

BENTHIC FISHERIES IN CHILE: Feasibility of co-management on an open access regime.

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10-5-83  
WORKSHOP IN POLITICAL THEORY  
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## PREFACE

Benthic fisheries in Chile are of great economic and social importance. Involved activities attract 47,7% of small-scale fisheries work force, satisfies in a 100% the internal fresh consumption demand and a high percentage of freezing, canning and seaweeds processing plants rough material needs.

The existence of considerable stocks, of an open access regime, of a high demand for shellfish and seaweeds on the world market and of efficient measures for improving sectoral harvesting and exports, induced a rapid and sustained development of benthic fisheries during the last years.

However, this sustained growth is not sustainable. main target species are over-exploited and drastic measures have been stated, wich are non respected and continously overpassed.

Recent fishing effort self-control and areas protection experiences at fishermen communities level, and some of the new Fishery Law contents, make possible to innovate in the management procedures, incorporating users into co-managements programs.

## BENTHIC FISHERIES EVOLUTION

### Landings composition and trends.

Benthic resource landings include mollusks, crustaceans, echinoderms, tunicates and seaweeds. During 1990, all them together represented a 5.9% of total Chilean fisheries landings and a 53.3% of the artisanal fisheries ones (table 1).

In twenty years (1971-1990), benthic resources landings have showed a sustained increase from 54.000 to 321.743 t. (graph 1). During this period the exploited species passed from 7 to 40, and during last ten years, main target species (five mollusks, one sea urchin and three species of seaweeds) have declined their participation from 91.8% in 1980 to 75.9% in 1990. Those data are showing a strong diversification trend, wich could be explained as a result of a growing demand and of traditional resources depletion atb their traditional areas. Seaweeds, whose landings records began in 1980, are a sustantial part of such trend.

Despite rules and measures put out by the authorities, there exists enough scientific evidence about over-exploitation for the main

target species. Benthic stock and fisheries assessment in Chile are scarce but some information exists. Biological and fisheries variables time series from 1985 to 1990® there are available for some of the main harvested species at Los Lagos Region (Fishery Zone IV, 42° to 45° S. ). From these, just three have been analyzed LOCO (*Concholepas concholepas*), a big snail; the sea urchin ERIZO (*Loxechinus albus*) and CLAWS (*Venus* sp.). All them presents over-exploitation symptoms, Erizo being the more depleted. Year by year the fleets totally depletes -in a commercial sense- Erizo fishing areas and then migrate to southern ones (Jerez, 1991). Loco and Clams shows marked trends to abundance, yields and average sizes diminishing and, for Loco, some areas seems over-exploited by recruitment over-fishing (Jerez, 1990).

A World Bank Mission which recently assessed the Chilean Fisheries Sector, in regards to benthic fisheries concluded:

- a) All benthic fisheries in traditional areas (North to 45° S.) are over-exploited;
- b) There exists increased fishing potential to the South of 45°S., but management is recommended and
- c) At Fishery Zones I to III there is not increased fishing potential and Mission recommends "urgent management". (fig. 1)

#### Work force characteristics and trends

These fisheries are mainly exploited by artisanal fishermen which use different work-intensive techniques. Semi-autonomous and skin diving are the most common ones for harvesting mollusks, urchins and tunicates. Crustacean are also harvested by divers, but mostly of them are exploited by traps. Seaweeds exploitation is done by shore gatherers and small non motorized boats.

Small-scale fisheries work force and fleet have quickly increased. During 1979-1989 period, fishermen number grew from 35.279 to 57.996, with a yearly average growth rate of 5% (Graph 2). During the same period, the artisanal fleet grew from 6.849 to 15.199 vessels, entering bigger and better equipped boats (Table 2), During 1982-85, a credit program took place for strengthening artisanal fishing capability, which transferred financial resources in the order of 15 million dollars.

Both, fishermen and fleet, shows a concentration trend at Fishery Zone IV (Fig 1), which its due to a higher relative resource abundance, the existence of a great exclusive area for artisanal activities, sea conditions that allows diving during great part of the year, still undepleted areas and a high demand from the numerous processing plants established there.

Shellfishermen ("mariscadores") and seaweed gatherers ("algueros") are in the order of 15.828 and 11.852 workers (1989). It can be assumed that, in general terms, those two groups belongs to different socio-cultural contexts. Shellfishermen comes from a fishing and maritime tradition. Their activities implies a big amount of specialized skills and competences dealing with

navigation, diving, working at sea and so on, of the game kind than fishermen. Archaeological findings reports the existence of shellfishermen peoples established all along the Chilean coast from the pre-hispanic period. Today's central and northern shellfishermen tends to live at rather small and isolated towns, settled near their traditional harvesting areas.

Seaweeds gatherers, instead, comes from different contexts. They came into scene during the early 80's crisis, from poor urban zones and depleted agricultural systems. During a pair of years they formed precarius villages at the coasts surrounding seaweeds natural prairies at regions IV (Fishery Zone II), VIII (Fishery Zone III) and X (Fishery Zone IV). Their main target specie was Gracilaria sp., which was quickly depleted. Today's Gracilaria production is done at aquaculture centers, some of which are owned by "algueros" associations and unions.

During the last years, a new form of productive organization its emerging among "mariscadores" from Fishery Zone IV and V. Several Erizo and King crabs fishing units now are working vertically integrated to processing plants under contract basis trough transporters-intermediaries. Such a productive organization responds to plants rough material supply needs and to the fact that the harvesting areas are more distant each year. It could be assumed that a semi-industrial fisherie its in a development phase.

"Mariscadores" and "algueros" are similar at one point: they have the same perceptions about the resources conditions. A recent study (Cereceda t. el. 1991) shows that both groups thinks that their target resources are diminishing due to over-exploitation. Those perceptions are different from the fishermen ones. They think in a minor percentage the same, but due to industrial fishing. That could mean that "mariscadores" and "algueros" are feeling guilty for their resources depletion.

#### MANAGEMENT OPTIONS FOR BENTHIC FISHERIES.

From a traditional perspective, improving management means more control, surveillance and rules enforcement. This kind of response is possible but it needs a high amount of financial, human and material resources which are so scarce.

According official information, total public investment for fisheries management in Chile represents a 0,3% of total fish products exported value. That amount equals roughly three million dollars, part of which are used for controlling 870 industrial vessels, 15.000 artisanal boats, five million t. of landings from 100 harvested species and 1.500 aquaculture centers.

Our opinion is that, in this context, no strengthening policy will be enough for an effective management plan in order to recover and sustain benthic fisheries resource base. Worldwide experiences demonstrates that fishermen have much to do in this field (Christy,

1982, Kurien, 1989; Hannesson, 1989 and others) and that fishermen participation and cooperation is so necessary and usefull.

#### The co-management option

Benthic fisheries are based upon the harvesting of sesile species that during their adult phase, lives at or depends from the bottom of the sea for their supervivence. Such a condition (sedentarism) makes them highly vulnerable to intensive fishing efforts, but allows their management at local levels by co-management mechanisms.

Such an option assumes that the resources are not open access. According Berkes statements (Berkes n.d.), Chilean fishery resources could be defined as "open access common property resources" ("res nullius"). Nevertheless, Chilean new Fishery Law modifies in some extention such definition. New rule creates a figure of "controled access common property resources" ("res communes"). New conditions in Chile are:

- a) establishment of an exclusive fishing area for artisanal fisheries, covering five miles from shore line base lines, interior waters of southern regions and around Chilean oceanic islands;
- b) A Licence system authorizing fishermen to operate into their enrollment region fishing areas only;
- c) Limited licences at any region for harvesting resources plenty or over-exploited;
- d) Benthic resources management and harvesting areas for community based management programs;
- e) A "Benthic harvesting and processing regime", which means that for benthic plenty exploited fisheries, there could be an individual harvesting quota for fishermen and individual processing quotas for enterprises.

The above conditions modifies the open access common property status of benthic resources and creates a controlled access common property figure, defining a res-communes resource.

In addition, the same legal framework creates some participatory mechanisms and instances at National, Zonal and Regional levels, where all player involved in fisheries development and management could be represented.

#### Feasibility of co-management.

Available information indicates that there are around 59 artisanal coves speciallized in benthicresources harvesting along the Chilean coast (Table 3). According their fishermen number, 37% are small (less than 100 workers), 35,6% are medium sized (100 to 300) and 27 are big ( more than 300). Among the biggers, 7 (44%) have 1000 to 7000 fishermen, all them at southern zones. Medium sized ones are rather homogeneously distributed along the country, but with a third of them at Fishery Zone IV. Small coves are concentrated at northern zones, none existing at fishery zones IV and V.

As it has been pointed out, southern zone have it least to groups of of fleets harvesting benthic resources: artisanal and semi-industrial. Their difference lies in their ways of integration to markets: artisanal boats works independently of plants, selling their landings to middlemen, while semi-industrial works vertically integrated to industry. By the contrary, northern shellfishermen are all artisanal and no integration to plants have been reported.

We have also showed that harvesting areas at South are so crowded in comparison to northern ones and landings take place on a few big coves. At North, instead, local communities have more exclusive harvesting areas and landings take place at each cove, which are widely disperse.

The above stated characteristics leads to think that enforcement capabilities must be focused to bigger coves and crowded areas, while at middle and small size ones co-management strategies could be developed.

Co-management feasibility is supported by actions performed by fishermen themselves, who are protecting areas and self-controlling "their fishing effort:

- Those experiences takes place at least at 20 small and medium sized coves from Fishery Zones II and III;
- Fishermen associations exists for all these coves, and resource protection is being one of their main targets. Those organizations are federated at provincial, regional and national levels;
- Local fishermen are cooperating among themselves and with their neighbours to protect their own areas and to respect each other ones, and
- All them seeks to cooperate with management and technical entities in order to get legal and technical support for their needs.

New rules and fishermen attitudes and behaviours are making possible Chilean benthic fisheries co-management. Fishermen challenges rejoin management authorities ones in order to sustain benthic fisheries resource base. Research institutions must to develop interdisciplinary applied research programs and to cooperate with fishermen to achieve information and to develop both, management plans and common property institutions.

FISHERMEN, SHELLFISHERMEN AND SEAWEEDS GATHERERS BY FISHING ZONE, 1980, 1983, 1989

ZONE	FISHERMEN			SHELLFISHERMEN			SEAWEEDS GATHERERS		
	1979	1983	1989	1979	1983	1989	1979	1983	1989
ZONE I	1.958	1.605	1.731	425	866	1.251	181	411	80
ZONE II	1.313	1.789	1.492	1.151	2.818	2.008	2.211	718	289
ZONE III	10.441	9.021	12.161	2.349	5.733	4.177	4.246	4.727	4.817
ZONE IV	3.377	4.987	8.266	1.829	4.251	7.984	2.286	5.452	6.666
ZONE V	1.322	1.053	2.662	101	151	408	0	0	0
TOTAL	18.411	18.455	26.312	5.855	13.819	15.828	8.924	11.308	11.852

SOURCE: IFOP

ARTISANAL FLEET BY FISHING ZONE YEARS 1979, 1983, 1989

ZONE	1979	1983	1989
ZONE I	612	898	1.211
ZONE II	998	1.287	1.184
ZONE III	2.977	3.659	4.008
ZONE IV	1.636	4.251	7.590
ZONE V	376	611	1.206
TOTAL	6.599	10.706	15.199

SOURCE: IFOP

BENTHIC COVER, BY FISHERY ZONE AND SIZE

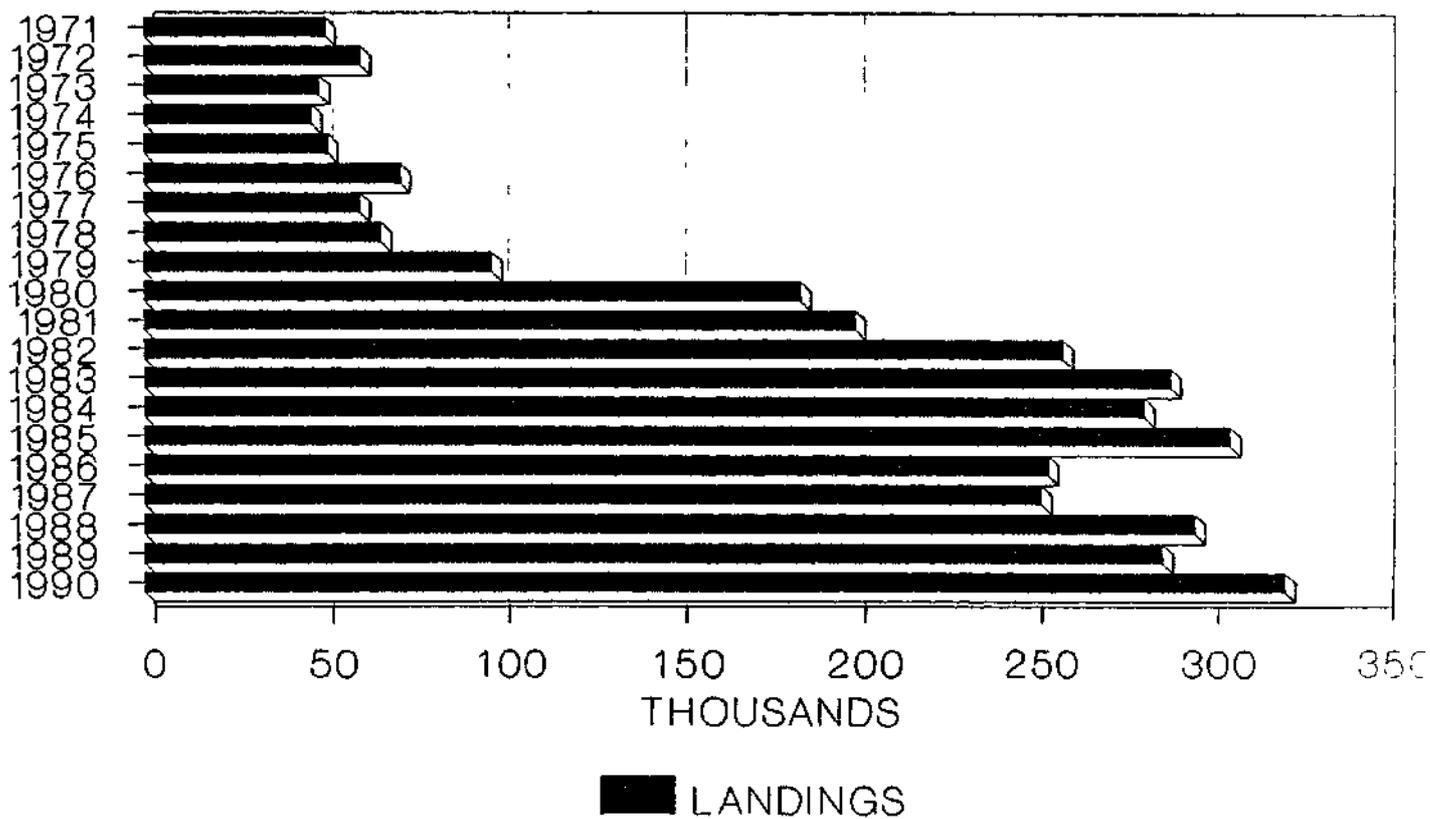
FISHERY ZONE	LARGE COVES ( > 300 WORKERS)	MEDIUM COVES ( 100-300 WORKERS)	SMALL COVES ( < 100 WORKERS)	TOTAL	
I	1 (6.3)	4 (19.0)	3 (13.6)	8 (13.5)	
II	0 (0)	4 (19.0)	10 (49.5)	14 (23.7)	
III	3 (18.8)	4 (19.0)	9 (40.9)	16 (27.1)	
IV	10 (62.5)	7 (33.3)	0 (0)	17 (28.9)	
V	2 (12.5)	2 (9.5)	0 (0)	4 (6.8)	
TOTAL		16	21	22	59

CUMMULATE PERCENTAGES

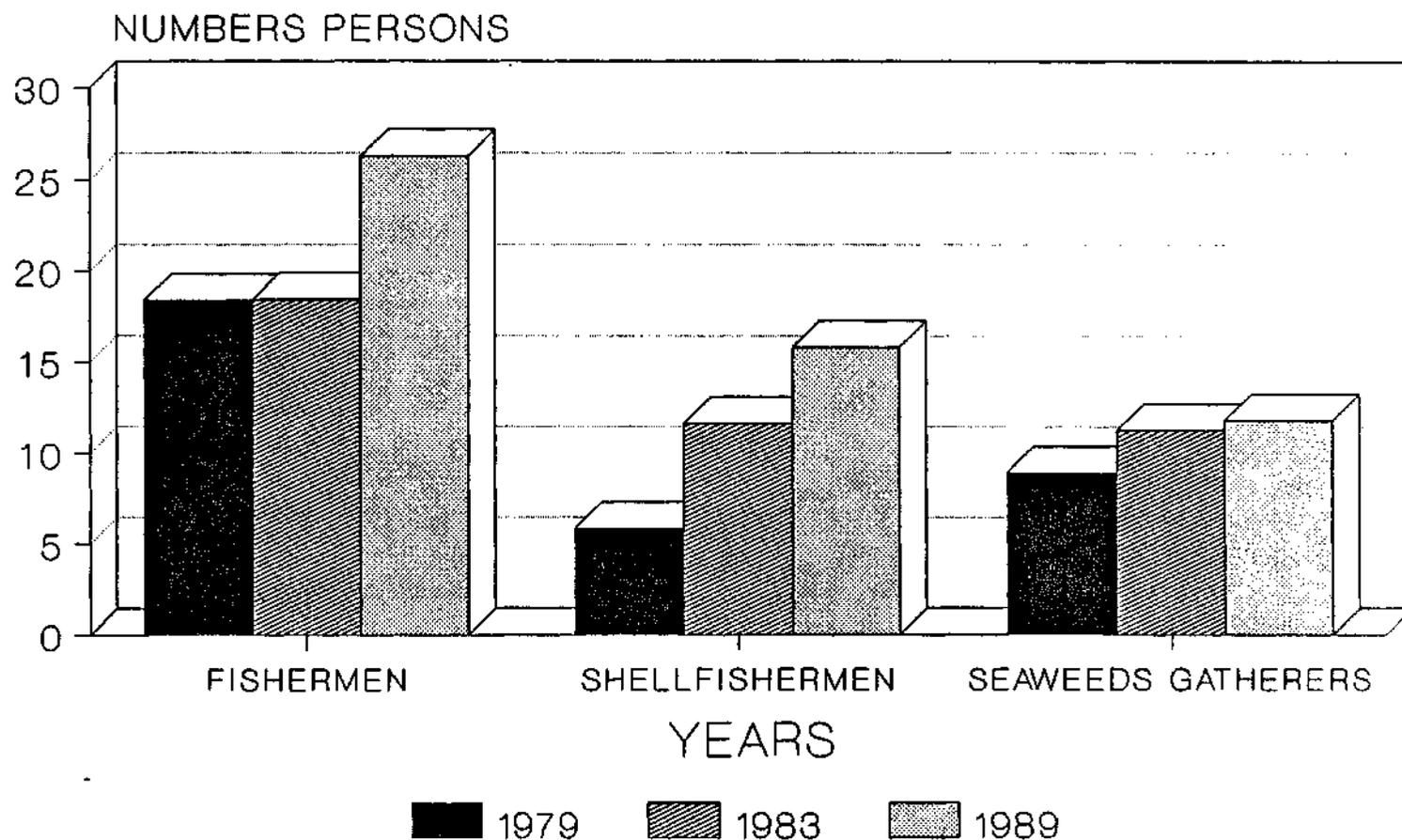
FISHERY ZONE	LARGE COVES ( > 300 WORKERS)	MEDIUM COVES ( 100-300 WORKERS)	SMALL COVES ( < 100 WORKERS)	TOTAL
I	6.3	19	13.6	13.5
II	6.3	38	59.1	37.2
III	25.1	57	100	64.3
IV	87.6	90.3	100	93.2
V	100	100	100	100

GRAPH. I  
CHILE, BENTHIC RESOURCE LANDINGS  
1971-1990

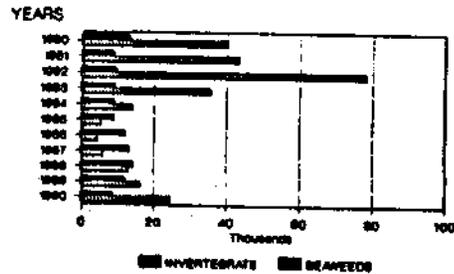
YEARS



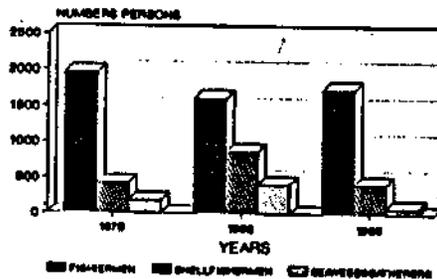
# CHILE, WORK FORCE EVOLUTION 1979-1983, 1989



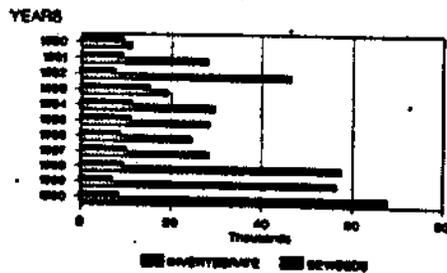
**FISHERY ZONE I  
BENTHIC RESOURCE LANDINGS 1980-1990**



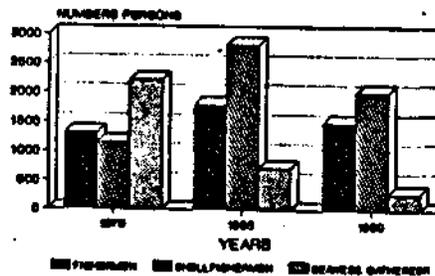
**WORK FORCE BY FISHING ZONE I  
1979-1983, 1989**



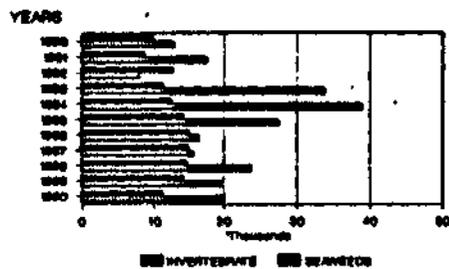
**FISHERY ZONE II  
BENTHIC RESOURCE LANDINGS 1980-1990**



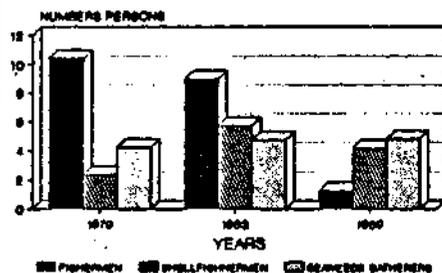
**WORK FORCE BY FISHING ZONE II  
1979-1983, 1989**



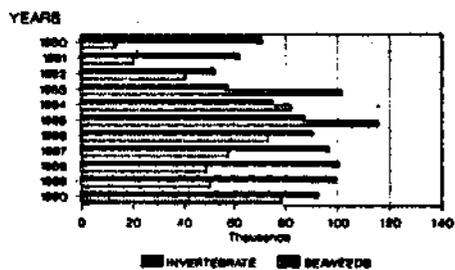
**FISHERY ZONE III  
BENTHIC RESOURCE LANDINGS 1980-1990**



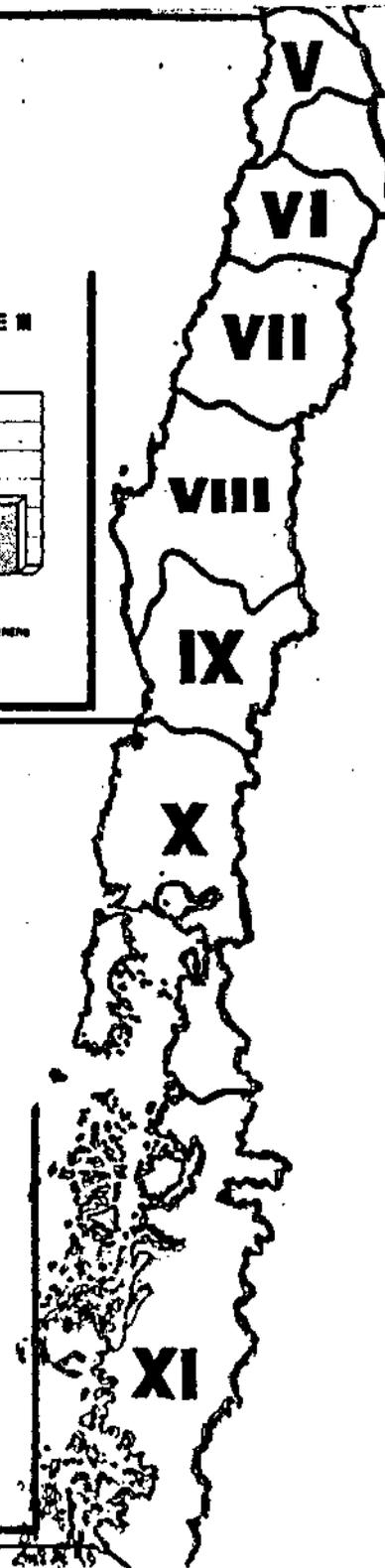
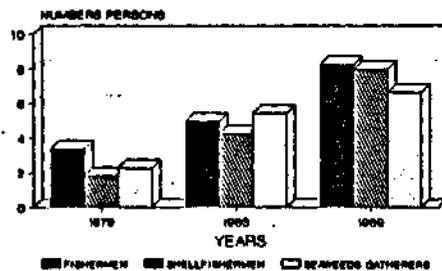
**WORK FORCE BY FISHING ZONE III  
1979-1983, 1989**



**FISHERY ZONE IV  
BENTHIC RESOURCE LANDINGS 1980-1990**



**WORK FORCE BY FISHING ZONE IV  
1979-1983, 1989**



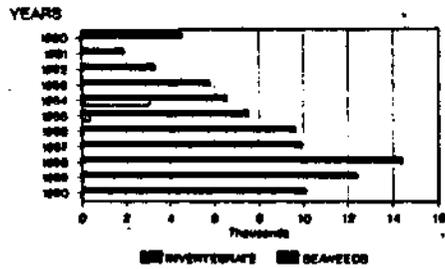
33°

30°

25°

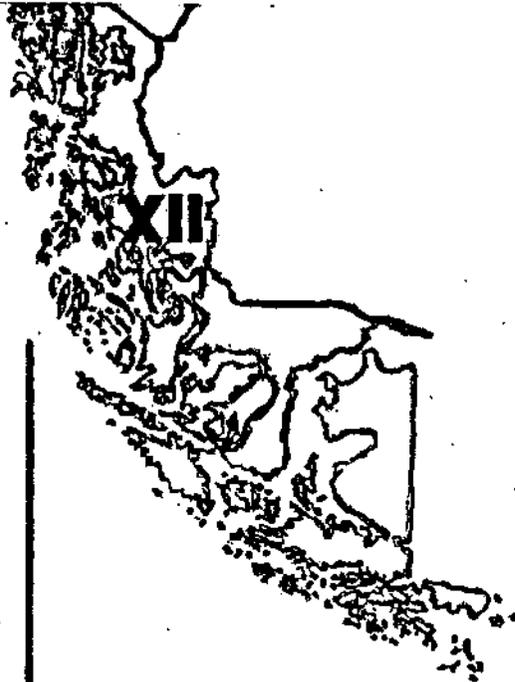
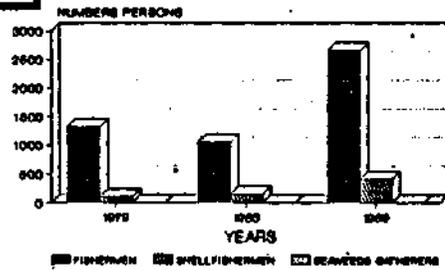
30°

### FISHERY ZONE V BENTHIC RESOURCE LANDINGS 1980-1990



35°

### WORK FORCE BY FISHING ZONE V 1979-1983, 1989



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