Ushuaia process most of the catch, but a few additional companies involved in the processing of other seafood products also process a limited amount of centolla.

[5]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

Table 6.—Chilean centolla exports by value (1970-84) and volume (1978-84).

	Value ($US million)			Quantity (t)			
Year	Frozen	Canned	Total[1]	Fresh	Frozen	Canned	Total[1]
1970		$0.1					
1971		0.1					
1972		Negl.					
1973		Negl.					
1974		0.2					
1975		0.6					
1976		1.5[2]					
1977		3.0[2]					
1978		3.6[2]				206[2]	NA
1979	$0.8	3.3			73	757	830
1980					42	240	282
1981				9	62	149	220
1982	4.8	1.4	$6.1		361	137	498
1983	7.9	1.4	9.3		554	81	635
1984	5.9	1.4	7.4		443	84	527

[1]Totals may not agree due to rounding.
[2]Includes some other crabs.
Source: SERNAP, "Anuario Estadistico de Pesca," 1978-84.

Table 7.—Chile's frozen and canned centolla exports, in metric tons, by country of destination, 1981-84[1].

	1981			1982			1983			1984		
Country	Frozen	Canned	Total	Frozen	Canned	Total	Frozen	Canned	Total	Frozen	Canned	Total
U.S.	38.3		38.3	239.8	11.4	251.2	305.0	NA	NA	290.6	19.4	310.0
France	2.5	80.4	82.9		82.5	82.5	32.5	NA	NA	71.3	37.1	108.4
U.K.		24.8	24.8									
Japan				34.1	10.7	44.8	67.7		67.7	13.7	0.2	13.9
Italy		22.1	22.1	14.3	24.2	38.5				7.0	8.9	15.9
Netherlands				25.2		25.2				42.0	10.2	52.2
Germany								NA	NA	12.3	5.1	17.4
Argentina	12.7	0.5	13.2									
Mexico		10.9	10.9									
Belgium	4.0	1.6	5.6	41.1	2.8	43.9	36.6	NA	NA	23.8	9.7	33.5
Brazil		5.2	5.2									
Other	4.4	3.7	8.1	6.9	4.9	11.8	4.6	NA	NA	16.2	2.4	18.6
Total	61.8	149.1	211.1	361.4	136.6	497.9	554.4	81.0	635.4	476.9	92.9	569.9

[1]Source: PROCHILE, unpublished statistics, and Servicio Nacional de Pesca, "Anuario Estadistico de Pesca," 1983 (1983 canned data). Totals may not agree due to rounding, and discrepancies with U.S. and other Chilean trade statistics (Table 6) are unexplained. NA = Not available.

Exports

Chile

The Chilean centolla industry depends primarily on the export market; only about 25 percent of the catch is marketed domestically. Exports in 1984 totaled nearly 530 t (product weight) valued at $7.4 million (Table 6). Shipments declined in 1984, probably because of a corresponding catch decline. The industry has still not surpassed the record export level of 830 t reported in 1979. Most exports are now shipped frozen. In 1984, frozen shipments totaled 443 t, compared with only 84 t of canned product.

The markets and presentation of Chilean centolla have undergone dramatic changes since 1980. European countries (especially France) were the traditional market for centolla, purchasing more than half of the centolla exported from Chile between 1972 and 1981, mostly canned product.

However, the European market for

canned centolla collapsed in 1980. Large inventories of unsold centolla developed and Chilean companies were forced to seek new markets. Exporters reported good prospects in the United States. Sales increased sixfold in only 1 year, from less than 40 t in 1981 to over 250 t in 1982 (Tables 7 and 8). The United States is now Chile's most important customer for centolla. Purchases totaled 310 t valued at over $4 million in 1984, more than half of Chile's total centolla exports of nearly 570 tons (Fig. 6)[6]. Most of the centolla marketed in the United States is frozen. The European market, especially France, continues to be important, but much less so than before 1980. Demand in Europe has also shifted toward frozen centolla, and in 1984 all important European importers (except Italy) were ordering more frozen than canned centolla. The marketing of centolla in the United States may be affected by the U.S. Food and Drug Administration's decision not to allow centolla to be labeled as king crab, having decided that the term applies only the genus *Paralithodes* (Alaskan red king crab) and not *Lithodes* (centolla and golden king crab). A major U.S. seafood company has filed a petition with the FDA to change the ruling.

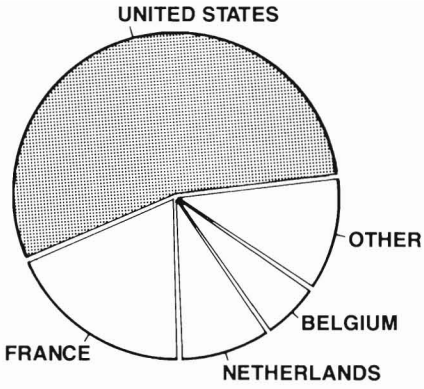


Figure 6.—Chile's centolla exports (total = 570 t) by country of destination, 1984.

Table 8.—U.S. crab imports[1] from Chile, 1977-84.

Year	Quantity (t) Frozen	Canned	Total
1977	190.4		190.4
1978	170.2	10.3	180.5
1979	173.6	0.5	174.1
1980	24.4		24.4
1981	53.4		53.4
1982	176.2	11.3	187.5
1983	415.4	3.9	419.3
1984	532.9	16.7	549.6

[1]Estimated at about 70-75 percent centolla. Discrepancy with other tables is unexplained.
Source: U.S. Department of Commerce.

[6]Available Chilean export data (Table 7) does not agree with U.S. import data in Table 8. The reason for this discrepancy is unknown, but could relate to various factors such as the time difference between shipment and receipt, losses in transit, and detentions. The problem is further complicated because U.S. import statistics do not list centolla separately, but include it in a larger crab and crab meat category. Observers believe that about 70-75 percent of U.S. Chilean crab imports is centolla.

Argentina

As stated, most of the production from Argentina's traditional centolla fishery is consumed locally; very little is exported. U.S. imports of all crab products (including centolla) from Argentina in 1984 was less than 4 tons. (Source: IFR-85/71).

Brazilian Fisheries, 1984-85

The Brazilian fishing industry is a relatively small sector of the national economy, representing only about 0.2 percent of the gross domestic product. Brazil exported a record $180 million worth of fishery products (mostly shrimp and lobster) in 1984, a 30 percent increase over 1983 shipments, but still less than 1 percent of the country's total exports. The Brazilian fisheries catch has grown steadily in recent years, reaching nearly 1.0 million metric tons in 1984, about 85 percent of which was taken in marine waters.

About 3.3 million people out of Brazil's population of 130 million depend on fisheries. Labor-intensive artisanal fisheries still account for half of the Brazilian fisheries catch. There are about 0.4 million artisanal fishermen in Brazil who still employ primitive fishing methods and gear. Domestic consumption of fishery products is also low, about 7.2 kg per capita in 1984, less than half of the world average of about 16.0 kg. Business opportunities for U.S. companies are limited, primarily because of restrictive Brazilian import regulations. Some opportunities do exist, however, for certain types of vessels, specialized equipment, and research devices. Other opportunities exist for U.S. companies leasing vessels and entering into joint ventures with Brazilian fishing companies.

The U.S. Embassy in Brasilia has prepared a 40-page report reviewing 1984-85 fishery developments. The report surveys important species (catfish, cod, shrimp), foreign trade, the closure of the whaling industry, fisheries management, development plans, export incentives, and other current developments. The report includes detailed statistical tables with catch, processing, and export data. U.S. companies can obtain a copy for $9.95 (personal checks or money orders) by ordering report PB-86-152469/GBA from NTIS, Springfield, VA 22161 and adding a $3.00 processing fee for each order. (Source: IFR-86/12 NTIS.)

Note: Unless otherwise credited, material in this section is from either the Foreign Fishery Information Releases (FFIR) compiled by Sunee C. Sonu, Foreign Reporting Branch, Fishery Development Division, Southwest Region, National Marine Fisheries Service, NOAA, Terminal Island, CA 90731, or the International Fishery Releases (IFR), Language Services Biweekly (LSB) reports, or Language Services News Briefs (LSNB) produced by the Office of International Fisheries Affairs, National Marine Fisheries Service, NOAA, Washington, DC 20235.

The Chilean Krill Fishery and Its Development

Introduction

Chile is one of five countries which has developed a commercial krill fishery. The Chilean Government believes that the country's small krill fishery could become an important part of the fishing industry in the next 10 years and is projecting export earning of $50-70 million by 1995.

IFOP, the Chilean Instituto de Fomento Pesquero (a government fisheries development corporation), first began to research the possibility of fishing Antarctic krill in 1974. Since then, two Japanese companies have established subsidiaries in Chile which have begun to catch and export krill. The 1983 catch totaled only about 5,000 metric tons (t), but Chilean officials believe that catches could be greatly increased and that krill could eventually become a major Chilean fishery. While the resource to support such a fishery does exist, a market for large quantities of krill products has not yet been developed.

Species

Six species of krill are found in the Antarctic: *Euphasia crystallorophias*, *E. frigida*, *E. superba*, *E. triacantha*, *E. vallentini*, and *Thionessa macrura*. *E. superba*, the principal species (Fig. 1), has been the subject of extensive scientific study in recent years because of the vast biomass that has been estimated by various researchers. Krill is widely recognized as the world's most abundant potential marine food source. Most published estimates of krill populations suggest a standing stock of 120-200 million t, with about 150 million t being the figure most commonly used.

Various authors provide estimates as high as 800 million t and one Soviet scientist (Moiseev, 1970) estimated 5,000-7,500 million t. Another Soviet scientist (Lyubimova, 1973), 3 years later estimated krill stocks at about 800 million tons. More recently some researchers have calculated a standing stock far below the commonly accepted 120-200 million t estimate. The validity of these lower estimates, however, has been questioned and they have not yet been published.

However, a stock of 120-200 million t could probably support annual catches of at least 40-50 million t, which could substantially increase the total world fisheries catch. The world catch of all species, for example, was only about 83 million tons in 1984. These potential krill catch figures are based on primary productivity estimates and thus only rough estimates of the potential yield from the fishery. While potential harvests cannot be forecast with any precision, the available estimates do suggest the possibility of substantially increasing the world's fisheries production. Chilean officials report that a large proportion of the Antarctic krill biomass tends to occur in the area of the Antarctic claimed by Chile, long. 53°-90°W (Fig. 2).

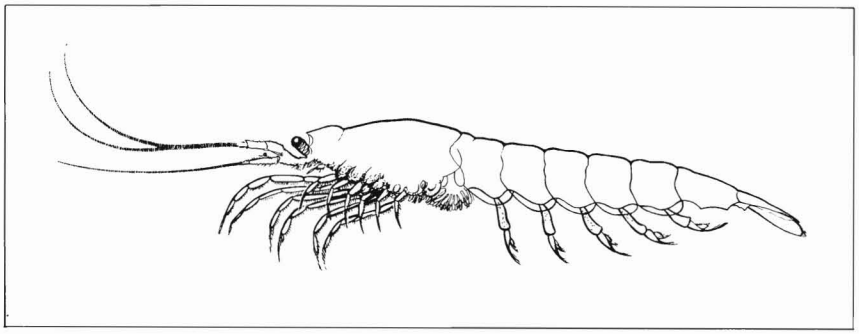


Figure 1.—The Antarctic krill, *E. superba*.

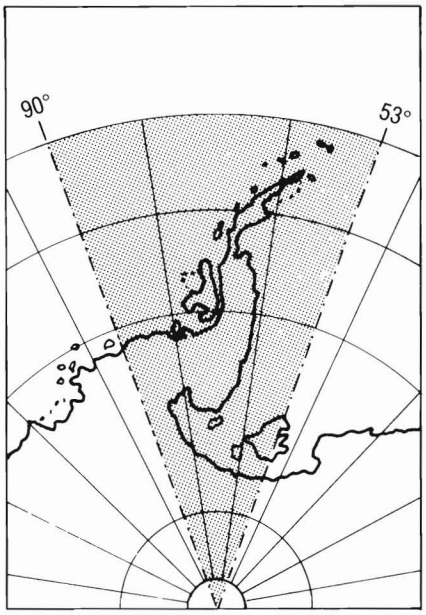


Figure 2.—Chilean Antarctic claim.

Antarctic krill measures about 4-5 cm in length and weighs about 1.0-1.2 g. Researchers have found that krill schools are very dense, up to 12 kg/m^3, and sometimes cover vast areas in dense swarms. Dense krill schools often congregate in the upper 100 m of the water column, especially near the surface. Daily vertical movements have also been observed, probably associated with feeding patterns. One of the key unanswered questions about krill is how long it lives. Some researchers believe that *E. superba* may reach sexual maturity at about 2 years and live a total

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of 4-6 years, although some estimates suggest life spans as long as 8 years[1].

Krill is found at depths ranging from 10 to 250 m. It is usually caught with midwater trawls with small mesh. Fishing is very difficult, however, because of the distance from important population centers and the severe climatic conditions. Handling the krill is also difficult because krill is very perishable. It has highly active digestive enzymes which will rapidly break down the flesh unless the catch is processed within 3-4 hours of capture. Even at cold Antarctic temperatures, fishermen have to be careful not to allow the krill to pile up over 0.3 m or heat will build up and spoil the krill in a matter of only a few minutes. Krill used for inedible products such as meal can be held for longer periods, but even that krill should be processed within 10-12 hours. It is therefore critical to develop procedures to quickly process the catch. This can prove extremely difficult as catch rates can be extraordinarily high, as much as 8 t in 5 minutes. Average catch rates are about 70 t per day.

Research

Krill has been the object of scientific study for more than half a century. The two major fishing countries, the Soviet Union and Japan, have each spent over $200 million studying krill. Serious information gaps, however, still exist. The most significant gaps include: The relationship between currents, surface rings, and krill distribution; the biology of all krill species; feeding habits; spawning areas; life history; predation; and the role of krill detritus in the Antarctic ecosystem.

CORFO, the Chilean Corporacion de Fomento de la Produccion (Corporation to Promote Production), through its fisheries subsidiary, IFOP, conducted a krill research project (Programa Krill) from 1974 to 1976 which included Antarctic fishing expeditions. The first Chilean expedition in 1975 deployed the research vessel *Valparaiso* and landed 60 t of krill. IFOP made two more cruises in 1976 using the *Arosa Septimo* (Table 1). Peeling machinery was tested on the ship and ashore.

The krill taken during these cruises was used for extensive studies by IFOP and the Universidad Catolica de Valparaiso which developed various edible products. Those products developed by IFOP included breaded products, empanadas, and krill fingers, hamburgers, croquettes, sausages, minces, and pastes. Some of these products were subsequently test-marketed in Chile. IFOP also distributed batter-dipped krill sticks in 1977 at a trade fair in Germany (FRG). IFOP determined that a commercial krill fishery was economically feasible with existing technology and attempted to turn the results of its research over to Chilean investors in 1976 and 1977, but was unable to find a company willing to make the necessary investments.

The Chilean Antarctic Institute (INACH) resumed krill research in 1981. INACH carried out three more cruises, using the *Itzumi* (1981) and the *Capitan Alazar* (1984 and 1985). These cruises were conducted as part of the international research programs conducted in the Antarctic, the First International Biomass Experiment (FIBEX) and the Second International Biomass Experiment (SIBEX) (Table 1).

Chile cooperates with several countries on Antarctic research. China, which wishes to establish a claim to Antarctic activities, has recently approached Chile concerning cooperative research. China has a research station on King George Island, within the Chilean territorial claim. It is believed that the Chinese are primarily concerned with ocean minerals, but some research on krill may be also conducted.

Table 1.—Chile's krill research expeditions, 1975-85.

Agency	Vessel	Captain	Chief scientist	Dates
IFOP	*Valparaiso*	Osvaldo Gonzalez	Oscar Guzman	January-February 1975
IFOP	*Arosa Septimo*	Constantino Fiusa	Oscar Guzman	May-June 1976
IFOP	*Arosa Septimo*	Constantino Fiusa	Oscar Guzman	September-October 1976
INACH[1]	*Itzumi*	Aldo Pedrini	Oscar Guzman	January-February 1981
INACH[2]	*Capitan Alazar*	Manuel Lagunas	Patricio Eberhard	January-February 1984
INACH[3]	*Capitan Alazar*	Manuel Lagunas	Patricio Eberhard	January-February 1985

[1]Conducted as part of FIBEX; INACH = Instituto Antartico Chileno.
[2]Conducted as part of SIBEX I.
[3]Conducted as part of SIBEX II.

Table 2.—World catch of Antarctic krill, 1980-85.

	Catch (1,000 t)					
Nation	1980	1981	1982	1983	1984	1985
U.S.S.R.	440.7	420.4	491.7	180.3	74.4	
Japan	37.8	27.8	35.2	42.5[1]	49.6[1]	40.0E[2,3]
Rep. of Korea			1.4	2.0	2.7	
Chile			0.5	4.9	1.6	2.8E
Poland	0.2			0.4		
France	Negl.					
Total[4]	478.7	448.3	528.8	230.0	128.3	NA

[1]This data differs from a report in the *Suisan-Keisai*, 8 November 1985, which reported 32,000 t for the 1983-84 season, 20,400 t for 1984-85, and 25,950 t planned for 1985-86, perhaps because their figures represent krill weight after processing, excluding that portion of the catch reduced to krill meal.
[2]E = Estimated from 1982-85 total published in *Chile Pesquero*, December 1985; NA = Not Available.
[3]Precise data is not available, but most published sources suggest the catch declined in 1985.
[4]Totals may not agree due to rounding.

Catches

IFOP's research work in 1974-76 was not immediately followed by a commercial fishery. Development of an actual krill fishery did not begin until a Chilean subsidiary of a Japanese fishing company launched an exploratory cruise in 1982 which landed about 500 t. The company followed up with a first commercial fishing in 1983 and landed about 4,900 tons, making Chile the world's third leading krill fishing country in that year after the Soviet Union and Japan (Table 2). Chilean companies reduced fishing effort in 1984 and the krill catch declined to only 1,600 t, dropping Chile to fourth place in the world krill fishery (Table 2). The decline reportedly resulted primarily from company decisions adjusting fishing effort to existing

[1]A good summary of available information on the biology of Antarctic species, including krill, is J. L. Bengtson's "Review of Information Regarding the Conservation of Living Resources of the Antarctic Marine Ecosystem," Univ. Minn., July 1978 (currently being updated). The major review of krill biology is J. W. S. Marr's "The Natural History and Geography of the Antarctic Krill (*E. superba*)," Discovery Rep. 32:33-464. Another monograph summarizing the krill potential is J. D. Kaylor and R. L. Learson's "Krill and Its Utilization: A Review," NOAA Tech. Rep. NMFS SSRF 769, July 1983, 10 p.

market demand and not from the availability of the resource. The Japanese companies which market the Chilean catch were concerned that the market could not absorb too large a catch which might cause a sharp price decline.

Press reports suggest that Chile increased krill catches to an estimated 2,800 t in 1985. Precise 1985 data, however, was not yet available for the other countries fishing krill but unconfirmed reports suggested that Chile probably continued its fourth place ranking. Press reports also suggested that in 1986 or 1987, a fifth country, Poland, would enter the Antarctic krill fishery. IFOP officials believe that Chile's small catch could easily be increased to 100,000 t, or more, during the next 10 years, based only on catches off the Antarctic Peninsula south of Chile and Argentina. IFOP projects that a catch of about 1.0-1.5 million t could eventually be possible.

Almost the entire Chilean catch is frozen whole aboard the vessel (Table 3). Actual procedures of the Chilean subsidiaries are unknown, but they probably follow the pattern of the Japanese vessels active in the fishery. The Japanese primarily process whole frozen krill. Most is frozen raw, but an increasingly large percentage is being boiled first. The Japanese are also increasing the production of peeled krill (Table 4). The meal is produced from krill which is not in good enough condition to process as an edible product and the offal which results from peeling the krill.

Table 3.—Chile's production and exports of Antarctic krill products by commodity, 1982-84.

	Production (1,000 t)			Exports (1,000 t)		
Year	Frozen	Meal	Total	Frozen	Meal	Total
1982	0.4	Negl.		NA	NA	NA
1983	2.9	0.2	3.1	2.3	0.1	2.4
1984	1.4		1.4	1.3	0.1	1.4

Source: Servicio Nacional de Pesca, "Annuario Estadistico de Pesca," 1982-84. NA = Not available.

Table 4.—Japan's frozen krill production by commodity, 1984-86.

	Amt. (1,000 t)	
Commodity	1984-85	1985-86
Whole		
Raw	15.7	15.6P[1]
Boiled	4.2	7.3P
Peeled	0.5	3.1P
Total	20.4	26.0

[1]P = Planned.

Companies

Chile's krill fishery has been developed by subsidiaries of two Japanese companies[2]. Press reports in the late 1970's suggested that various Japanese and European countries (France, Spain, and others) were considering investments in Chile to develop a krill fishery, but only the Japanese have pursued the opportunity. The two Chilean subsidiaries of Japanese companies currently fishing krill are: Empresa de Desarrollo Pesquero (EMDEPES) and Nichiro Chile. EMDEPES is a subsidiary of Nippon Suisan Kaisha Ltd. (NSK) and Nichiro Chile is a subsidiary of Nichiro Gyogyo Kaisha Ltd. (NGK). The two Chilean subsidiaries have each deployed a factory vessel in the fishery and have a combined work force of 150 employees. EMDEPES began the commercial fishery in 1983 and was followed by Nichiro Chile in 1984. The two companies normally deploy their vessels in the fishery for hake and other demersal species off southern Chile, but for 2 months during the Antarctic summer, one or two vessels are deployed for krill.

Government Promotion

IFOP has been promoting Chile's krill fishery since 1974. At the request of the Chilean Government, IFOP has devised a strategy for developing a large krill fishery by 1991. As part of that strategy, IFOP has prepared investment studies to provide interested foreign companies details on the feasibility of investing in the krill fishery. IFOP held a seminar on "Chile and the Fishery for Antarctic Krill" during October 1985. The seminar was attended by various Chilean Government and private industry specialists and dealt with: Chile's Antarctic program; international legal problems; climatic, oceanographic, and biological factors; and technical and economic aspects of fishing and processing krill. CORFO Deputy Director, Brigadier Fernando Hormazabal, inaugurated the seminar and stressed the importance of krill in Chile's overall Antarctic policy.

Marketing

Chile is the leading fishing country in Latin America. While most of the catch is reduced to fishmeal, a wide variety of high-quality seafood products is available to Chilean consumers. As a result, Chile has one of the highest levels of seafood consumption in Latin America, 15.8 kg per capita (live weight equivalent), about the same as in the United States. Chilean companies will thus find it difficult to introduce krill into the Chilean market unless they can develop an unusually attractive product or one that is very inexpensive. Small quantities probably could be sold in some of the product forms developed by IFOP, but any commercial success would necessitate reducing the cost of producing krill.

This limited domestic potential and the country's small population (about 12 million, 1985 data) suggest that only limited quantities of edible krill products can be marketed domestically. Local observers note, however, that Chile has begun to develop a salmon culture industry. Although current salmon production is small (about 600 t in 1985), the country's potential is much larger. Chile has the potential to build a sizeable aquaculture industry based on salmon and several other species. As this industry develops, a market may grow in Chile for fish feed made from krill.

The primary market for any major Chilean krill fishery would have to be in foreign countries, especially in Japan. Both EMDEPES and Nichiro Chile currently export their entire krill catch to Japan. The market for krill in Japan, however, is just beginning to develop. NSK, for example, has developed more than 40 different krill products, but sales have reportedly been poor. Both Chilean companies export the krill whole without processing it in Chile (Table 3). They receive about $350 per ton. The krill is then processed in Japan into various edible products. One Japanese executive believes that current krill

[2]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

prices could drop as much as 35 percent unless the companies involved carefully limit production of both domestic and Antarctic krill[3]. Japanese companies have been carefully monitoring inventories and market demands. As a result, those companies reduced purchases in both Chile and Korea during the 1984-85 season (Table 5).

Most of Japan's krill is marketed frozen (Table 4) in both edible and inedible forms. Data on consumption by commodity is not available, but unconfirmed reports suggest that most of the krill is utilized to produce inedible products.

Edible Products

The major edible krill products are primarily frozen whole krill, peeled and dried krill meats in shrimp-like presentations, and a small quantity of paste. A small boiled shrimp (sagura-ebi) is popular in Japan, and krill is being marketed as a less expensive substitute. Nippon Suisan has reportedly begun to can krill for Japan's school lunch program. Japan has also done considerable research on using krill to make surimi or a solvent extracted protein concentrate (marine beef), but these projects are still at the research level. Unconfirmed reports suggest that there is increasing interest in edible krill products in Japan.

Inedible Products

The major inedible products are frozen krill and meal for fish feed. One unconfirmed report indicates that more than half of Japan's krill catch is marketed frozen for fish feed in Japan's expanding aquaculture industry or for bait in Japan's popular recreational fishery. Meal produced from krill is used for fish feed. Krill meal reportedly commands high prices. The demand for krill fish feed is likely to increase as most observers believe that Japan's aquaculture industry is likely to continue expanding for the foreseeable future. Krill has proven a valuable dietary supplement for species such as salmon, sea bream, and kuruma shrimp. Carotenoids in the krill, rich in vitamin A, also enhance the red color of the flesh of salmon and other species which makes the harvested fish more marketable to color-conscious Japanese consumers.

IFOP officials report that Chile exported 2,000 t of krill worth $1 million in 1983, although shipments declined in 1984. Officials believe that shipments could be increased to $50-70 million in 1995. Increases of that magnitude, however, will depend on the development of krill products in Japan and other export markets. A great deal more product and market development will have to take place before the Chilean fishery can expand along the lines projected by IFOP.

Currently, the use of krill for many product forms is not possible because of the high fishing costs, low meat yields, and lack of suitable products for the offal. Until more progress is made in these areas, significantly increased krill fishing is unlikely. The Soviet Union and Japan, the two major krill fishing countries, have reduced their fishing effort. The Soviet Union sharply reduced krill catches in 1983 and 1984. Unconfirmed reports suggest that the Soviets reduced their fishing effort for a variety of reasons: The retirement of many older vessels, low demand for such edible krill products as pastes, quality control problems including high chlorine levels in krill products, and complications in the use of krill meal for animal feed[4]. The Japanese reduced their fishing effort during the 1984-85 season, but were planning to increase effort during the 1985-86 season (Table 5). Japanese observers report that the companies involved are only beginning to develop edible krill products and they are concerned that an over supply of krill could cause prices to decline precipitiously, especially given the limited size of the existing market.

Table 5.—Japan's krill supply and fishing effort, 1983-86.

Item	Supply (1,000 t) 1983-84	1984-85	1985-86
Antarctic krill			
Catch	32.0	20.4	30.0P[1]
Imports			
Chile	3.5	1.2	1.2P
Korea	1.5	Negl.	
U.S.S.R.	Negl.	Negl.	
Inventory	8.0	20.0	12.0P
Domestic krill			
Catch	65.0	50.0	NA
Inventory	15.0	20.0	20.0P
Total supply	125.0	111.6	NA
Effort: No. of trawlers	10	7	9P

[1]P = Planned, NA = Not available.

Economic Factors

IFOP believes that the development of Chile's krill fishery will probably rely primarily on importing used factory trawlers. The cost of initiating a krill fishing company is about $6.7 million, $6.0 million for the factory vessel and $0.7 million for working capital. Since krill fishing is only possible for about 5 or 6 months each year (November to April or May), krill ventures require alternative fisheries for the rest of the year. Two possible alternatives for krill fishing operations off the southern coast of South America include cephalopod fishing off Argentina or mackerel fishing off Chile. The two existing Chilean krill companies currently participate in the trawl fishery for demersal species off southern Chile. Chilean fishermen, however, have begun to criticize the Government's policy of allowing foreign companies to participate in the southern trawl fishery, so new significant demersal allocations for foreign fishermen are unlikely.

Chile would like to attract foreign investors to help fund new companies to catch and process krill. IFOP has prepared a feasibility study on krill fishing and has advertised for interested foreign companies with capital and technological capabilities.

New Development Law

The Chilean Government enacted a new law (Number 18,392) on 14 January 1985 to promote economic development south of the Straits of Magellan. The law applies only to shore-based facilities which are of little benefit to Chilean investors because companies would probably follow the existing system of using factory vessels and exporting whole frozen krill without processing the catch

[3]Press reports of 8 November 1985, quoted prices of about ¥100/kg domestic krill and ¥200/kg of Antarctic krill; the U.S. dollar was then trading for about ¥200.

[4]The Soviets have noted a sharp decline in the fecundity of pigs given feed with a high krill content. As a result they have reportedly restricted the use of krill meal to produce feeds for fur producing animals.

in Chile. The law could, however, benefit Chilean companies which begin to process krill in Chile. As the industry develops, it may be able to convince Government officials to modify the provisions restricting the benefits of the law to onshore facilities.

Antarctic Convention

Chile has both a territorial claim in the Antarctic (D.S. 1,747, made 5 Nov. 1940) (Fig. 2) and is a signatory of the Convention for the Conservation of the Antarctic Marine Living Resources (CCAMLR) which has as its primary objective the conservation and rational use of marine fauna within the Antarctic Convergence. CCAMLR, through its Scientific Committee (SC) can establish various resource management procedures (set quotas and area and gear restrictions). Signatory CCAMLR countries can also unilaterally require their own fishermen to follow management measures which best satisfy their economic and/or political interest, as long as they are consistent with CCAMLR management objectives.

The Soviet Union and Japan (both CCAMLR signatories) have been the most active since the beginning of the fishery in 1976. Because historic rights are based on the Law of the Sea provisions, if a quota-by-area system were established, these two countries might claim historic rights over important fishing areas within the Antarctic Convergence.

The Soviets began fishing for krill in 1961. Until 1983, the Soviets had been catching over 400,000 t of krill annually, more than 90 percent of reported world krill catches. Soviet catches, however, declined to only 74,400 t in 1984 (Table 2). Japanese fishermen have reported a smaller, but more stable fishing pattern. Japanese catches in the 1980's have varied from a low of 27,800 t in 1981 to a high of 49,600 t in 1984. Several other countries reported experimental catches in the 1970's and 1980's, but only the Soviet Union and Japan have demonstrated significant, sustained commercial fishing operations.

Filippi Parada, Executive Secretary of the Chilean section of CCAMLR, is increasingly concerned over Chilean rights to fish in Antarctic waters. He believes that the Soviet and Japanese fishing efforts may be used to demonstrate historic krill fishing rights in future negotiations over the Antarctic. As a result, Chilean officials are convinced that it is important for Chile to establish a commercial krill fishery so that it can also make a case for historic fishing rights. Francisco Ramirez, Vice President of CORFO, confirmed that the Chilean fishery will "permit Chile to solidly establish its claims of sovereignty (in the Antarctic)..." (Source: IFR-86/70.)

Japan's 1985 Fish Production Second Highest on Record

Japan's annual landings of fisheries and fish culture products for 1985 totaled 12,197,000 metric tons (t), a 5 percent decline from the historical high landings of 12,793,000 t in 1984. Distant-water and offshore fisheries production declined 8 and 6 percent, respectively, while inland fisheries production rose 3 percent. Production from coastal fisheries, marine culture, and inland culture were relatively stable.

By species, significant gains were recorded in the catches of herring (+43 percent), pink salmon (+36 percent), and large yellowfin (+17 percent), whereas sharp declines occurred in rockfish (−33 percent), skipjack (−29 percent), common squid (−28 percent), yellowtail (−20 percent), and bluefin tuna (−17 percent). The most important species landed in terms of quantity was sardine, with a catch of 4,242,000 t, followed by Alaska pollock with 1,511,000 t, and Pacific mackerel with 779,000 t. Sardine, Alaska pollock, and Pacific mackerel together accounted for 57 percent of Japan's total marine fisheries catch for 1985. The landings by major fisheries and species are shown in Tables 1 and 2.

Table 1.—Japan's catch by type of fishery 1979-85.

	Catch (1,000 t)						
Fishery	1979	1980	1981	1982	1983	1984	1985
Marine fisheries							
Distant-water	2,066	2,167	2,165	2,089	2,127	2,263	2,077
Offshore	5,458	5,705	5,939	6,070	6,433	6,937	6,547
Coastal	1,953	2,037	2,038	2,072	2,137	2,281	2,283
Marine culture	883	992	960	938	1,060	1,107	1,083
Inland fisheries	136	128	124	122	117	107	110
Inland culture	95	94	92	96	94	99	97
Total[1]	10,590	11,122	11,319	11,388	11,967	12,793	12,197

[1]May not add due to rounding.

Table 2.—Japan's marine fisheries catch by selected species, 1984-85.

	Catch (1,000 t)			Catch (1,000 t)	
Species	1984	1985	Species	1984	1985
Tuna			Cod		
Bluefin	36	30	Cod	114	136
Albacore	64	59	Alaska pollock	1,621	1,511
Bigeye	131	148			
Yellowfin, large	115	134	Subtotal	1,735	1,647
Yellowfin, small	19	20			
			Mackerel, Pacific	814	779
Subtotal	365	391	Flatfish	257	210
			Rockfish	15	10
Skipjack			Hairtail	34	31
Skipjack	446	316	Herring	7	10
Frigate mackerel	21	24	Red snapper	16	15
			Sardine	4,513	4,242
Subtotal	467	340	Sandlance	164	128
			Saury	210	243
Billfish	49	48	Yellowtail	41	33
Shark	35	34	Squid, common	174	125
Salmon (excluding pinks)	136	171	Octopus	43	40
Salmon, pink	22	30	Shrimp	61	53
Mackerel, Jack	136	152			
Mackerel, scad	98	73			
Mackerel, Atka	66	68			