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Reconnaissance and exploitation of the Chilean jack mackerel by the Polish fleet in 1978-1984*

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SUMMARY: The milestone for beginning the exploitation of Chilean jack mackerel by the Polish fleet in the waters extending beyond the Chilean 200 mile Exclusive Economic Zone was the trip of m/t PERSEUS under captain K. Kopański on the voyage of 1978 and 1979. It was followed by the cruise of research vessel PROFESOR BUGUCKI from the Sea Fisheries Institute in Gdynia in 1980. During her trip the locality of the richest fishing grounds was determined, and the behaviour of the Chilean jack mackerel was studied in relation to fishing effort. In 1982-1984, the Polish fishery exploited the resources in the waters adjacent to the Chilean EEZ, taking in the last year 80 000 tons. The length range of the caught fish was 30-68 cm, and fish measuring 32-45 cm (assigned to age groups III-V), prevailed in the catches. The CPUE index showed two peaks within a 12 month period: firstly in January-February, and secondly in June-September. Fish concentration showed a considerable diurnal migration in the water column. During the daylight hours fish were scattered from 80 to 240 m depth from the surface, whereas at night, the jack mackerel shoals moved to the upper layers extending between the surface and 80 m depth. The values of the von Bertalanffy's growth equation parameters-L_∞, K, t_0 were 72.08 cm, 0.223 and -0.038 respectively.

Key words: History, description of fishery, growth parameters.

RESUMEN: RECONOCIMIENTO Y EXPLOTACIÓN DEL JUREL CHILENO POR LA FLOTA POLACA EN 1978-1984. – El viaje del pesquero polaco PERSEUS al mando del capitán K. Kopański durante los años 1978 y 1979 marca el inicio de la explotación del jurel chileno más allá de las 200 millas de la ZEE. A esta campaña siguió otra de carácter científico por el B/I PROFESOR BOGUCKI del Instituto de Pesca Marina de Gdynia en 1980. Durante estos cruceros se localizaron ricos caladeros y se estudió el comportamiento del jurel en relación con la pesca. Desde 1982 a 1984 la flota polaca explotó este recurso en aguas próximas a la ZEE chilena, alcanzando las 8.000 Tm. en el último año. Los ejemplares capturados midieron entre 30 y 68 cm siendo las tallas más abundantes las comprendidas entre 32 y 45 cm, correspondientes a III-V grupos de edad. El índice CPUE mostró dos máximos en el periodo de 12 meses: uno en enero-febrero y el segundo en junio-septiembre. La concentración de estos peces mostró una fuerte migración en la columna de agua . Durante las horas de luz se sitúan entre los 80 y 240 m. de profundidad y durante la noche entre la superficie y los 80 m. de profundidad. Los valores de los parámetros de la ecuación de von Bertalanffy-L_∞, K, t_0 fueron 72.08 cm, 0.223 y -0.038 respectivamente.

Palabras clave: Historia, descripción de la pesquería, parámetros del crecimiento.

INTRODUCTION

Chilean jack mackerel (*Trachurus murphyi* Nichols, 1920) inhabiting the waters extending from the coasts of South America to New Zealand (BAILEY 1989) is distinguished from others species belonging to genus *Trachurus* by a large number of scutes on the lateral line (93-107) and the higher relative height of scales and scutes on the curve lateral line. (BERRY and COHEN 1974). The species is closely related morphologically to *T. symmetricus* occurring in the NE Pacific and *T. declivis* of

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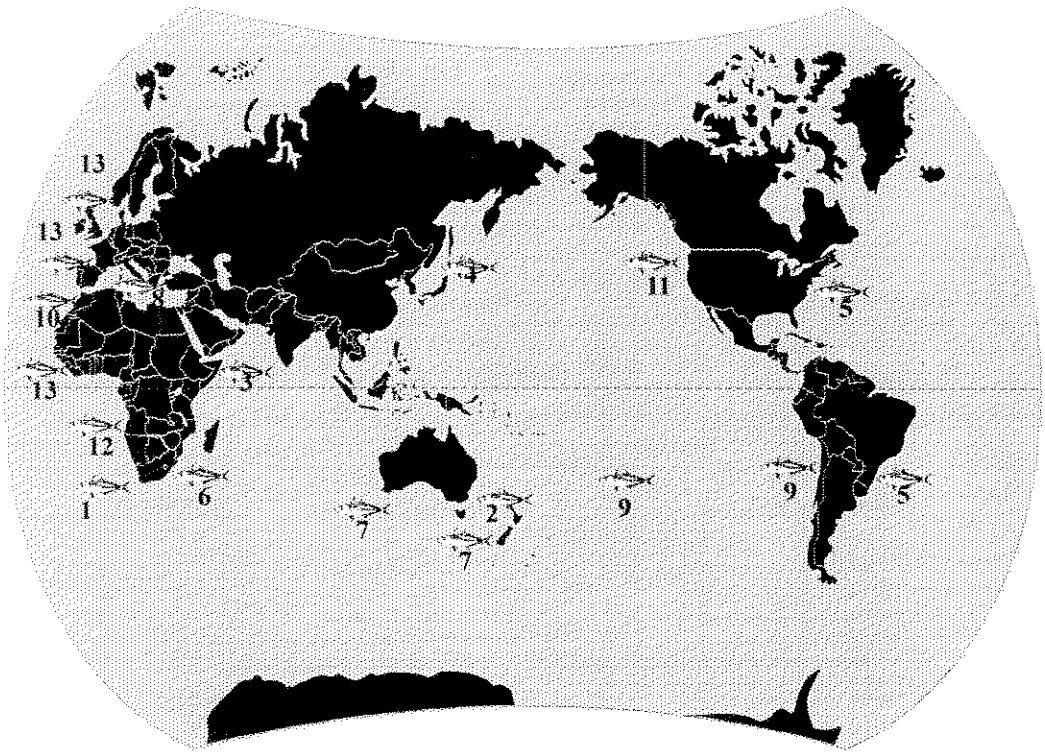

FIG. 1. – Geographic distribution of *Trachurus* sp. (based on BERRY and COHEN 1974).

1 *Trachurus capensis* (Castelnau, 1861)
2 *Trachurus declivis* (Jenyns, 1841)
3 *Trachurus indicus* (Necrassov, 1966)
4 *Trachurus japonicus* (Temminck and Schlegel, 1844)
5 *Trachurus lathami* (Nichols, 1920)
6 *Trachurus margaretae* (Berry and Cohen, 1972)
7 *Trachurus mccullochi* (Nichols, 1920)
8 *Trachurus mediterraneus* (Steindachner, 1868)
9 *Trachurus murphyi* (Nichols, 1920)
10 *Trachurus picturatus* (Bowdich, 1825)
11 *Trachurus symmetricus* (Ayres, 1855)
12 *Trachurus trecae* (Cadenat, 1849)
13 *Trachurus trachurus* (Linnaeus, 1758)

Australia and New Zealand (Fig. 1). Its career in the world fishery commenced at the end of 70s' when long range distant fleets expelled from their traditional fishing grounds started desperately to look for an accessible resource providing catch volume justifying the energy input. Starting from a dozen or so hundred tons at the beginning of the 60s' the catch climbed up to second place on the list of pelagic species supporting the world fishery in 1991-3.9 million tons (Fig. 2). The Polish fishing fleet in which the vessels assigned to size-class 2000-4000 GRT constituted 70% of the total fleet tonnage (Table 1), was engaged in those years in SE Atlantic (Cape horse mackerel), NE Pacific (hake and Alaska pollock), SW Atlantic (blue whiting and squids) and in SE Pacific, wherein the 200-mile EEZ waters it worked in co-operation with the Peruvian fishery under the pressure of fierce competition of other countries. These conditions forced the Polish fishery managers to look for a "relatively" stable and free-access resource. At the end of 1978, m/t PERSEUS under captain K. Kopański made a reconnaissance trip to the area extending between 20°-47° S latitude and the boundary of Chilean exterior 200-miles EEZ-90° W longitude. In his report of 27th March 1979, Capt. Kopański said that during 35 fishing days PERSEUS fished 880 tons of jack mackerel measuring 30-60 cm suitable for fillet production. Among many details in his report two where worth particular notice: successful trawling operations (5-10 t/hour fished) were possible in the night hours only; jack mackerel concentrations were very mobile,

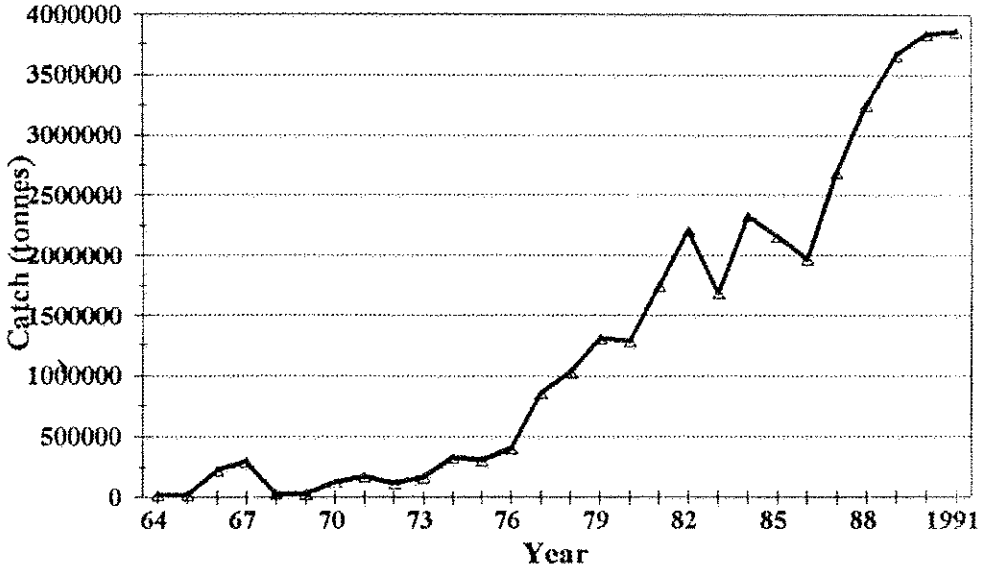

FIG. 2. – Chilean jack mackerel annual catch in 1963-1991.

TABLE 1. – Tonnage of the Polish fishing fleet by vessel class category (1979).

Class (GRT)	No	Total tonnage
1 - 24.9	825	1 704
25 - 49.9	235	9 333
50 - 99.9	16	1 755
100 - 149.9	185	19 232
500 - 999.9	13	10 400
1 000 - 1 999.9	28	36 800
2 000 - 3 999.9	75	185 200

requiring a powerful engine thus assuring a trawling speed of at least 5.5 knots with vertical trawl opening of 30 m.

In 1980, the research vessel PROFESOR BOGUCKI of the Sea Fisheries Institute in Gdynia was sent to the SE Pacific waters extending beyond the Chilean 200-mile zone. She carried out fishing operations within the limits of 37°-46° 30' S latitude and 74°-86° W longitude. During the period February-May, 152 hauls were effected and 1780 tons of jack mackerel where fished. The results of the cruise provided information on the feasibility of fishing operations. The Polish fleet started commercial fishery in the area in 1982 with vessels of 2000-3000 GRT size class and took 7136 tons of jack mackerel in that year. In two subsequent years the fleet took 30000 and 80129 tons, respectively. In October 1984 the fleet ceased its operations in the area. In the period of these three years scientific teams from the Sea Fisheries Institute in Gdynia took part in four cruises of commercial vessels and carried out observations on the fishing operations, species catch composition, length and age composition and other biological characteristics of the fished jack mackerel which contributed 99% of the total catch. The results of their findings are presented in this paper.

MATERIALS AND METHODS

The materials were retrieved from the unpublished reports of the following authors: ANON. (1982), DŁUGOSZ and MIŁOSZ (1982), BRZEZIŃSKI and PACTWA (1983), BOROWSKI and MAJEWICZ (1983), GRZEBIELEC and FUŁAWKA (1984). The reports contained the results of observations on fish spatial distribution, shoal density and movements in relation to the surface water temperature. Routine ichthyological analysis provided information on the caught fish length maturity stage and feeding habits. Details of fish measurements are given in Table 2.

TABLE 2. – Chilean jack mackerel, measurements of the population fished in 1980-1984.

Period	Length measurements	Maturity stage, stomach fullness	Age
February-May 1980	68,034	5,551	2,683
March-June 1982	35,964	3,701	
December 1982-June 1983	30,762		
January-May 1984	29,544	1,209	

The distribution of CPUE index assigned and grouped by the 20' latitude and 30' longitude standard area unit, was based on the master records submitted daily to the vessel owners and processed for this paper. Other fishery statistics were retrieved from the documents available in the Department of Economics, Laboratory of Fishery Statistics of the Sea Fisheries Institute in Gdynia.

Catch and CPUE index distribution

Within a period of 27 years the Chilean jack mackerel catch rose from 1200 tons to almost 4 million tons in 1991. The drop in 1985 was due to the withdrawal of the Polish fleet. The fleet operated within the limits: 33°-46° S and 75°-89° W. Although the horse mackerel was scattered within a vast area, the richest grounds were located in the north-eastern part of the entire area covered by the fleet (Fig. 3).

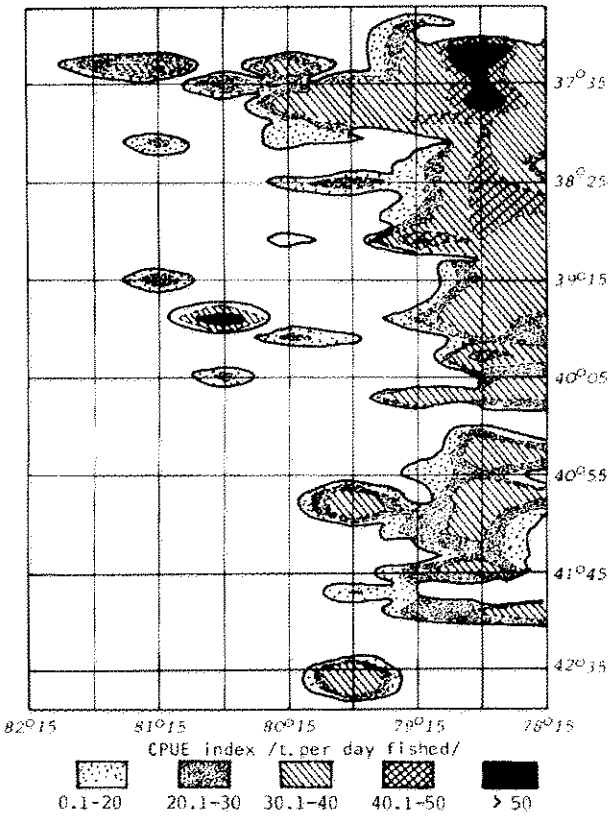

FIG. 3. – Spatial distribution of the Chilean jack mackerel CPUE index recorded by the Polish fleet in 1983.

According to DRAPACKIJ and TSHERNYJ (1991) the jack mackerel created dense concentrations westward of 90 meridian (119°-107°W). The catch rate showed

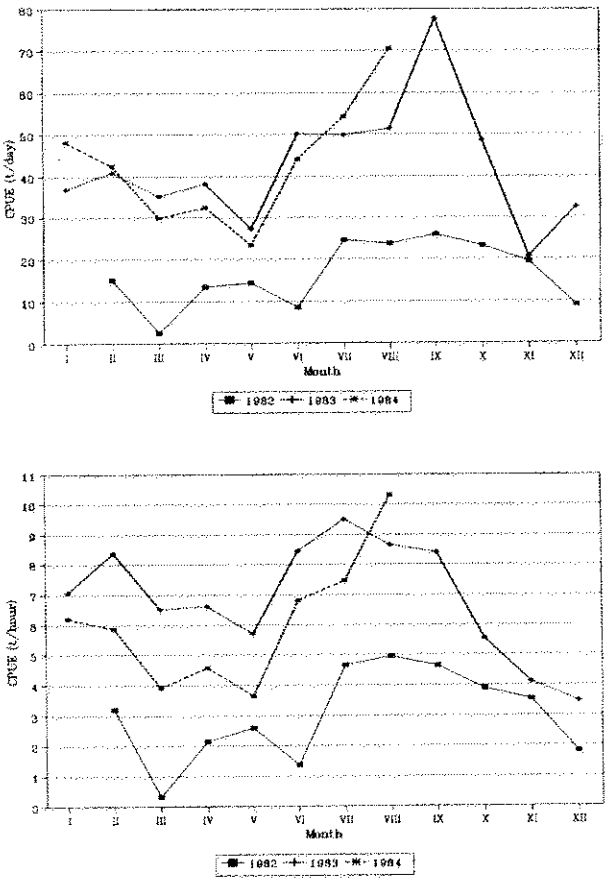

FIG. 4. – Chilean jack mackerel CPUE index in 1982-1984.

two distinct peaks in the twelve month period, one in January-February and the second in June-September (Fig. 4). In the case of USSR vessels which were not confined to a limited area as was the Polish fleet, the seasonality in jack mackerel catches was not so notable (DRAPACKIJ and TSHERNYJ, 1991). Nevertheless, May was the month of lowest catch rate in the year. The lower catches recorded in 1982 were the effect of the learning factor that proved very important in the jack mackerel fishery. DRAPACKIJ and TSHERNYJ (1991) pointed out the differences in the 10 years average catch rate of jack mackerel dependent on the type of vessel. As these differences became outstanding in the month preceding the peak catch season, their interpretation as the reflection of the effect of vessel fishing power seems reasonable. The vertical distribution of dense fish shoals ranged in the daylight hours from 80 to 240 m. During the night, the shoals moved to the upper layers extending between the surface and 80 m depth and provided the most successful trawling (from 18:00 to 24:00). Surface temperature showed a mosaic pattern in the fishing

area (BOROWSKI and MAJEWICZ, 1983) and can hardly be related with the catch rate due to the strong sub-surface current effects.

Nevertheless, the most successful trawling were observed in the localities where the surface temperature did not exceed 19°C, more precisely, at the highest temperature gradient (Fig. 5).

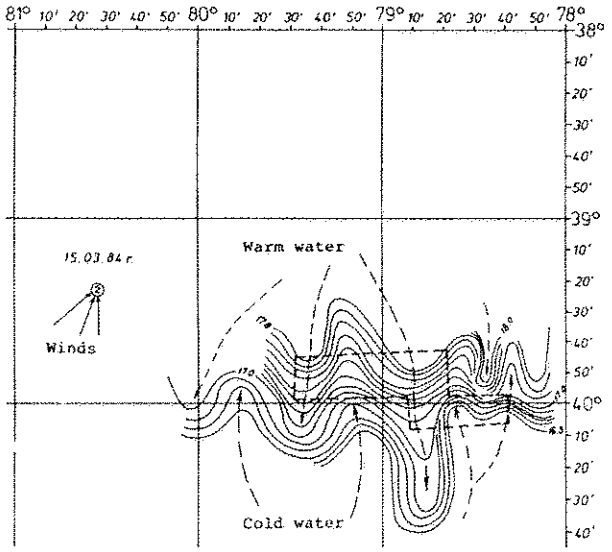

FIG. 5. – Distribution of the fleet fishing for Chilean jack mackerel in respect to water surface temperature.

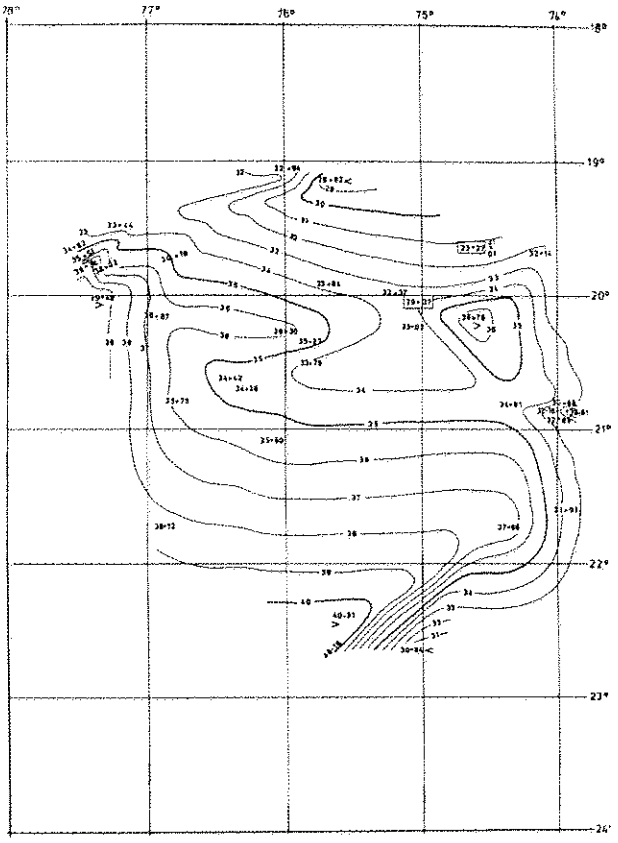

FIG. 6. – Chilean jack mackerel distribution by average length in 1982.

Biological features of Chilean jack mackerel derived from the sampled fish in 1982-1984

The most outstanding feature of the fished jack mackerel was the relatively large size of the fish. The linear size of the fish caught in 1980 varied between 30-68 cm, and has not changed noticeably during the period of 5 years. The bulk of the catch was composed of fish measuring 32-45 cm and varied in accordance with distance from the area of subtropical convergence and shelf waters where spawning and egg development took place (EVSEENKO, 1987). The individual fish mass varied from 200 g to 2000 g. The average size in the northern part of the area (19°-23°S) in 1982 increased with movement towards the south-western direction (Fig. 6). The age of exploited fish ranged from the III to XII age group (Fig. 7). The fish assigned to age groups III-V supported the catches, contributing 95% of the total catch. The growth parameter values for the von Bertalanffy formulae were L_{∞}.= 72.08 cm, K= 0.223 and t_0 = -0.038. They suggest faster growth than was estimated by ABRAMOV and

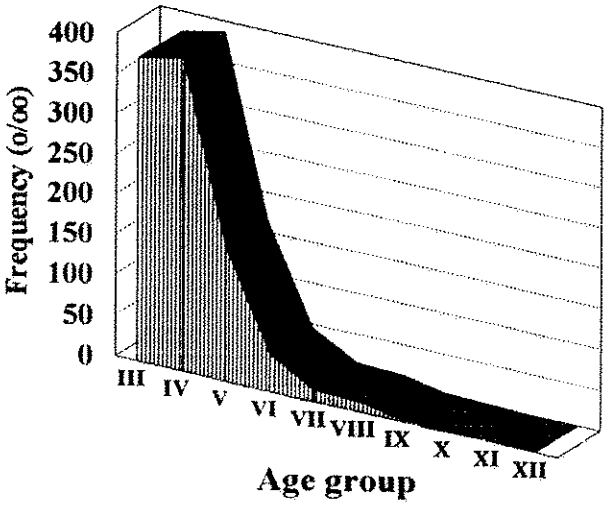

FIG. 7. – Age composition of Chilean jack mackerel fished in 1980.

KOTLAR (1980), SHEVCHUK and CHUR (1984), NIEKRASOV (1987), and KOCHIN (1993). The L_{∞} values given by ABRAMOV and KOTLAR (1980) and KOCHIN (1993) are similar (71.99 and 72.24 cm respectively), the difference in the K value is conside-

rable (0.094 and 0.119). If the last values are correct, it means that the fishery is supported by 5-9 year old fish. Jack mackerel is a batch spawning species and specimens with part of the gonads in advanced maturity stages (gravid and spawning) were foundin the adult population observed from December till May. The highest percentage of females with hydrated eggs was recorded in March. A share of fish with developed gonads varied according to KAISER (1973) and ALEKSEEVA (1986). In the southern part of the SE Pacific in January-March, the highest occurrence of fish with mature gonads was observed (ALEKSEEVA 1986). This author presented the data on absolute Chilean jack mackerel fecundity that ranged from 64 to 949 thousand eggs for females measuring 28-48 cm in total length, respectively (Table 3).

TABLE 3. – Fecundity of Chilean jack mackerel (after Alekseeva, 1986).

Female length (cm.)	No. of eggs
48	949 000
42	633 000
38	293 000
32	150 000
28	64 300

The most dense jack mackerel larvae concentrations were found in the area 38°-39°20' S and 87°-90°10'W (BENDIK and RUDOMETKINA 1986).

Unlike the anchovy, a strong El Niño effect favoured the occurrence of strong year-classes (ESIN, 1991). The highest index of stomach fullness was noted in May-June. In the food spectrum of fish analyzed in February-April 1980, bathypelagic fish and squid were most frequently found. The food of young jack mackerel (2-10 cm long) was composed of copepods, euphasiids, amphipods and fish larvae including jack mackerel larvae (GARDINA, 1991). Due to the vast geographical distribution of the jack mackerel population in the South Pacific, no sound stock size estimates are available. For the eastern part of the area, figures ranging from 2.5 to 8.8 million tons were mentioned as biomass estimates (NAZAROV, NESTEROV and SOLDAT, 1991). In view of species distribution within the extensive area it seems doubtful if the exploited populations might be considered as belonging to one stock in the classical concept. Therefore, any assessment of the stock size is subject to criticism regarding the assignment of data on fish stock statistics to the same biological unit. The variability of the length structure recorded in 1980-1984 prevent any conclusion on the relationship between the trends in catch value and age or length structure.

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