NEW ZEALAND'S PELAGIC FISHERIES: THEIR POTENTIAL FOR DEVELOPMENT

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ABSTRACT

The potential for the development and growth of commercial fishing for pelagic fish species in New Zealand waters is discussed in this paper. The moderately high levels of primary production reported for these waters and the presence of foreign fishing fleets suggest that the area supports substantial stocks of fish. The paper reviews briefly the fisheries currently operating in New Zealand and includes discussions of the tunas (albacore, southern bluefin tuna, and skipjack), trevally, horse mackerel, barracouta, pilchards and squids.

The problems relating to the development of new fisheries are discussed; included are comments on marketing, capitalization and fishing gear. The lack of current knowledge regarding the size of the resources and the sustainable yields which can be harvested are stressed. Except for tuna and squid, the current view is that the development of the pelagic fisheries in New Zealand must be based on resources which can be reduced to fish meal and oil to meet domestic needs.

1. INTRODUCTION

The area of the New Zealand land mass and the immediately adjacent shelf shallower than 200 m is not great but New Zealand territory includes the Kermadec Islands to the north and, in an arc to the east and south, the Chatham, Bounty, Antipodes, Auckland, and Campbell Islands. The Chatham Rise, Campbell Plateau and Lord Howe Rise include very considerable areas of depths shallower than 1000 m (Map 1).

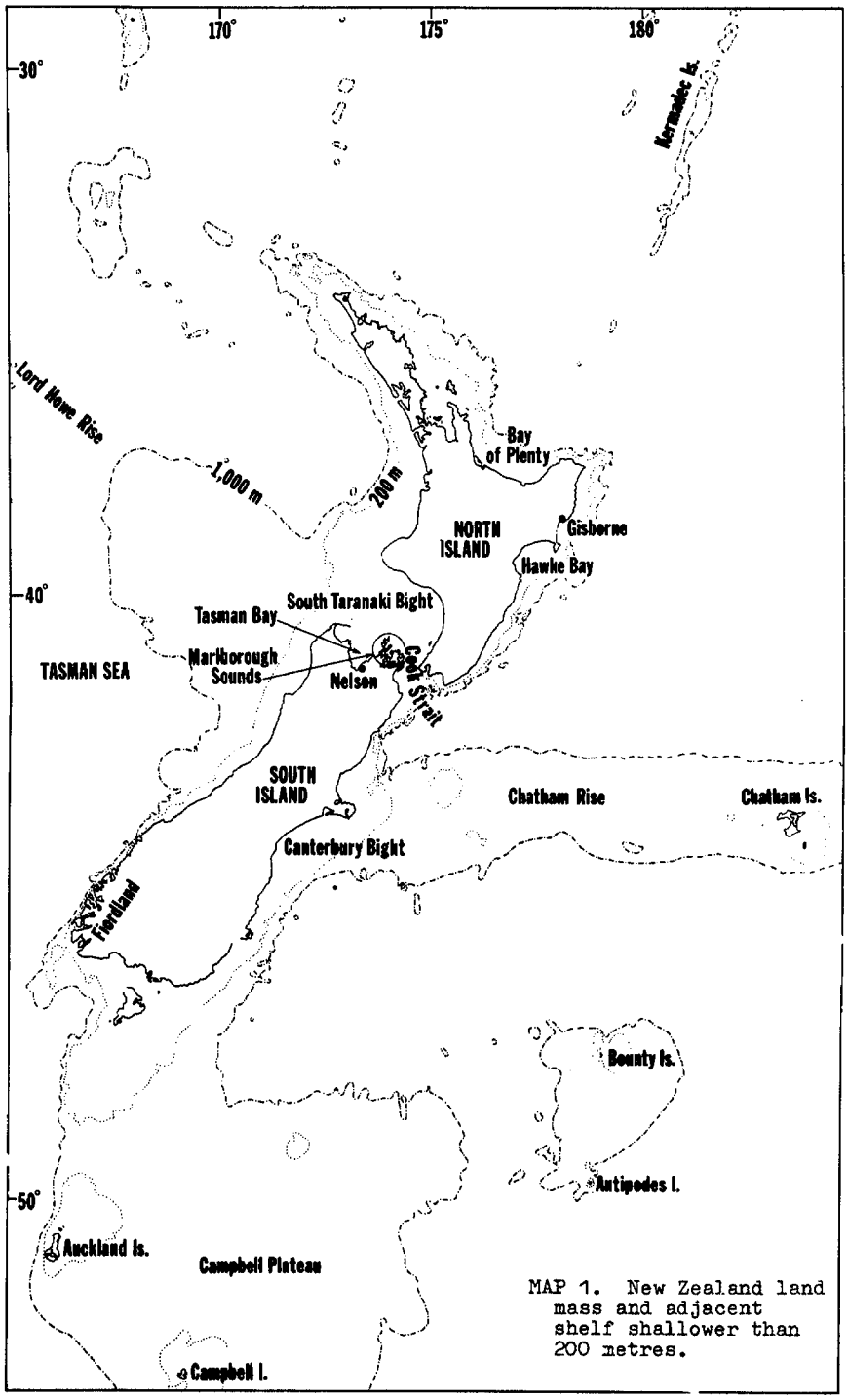
The current patterns and the distribution of water masses around New Zealand have been described and illustrated by a number of workers, including more recently, Brodie (1960), Garner (1959), Garner and Ridgway (1965) and Heath (1971). The broad New Zealand area includes subantarctic, subtropical and tropical waters and the main islands of New Zealand straddle the subantarctic-subtropical convergence zone. The presence of the different water masses and the current patterns affect the distribution of both pelagic and demersal fish. Within the New Zealand area fish populations vary greatly so that species having tropical, subtropical, and subantarctic distributions are present and accessible to local fishing vessels.

In general the primary productivity of the seas around New Zealand is moderately high with particularly high concentrations of chlorophyll a and C14 uptake levels along the west coast of South Island and on the Chatham Rise (El-Sayed 1970). Volkov, Dolzhenkov and Karedin (1971) refer to the rather high standing crop of macroplankton in the Tasman Sea and Tasman Bay (20-1000 g/1000 m^3) and to the south east of New Zealand (50-3000 g/1000 m^3). Several speakers (including Kasahara, Moiseyer and Rodin) at the 12th Pacific Science Congress (Canberra 1971) also mentioned the area as being one of the more productive areas of the South Pacific, and stated that the New Zealand area, and in particular the south, is of high fisheries potential. Increasing activity in this area by distant water trawling fleets from Japan and the U.S.S.R. also argues for their belief in the high standing crops of exploitable fish in the region.

It therefore seems reasonable to assume that the area supports substantial stocks of fish. Though the pelagic fishes are lightly exploited at present it also seems reasonable to suppose that the stocks will be at least as large as those of demersal fishes on the continental shelf area around New Zealand.

New Zealand's fishing fleet consists largely of small (20-30 m l.o.a.) vessels which trawl for demersal fish and fish for rock lobsters. The trawlers fish the inshore waters to depths of 200 m, and land approximately 80% of the wet fish catch. Pelagic fisheries, on a small scale, are a recent development. In planning for the expansion of the economy, the New Zealand National Development Conference in 1968 reviewed the status of the fishing industry and drew up targets for its development. The Conference recognised that if greater use was made of unconventional species and less accessible grounds, the landings of demersal fish from the shelf immediately adjacent to New Zealand could be doubled without over-exploiting stocks. However, it also recognised that pelagic fishing should be capable of very considerable expansion and should be capable of producing a weight yield at least equivalent to that of the demersal fishery. This suggestion was supported by the knowledge that foreign trawler fleets were making very substantial catches of pelagic fish such as barracouta (Thyristes atun) and horse mackerel (Trachurus declivis).

It is unlikely that the New Zealand fleet with its small vessels would be able to operate economically in the more distant waters, thus any major increase in fish landings is likely to come from exploitation of the currently unfished pelagic fish resources.



MAP 1. New Zealand land mass and adjacent shelf shallower than 200 metres.

2. THE RESOURCE

Although surface schools of pelagic fish are frequently seen in New Zealand coastal waters there are few data on which to base estimates of abundance. Limited aerial surveys of surface fish schools have been made in the Tasman Bay-Cook Strait area (Webb 1971) and a short-term survey of the pilchard (Sardinops neopilchardus) resource in Tasman Bay was made by Tunbridge (1969). Baker (in press) discusses the biology of the pilchard. York (1969 and in press (a)) gives some biological data relating to tuna distribution and Slack (1969 and 1972) records tuna catch rates in New Zealand. York and Fenaughty (in press) describe the results of an investigation on albacore off the west coast of the South Island. Webb (in press (a)) describes the activities of an exploratory and experimental tuna, baitfish, and squid fishing venture off the west coast of New Zealand. Data relating to tuna are given in several papers in the Fishing Industry Board's tuna seminar (F.I.B., 1971). There have also been studies on aspects of the biology of some pelagic species (Mehl 1969, 1970, 1971, Baker 1971, Roberts in press, James in press, etc.) and investigations on tuna, trevally (Caranx lutescens), horse mackerel, kahawai (Arripis trutta), and barracouta are currently being carried out by Marine Department's fisheries scientists. Shuntov (1970) discusses the general results of research by research vessels of the U.S.S.R. and describes the migration patterns of barracouta as well as giving data on other pelagic species.

Recently, proposals to help stimulate pelagic fishing in New Zealand have been actively discussed. The pelagic fish which could be commercially exploited are listed in Table 1. A description of the status of each fish and the fishery for it is given in "New Zealand Fisheries" prepared by the New Zealand Marine Department for the 1972 Meeting of I.P.F.C.

The combined yield from trevally, barracouta, and horse mackerel as estimated by the National Development Council was 20,950 tons (Table 1). All three species are pelagic but the majority of the New Zealand catch of 7,500 tons in 1971 was made by demersal trawlers though one purse seiner, fishing primarily for trevally and kahawai, did land some 600 tons during the summer season of 1971-72. During 1971 the Japanese catch of barracouta and horse mackerel in the New Zealand area greatly exceeded the total yield predicted by N.D.C. Thus it appears that the catches of these species could be substantially increased.

Tunas are seasonal visitors with albacore, skipjack, and southern bluefin being present close to the coasts from January to May. Southern bluefin, together with albacore and other species, have been fished by Japanese long-liners around New Zealand since 1956 (Shingu and Hisada 1971, Eggleston 1971). Though the 1968 N.D.C. estimated a New Zealand catch of 8,000 tons of southern bluefin, it appears from more recent observations that such a yield is unlikely to be achieved by New Zealand vessels with their current limitations.

Kahawai, which often form mixed schools with horse mackerel and skipjack, are very abundant in inshore waters around New Zealand and schools are frequently sighted in summer. The species (as "Australian salmon") is the basis of an important beach-seine fishery in Australia but is only lightly exploited in New Zealand. There are indications that the New Zealand fish, like their Australian counterparts, make extensive migrations (Webb 1971).

Salmon are listed in Table I, but currently it is illegal to sell any salmon caught in New Zealand or to catch a salmon other than by angling. The quinnat (Onchorhynchus tchawytscha) is the only species established in New Zealand, where it occurs in the major rivers of the east coast of the South Island. Population densities are relatively low

and though, in recent years, Japanese vessels have caught salmon in New Zealand waters it appears unlikely that a major fishery could be developed unless there was investment in smolt-rearing stations.

Maomao (Scorpis aquipinnis) are locally common but are little used at present.

The abundance of koheru (Decapterus koheru) is not well known. It is frequently confused with horse mackerel. It has been purse-seined in the Bay of Plenty and large schools have been seen around the north of the North Island.

Pilchards have been more extensively studied than the other small pelagic species. They were the basis of a small fishery in the Marlborough Sounds in the 1940s (Baker in press, Webb in press (b)). Large numbers of schools have also been seen in other areas including Fiordland and Bay of Plenty. Experimental purse seining in Tasman Bay and Marlborough Sounds has shown that pilchards can easily be purse seined in summer. They are suitable as bait for pole fishing for tuna. Shuntov (1970) describes pilchards as plentiful.

Shuntov lists sprats as being present in commercial abundance. The conventional bottom-trawl gear used in New Zealand fisheries does not capture quantities of this small species, but it is frequently present in fish stomachs. Immense schools have been recorded off the south east of the South Island (Graham 1956).

Yellow-eyed mullet (in New Zealand known as herring) are abundant in inshore waters but are rarely seen away from the coast.

Squid are fished around the New Zealand coast by Japanese vessels. In 1972 this form of night fishing was combined with albacore trolling by day. Vessels which fished off the west coast of the South Island in January-March 1972 each landed up to 400 tons of squid in Japan. Though squid have been reported all around New Zealand, the fishery is new and the best areas have not yet been defined.

For the future it is possible that other less conventional resources, such as the lantern fish and euphausiids which are abundant in some localities, may be exploited.

3. CURRENT FISHERY

As mentioned earlier there is little fishing directed at pelagic species at present. Since the late 1960s a small tuna fishery has developed. The Marine Department technology vessel "W.J. Scott" has carried out experimental purse seining at intervals since 1966, (Anon 1967(a), (b), 1969, 1970, Webb (1970)). This demonstrated that the kahawai, horse mackerel, English mackerel, and trevally could be purse seined and several vessels have purse seined commercially since that time. At present only one purse seiner, based at Gisborne, holds a current fishing permit and the catches from purse seining are less than 2% of the total wet fish landings and are worth less than 0.5% of the total wet fish value. Landings by species and method are described by Cunningham (in prep.). It is expected that this form of fishing could be greatly expanded.

A greater interest has developed in the possibility of trolling for tuna species and since 1969 the numbers of vessels using this method have increased considerably.

Apart from the commercial fishery there is an active sports fishery for bill fishes, sharks, and tunas. Landings are recorded in New Zealand Marine Department Annual Reports.

4. METHODS AND FISHERIES

Trolling: Tuna fishing by trolling is becoming increasingly popular (Roberts, Baker and Slack in prep.). Tuna landings are increasing each year: 1969 - 15 tons; 1970 - 85 tons; 1971 - 250 tons. For trolling little modification of vessels is involved, and the gear required is relatively simple and readily obtainable. Little experience is necessary and the fishermen soon become efficient. Small one or two-man boats can troll effectively and profitably for tuna when they are present and can quickly revert to other fishing methods when the tuna leave the area. Kingfish, kahawai, and barracouta can also be taken by trolling but the unit price for these species is low and very high catch rates would be necessary to make a livelihood from these species by trolling.

Gill nets, either anchored or free, could be used to catch most species. Gill nets can be set from small boats, but some form of mechanisation would be necessary to haul the nets if this method is to be used frequently. The setting of short gill-nets in the path of tuna schools has been successfully used by Bay of Plenty fishermen (York 1971a). Unless catch rates are high, gill netting is too labour-intensive to be profitable.

Fish traps are used in many countries to catch both demersal and pelagic fish. Many species of New Zealand pelagic fish, including kahawai, horse mackerel, trevally, kingfish, koheru, pilchards, sprats, anchovies, mullet, etc., enter harbours and inlets. The greatly indented coastline, particularly in the north east of both islands, is geographically suitable for the use of trap nets. One company is using an experimental trap net at present but there has been no previous fishing of this kind. The great advantage of this type of fishing is that, following the capital cost of obtaining and setting up the trap net, there is little labour required to service it and the trap can be operated as a means of secondary employment.

Pole fishing is a familiar method of tuna fishing. One large vessel has pole fished for tuna since summer 1970 but with varying success. Some good catches have been made but difficulties in obtaining supplies of live bait and long periods of searching time have reduced profitability. A Japanese pole-fishing vessel participating in a joint venture between New Zealand and Japanese fishing companies fished for albacore off the west coast of the South Island in the summer of 1971-72 with some success. Small vessels with 1-2 men successfully pole fished skipjack for a period in the Bay of Plenty in early 1972. The development of an acoustic lure to attract tuna to a fishing vessel (York in press (b)) may well increase the efficiency and profitability of pole fishing. Greater efficiency in bait locating will also increase pole-fishing productivity.

Most of the pelagic schooling fish can be taken by purse seiner or lampara. Kasserroff (1971) suggests that lampara netting would be suitable for smaller New Zealand vessels and describes a suitable net. At present lamparas are used on only a very small scale for catching bait fish for groper long-lining and tuna pole-fishing. Purse seining is expensive and requires a skilled crew but, if successful, catches are very large and the method can be very productive. New Zealand purse seining to date has been almost solely for surface-schooling fish which can be seen from the vessel during fishing Weather factors affect the suitability of some areas for purse seining, particularly if a skiff is used. Webb (in press (c)) describes the weather patterns of the Cook Strait-Tasman Bay area in relation to suitability for purse seining and points out that a considerable number of days would be lost in the area to unfavourable weather. The Bay of Plenty is thought to be the most suitable for the development of a purse-seine fishery (Payne 1969).

Long lines are not used at present to catch pelagic fish commercially, although some experimental tuna lining using modified horizontal and vertical long lines has been done (York 1971b). Kingfish and large albacore were caught. It is doubtful if large scale tuna long lining on the Japanese patterns would be profitable in New Zealand (Eggleston 1971) but modified long-line gear may be successful in chosen localities as a method of catching tuna or kingfish.

Most of the catch of trevally and barracouta is made by trawlers using a granton or modified-granton trawl. Catches of these off-the-bottom species could undoubtedly be improved by using nets having higher head ropes. It also seems certain that mid-water trawls would be an effective way of catching pelagic fish in New Zealand for echo-traces show extensive shoals of mid-water fish in some areas. Pair-boat mid-water trawling would probably be most suitable to New Zealand conditions as smaller vessels of low engine size can be used. (Few local vessels are sufficiently powerful to tow a large mid-water net.) Pilchards, anchovies, sprats, horse mackerel, barracouta could be taken by mid-water nets. Pair trawlers could also "aim" for surface-schooling fish as well as mid-water fish.

The Fishing Industry Board has imported two squid-fishing machines for trials and a Nelson based company has carried out experimental fishing. Only a few nights' good catches have been made, but performance should improve with experience and the accumulation of information on squid distribution and catchability.

5. USAGE OF THE FISH

The usage to which the pelagic fish is to be put has a great bearing on the type of fishing method and the shore facilities to be used. The local market for pelagic fish is small and none of the species is popular in New Zealand as fresh fish. Although the local market could be expanded it certainly could not support a major fishery. Many of the fish, e.g. tuna, kahawai, pilchards, mackerel, koheru, are suitable for canning but the local market would be insufficient to allow New Zealand companies to produce a quality product at prices which would compete with imported canned fish. Consequently if fish are to be landed on a large scale then suitable export outlets are essential. Tuna and particularly albacore can be shipped whole, frozen, to canneries in the U.S.A., but other fish (such as kahawai and the pompano-like trevally) for export and for direct consumption would probably have to be filleted and frozen in New Zealand before shipment. The decline of the South African pilchard fishery has left established markets for canned pilchards undersupplied.

In view of the undeveloped and uncertain nature of many of the markets it would seem likely that, at least initially, the bulk of any pelagic fish caught will need to be reduced to fish meal and oil for which there is an increasing market in New Zealand.

A limited proportion of the catch could also be sold as crayfish bait or fish bait, for example, in Western Australia kahawai are sold at $150 a ton as rock lobster bait.

It is therefore apparent that, with the exception of tuna, pelagic fish will be marketed at low prices. This means that in order to be profitable the cost of catching, handling, and processing the fish must be kept low. This argues for the use of bulk fishing methods such as purse seines, lampara nets, and mid-water trawls. Trolling, gill netting, pole fishing and other methods are labour intensive and of low productivity and are suitable only where the fish caught bring a high unit price; however, they require relatively little capital equipment and can be used as a secondary fishing method.

6. RESTRICTIONS ON DEVELOPMENT

Marketing is a major problem and this will be especially so in the case of many New Zealand pelagic species. The tuna (and salmon if the industry develops) is the only fish with established markets: canned pilchards, sprats, and mackerels are also familiar products, though the production of the New Zealand industry will inevitably be small. The "low" production will also bring difficulties in competition with other countries where greater quantities are produced and where wages are less and working hours longer. To overcome these problems it will be necessary to increase unit productivity by bulk catching and automated processing.

The development of a pelagic fleet of fishing vessels, such as purse seiners, together with ancillary shore establishments for fish-meal production or canning is costly. Few, if any, of the New Zealand fishing companies have sufficient capital for such developments and assistance either directly by Government or from a joint venture basis with a company from another country may be necessary to aid development.

A major difficulty in planning development is that the sustainable yield of the pelagic fish stocks around the coast is not yet known. Although limited pelagic fishing has been carried out for several years little is known of the catchability of the fish species, their vulnerability to various methods of fishing, and changes in catchability with seasons and in relation to environmental conditions. However, only extensive fishing can give the final answer to these problems. It will be some years before research on this topic provides the required information.

Few of the pelagic fish are confined to New Zealand fisheries waters (limit 12 miles). For example, barracouta and horse mackerel are fished by Japanese trawlers around New Zealand. The captain of one of these vessels is reported (Evening Post, Wellington, June 7, 1972) as stating that the catches of barracouta are falling off as a result of fishing. The southern bluefin tuna has been fished around New Zealand by Japanese long-line vessels since 1956. Since then catches have fallen from 10 tons to around 2 tons per set. A fishery for squid by Japanese vessels is developing off New Zealand. Thus those species which have a large proportion of their stock outside New Zealand fisheries waters are vulnerable to exploitation by other nations, and the development of a New Zealand fishery exploiting these same resources could be seriously affected by the activities of other fishing nations. Sprats, pilchards, kahawai, and possibly kingfish and other minor species, are probably the only species in which the bulk of the population occurs within the New Zealand fishing limits.

7. CONCLUSIONS

Tuna are regular visitors to the New Zealand area and other pelagic school fish occur in abundance around much of the New Zealand coast. However, the sustainable yield of these stocks is unknown. New Zealand conditions are such that, with the exception of tuna and squid, any pelagic fishery must be based on highly productive low-cost methods. High labour costs, the small local market, and the distance from the export markets mean that much of the catch must, at least initially, be reduced to fish meal and oil until profitable export markets can be found for the fish.

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TABLE 1. New Zealand Pelagic Fish Species

Species	Distribution	Area of greatest abundance	N.D.C. estimated yield (tons)	1971 landing (tons)
Trevally	North Island, north of South Island	Bay of Plenty and north	10,550	5,850
Barracouta	All areas	Canterbury Bight, Tasman Bay	5,450	1,050
Horse mackerel	North Island, north of South Island	Taranaki Bight, Tasman Bay, East Coast of North Island	4,950	600
English mackerel	North Island	East Coast, Bay of Plenty		
Southern bluefin	West of South Island, east of both Islands	Seasonal Fiordland	8,000	
Albacore	North Island, west coast of South Island	Summer West coasts	2,000	250
Skipjack	All areas	Summer Hawke Bay and north	750	
Yellowfin	North of North Island	Summer Bay of Plenty	-	
Kingfish	North Island, north of South Island	Bay of Plenty and north	1,850	600
Kahawai	All areas	Cook Strait and north	5,450	550
Salmon	East coast of South Island	Canterbury Night	-	-
Mao Mao	North Island	Bay of Plenty and north	-	50
Koheru	North of North Island	East Coast North Island	-	-

TABLE 1. New Zealand Pelagic Fish Species (Continued)

Species	Distribution	Area of greatest abundance	N.D.C. estimated yield (tons)	1971 landings (tons)
Pilchard	North Island, northern part of South Island	Tasman Bay, Marlborough Sounds, Bay of Plenty, Fiordland		
Sprat	South Island	East coast of South Island	6,000	1
Anchovy	Widespread	Tasman Bay, Marlborough Sounds, Bay of Plenty, west coast of South Island		
Yellow-eyed mullet	Inshore areas both islands	?	7,500	15
Squid	All areas	? West coast South Island	-	-