BAY OF BENGAL PROGRAMME
Development of Small-Scale Fisheries

BOBP/REP/23
(GCP/RAS/040/SWE)

Summary Report of BOBP Fishing Trials and Demersal Resources Studies in Sri Lanka

SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

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SUMMARY REPORT OF BOBP FISHING TRIALS AND DEMERSAL STUDIES RESOURCES IN SRI LANKA

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This paper briefly describes the various studies and fishing trials concerning the demersal fishery resources of Sri Lanka conducted between 1979 and 1985 by the Bay of Bengal Programme (BOBP). Some of these activities have been documented through the following papers :

BOBP/WP/6 — "Fishing Trials with Bottom-set Longlines in Sri Lanka" by G. Pajot, K. T. Weerasooriya.

BOBP/WP/16 — "Further Trials with Bottom Longlines in Sri Lanka".

BOBP/WP/40 — "Promotion of Bottom Set Longlines in Sri Lanka" by K. T. Weerasooriya, S. S. C. Pieris, M. Fonseka.

BOBP/WP/41 — "The Demersal Fisheries of Sri Lanka" by K. Sivasubramaniam and R. Maldeniya

BOBP/WP/42 — "Fish trap trials in Sri Lanka".

This paper distils the findings of these papers-and of one other paper under preparation -for quick assimilation by planners, decision-makers and researchers.

The demersal fishery activities reported in these papers were carried out by the BOBP's small-scale fisheries project (funded by SIDA). A senior fishing technologist and a senior fishery biologist were mainly responsible for the execution of BOBP activities. Officers from the Ministry of Fisheries and scientists from NARA (National Aquatic Resources Agency) were closely associated with the trials.

The small-scale fisheries project of the Bay of Bengal Programme (BOBP) began 1979. It covers five countries bordering the Bay of Bengal — Bangladesh, India, Malaysia, Sri Lanka and Thailand. It is 'funded by the Swedish International Development Authority (SIDA) and executed by the Food and Agriculture Organization of the United Nations (FAO). It is a multi-disciplinary project, active in the areas of fishing craft and gear, aquaculture, extension, information and development support. The project's main aims are to develop, demonstrate and promote appropriate technologies and methodologies to improve the conditions of small-scale fisherfolk in member countries.

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1. INTRODUCTION

Before the late 50s demersal fishery resources made a significant contribution to fish production in Sri Lanka through handlining, bottom-set longlining and bottom-set gillnetting. With the advent of the motorization programme for small fishing boats and the introduction of synthetic netting material, driftnetting for large pelagic species improved ; simultaneously drift-longlining for large pelagic species also became popular. As for the tapping of demersal resources, motorization helped the small boat bottom trawl fishery in the northern sectors; but the suspension of the distant water trawl fishery on the Wadge Bank after the 1976 agreement between India and Sri Lanka (on the maritime boundary between the two countries) affected demersal resource utilization. The pendulum swung again towards the end of the 70s, when rising fuel prices hit the viability of the pelagic fishery during the lean seasons and reduced the fishing effort. This again focused attention on demersal fisheries.

However, the consensus of opinion is that except for some scope in small-scale trawling and bottom-set longlining, the demersal fisheries do not present a substantial potential for expansion. Results from surveys undertaken by R. V. Fridjtof Nansen during 1978, 1979 and 1980 seem to indicate possibilities of the yield from demersal fisheries being doubled. The most productive trawling grounds are limited to the north and northwest coasts where additional production would largely consist of small and low grade varieties. Most other areas are studded with rocks and corals; it is evident that the more economic varieties of large demersals, though limited, can be tapped by passive fishing methods using stationary fishing gear. Such methods are, in addition, pre-eminently well suited for small-scale fisheries.

Recognising these facts, as well as the seasonal nature of the present demersal fisheries, the small-scale fisheries project of the Bay of Bengal Programme (BOBP) decided to investigate the techno-economic feasibility of improving existing fishing methods, and also of introducing some of these methods to new areas and seasons.

During the identification phase of this work, it was recognised that

- Handlining was widely and seasonally operated by artisanal fishermen even up to the edge of the continental shelf;
- Bottom-set gillnetting was limited in practice to the northern and southern regions;
- Trap fishing was limited and confined to the north and north east;
- Bottom-set longlining was practised more widely but was still handicapped byvariousfactors.

Considering the existing status of the demersal fishery and the problems in further development, alternative solutions were sought mainly through activities on :

- Improvement and extension of the existing bottom-set longline fishery,
- Investigation of the suitability and feasibility of the bottom-set gillnet fishery,
- Trials with fish traps,
- Identification of alternative fisheries during lean seasons at centres which primarily concentrate on pelagic species,
- Review of past survey efforts to identify areas and resources with potential for further development.

To the extent possible, the services of Sri Lankan personnel, government and private, were availed of for each activity, and genuinely interested fishermen were inducted for demonstrations and fishing trials. The BOBP provided expatriate personnel to design, develop and demonstrate fishing techniques, and was responsible for procuring the required equipment and fishing gear, and for paying local labour, contract fees, a guaranteed minimum income to fishermen, and local subsistence and travel costs for government and institution personnel.

What follows is a report of the BOBP's activities from 1979 to 1985 (listed in Appendix 1). It includes a review of the present status of Sri Lanka's demersal fisheries and recommendations for future development on the basis of identified resource potential.

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2. REVIEW OF BOBP FISHING TRIALS

Bottom-set longlining (BSL): By far the longest of BOBP's activities on demersal fisheries related to this fishing method. It was on from October 1979-June 1983. The principal reasons for this priority were : limited scope for trawling, extensive use of handlining, and the high cost of bottom-set gillnetting. The main object of the BSL experiments was to test the commercial feasibility of bottom-set longlining in selected areas, and to experiment with and observe the performance of longline haulers, different types of boats and different types of lines and hooks.

The first trials for about four months during 1979-80 — mainly off Panadura and Galle on the southwest coast-were exploratory. A 11 metre boat powered with a 65 hp diesel engine was commissioned for the trials. This type of boat was selected more because it afforded adequate working space and accommodation than because it was ideal for testing commercial feasibility.

From the production standpoint, the catch from the exploratory trials was low, the average rate being 4.6 kg per 100 hooks as against about 10 kg for commercial viability. The low catch was because of the exploratory nature of the trials, experiments with different types of bottom-set longlines and bait, and low and scattered availability of fish at that time of the year (October to March). However, the following useful information was obtained for future guidance.

- The best hooking time was just before dawn, and the ideal soaking time 1½ to 2 hours;longer working exposed the hooked fish to attack by sharks.
- The fishing gear setting should be only over rocky patches and the lines should be shorter, with 500 to 1000 hooks. The bottom-set longlines should be set parallel to the current, regardless of the bottom configuration.
- Since the echosounder should be used more to locate rocky patches than to locate fish, a cheap and simple 'flashing type' echosounder would suffice.
- A mechanically or manually driven line hauler, rather than a hydraulic line hauler, is what is suitablefor small boats.
- As bait, squid gave the best results because of the fishes' preference and because of its retention on the hooks due to tough texture. However, since all available bait fishes are marketable as food fish, a major constraint is the expenditure on bait fishes.
- The main line, made out of spun polyester (PES) of 4 to 5 mm diameter, was quite suitable. Snoods made of PA nylon hard-laid yarn of R 1520 tex-size were suitable for mechanical hauling; for manual hauling, PA monofilament of 1.0-1.2 mm diameter was equally good.
- There were no differences in catching efficiency between kirbed hooks and straight hooks; the recommended size was 5-6.
- The common 33 tonners (28-footers) would be more suitable to simulate commercial conditions.

Further trials were carried out from Kalkudah (east coast), Silvathurai (northwest) and Negombo and Colombo (west) between June 1980 and July 1981. The boats employed were 3½ tonners, powered by inboard engines of 30-33 hp. Portable battery-powered echosounders were used, and line-hauling was done by hand. Multifilament was mostly used for the main line as well as the snoods. The hooks were both of the kirby type and the conventional straight type, in size 5 to 7. The bait was procured locally, by whatever type and in whatever form it was available.

At Kalkudah, where the trials extended for one year, the average catch rate was 5.5 kg per 100 hooks — better than during previous trials. Wide gap hooks caught more fish than the conventional straight hooks of identical size.

The Silvathurai trials were discontinued in less than a month because of an outbreak of cholera; the average catch rate was 5 kg.

Off Negombo, a better average catch rate of 7.4 kg was obtained.

The Colombo trials had the additional objective of comparing the performance between monofilament and multifilament longlines. While the overall catch rate was 9.1 kg, the monofilament longlines recorded a distinctly higher rate, approximately twice that of multifilament longlines.

The most important outcome of these sets of trials was that a reasonable chance emerged of the BSL being financially viable off Negombo between January and May. Further evidence of this was the entry of 17 commercial boats which recorded a better catch rate of 23.9 kg.

During the following season (December 1981 to March 1982), 24 commercial boats were engaged at Negombo. Of these, 20 were 3½ tonners; the average catch rate was 9.5 kg and 4 were 18' FRP boats with a catch rate of 9.7 kg.

From the economic standpoint, out of 11 boats (3½ tonners) engaged rather steadily during the period, seven were reported to have operated economically, the net income ranging from Rs. 300 to 800 per day. The other four could not attain the break-even point. Three out of four 18 footers showed a net earning of Rs. 400 to 650; the other boat narrowly missed the break-even point. Incidentally, it would appear that the BSL may be more economic for smaller 18 footers than for the 28 footers (3½ tonners).

Subsequent fishing trials were carried out by the government agency, National Aquatic Resources Agency (NARA); BOBP lent the fishermen hooks and lines and NARA provided technical know-how on rigging of gear. The trials were held at Puduwakattuwa (northeast) and at Dehiwala, Panadura and Ratmalana (west). At Puduwakattuwa and Panadura, trials were conducted with 28' boats, at Dehiwala with a 18' FRP boat and at Ratmalana with a non-motorized traditional out-rigger canoe (Oru). All the trials were found to be economically viable; the average catch rates at Puduwakattuwa, Dehiwala and Panadura were 9.0, 6.0 and 7.0 kg respectively. Although the non-motorized boat registered only 2.3 kg, the returns were found to meet operational costs, as there was no expenditure on fuel.

Since BOBP's approach to development is catalytic, its BSL activity can be said to have achieved the purpose. It has helped obtain enough information and data on the possibility of viable BSL operations at specific grounds and seasons to enable commercial operators to take their own decisions. It is up to the authorities to decide how much state support should be given to encourage commercial activities. This stage has been reached at Negombo; elsewhere on the southwest and on the northeast coasts, the results are encouraging enough to embark on more extensive and extended activities.

Bottom-set gillnetting (BSG): An open FRP boat of a local fisherman (8 m length; 15 hp) was engaged for about two months at Ambalangoda (southwest). The trials aimed at comparing the catch between the traditional smaller meshed gillnet (90-100 mm) and the experimental larger meshed gillnet (125-160 mm).

The trials were of a short duration; still they showed a distinct difference in catch, the experimental fishing gear capturing twice as much as the traditional in terms of weight; the average catch per net per set was 5.2 kg in the former and 2.7 kg in the latter. Of the total average catch of 71 kg per operation, the share of the large meshed gillnet was 44 kg. The difference was because the catch of the experimental fishing gear comprised more of adult and large fish, whereas those of the traditional gear consisted mostly of young fish and smaller varieties.

Provisional conclusions were :

- On a small-scale basis (conducted inshore with a small boat), the fishery appeared to be technically feasible and commercially viable.
- The large-meshed gillnet was more efficient and cheaper, suffered less damage and required less time and twine for maintenance.
- Use of cheap, locally produced light weight net hauler would make operation easy and allow use of more nets in deeper waters for bigger catch.
- A slightly larger and more stable boat would help even in rough conditions and allow more space and stability for using a net hauler.

Trap fishing: Trials were undertaken for about six weeks with Colombo and Trincomalee as bases and with 11 types of traps differing in material, size and shape. Some were imported, others made locally. Catches, however, were very low and did not encourage further work or promotion. Fish traps can be used only in inshore areas at a subsistence level and/or as a supplementary method from fishing craft which undertake other passive demersal fishing methods.

High-opening bottom trawling: Project work for the development of high-opening bottom trawls was carried out south of Palk Bay, north of the Gulf of Mannar and Dutch Bay from June 1982 to October 1985. The aim was to ascertain the technical and economic feasibility of high opening bottom trawls for catching shrimp as well as fish.

The trials confirmed the superiority of high-opening bottom trawls for harvesting shrimp as well as food fish.

Shrimp-cum-fish high-opening trawls, with large mesh in all sections of the trawl, caught as much shrimp as conventional shrimp trawls while catching a substantial quantity of food fish.

High-opening bottom fish trawls caught more fish than any other orthodox shrimp trawl.

At the request of private fishermen/boat owners, an extension and training programme for construction at cost of improved high-opening bottom trawls was implemented. Most of the conventional trawls of boats operating from Pesalai and Kalpitiya were replaced by new trawls.

The design of high-opening bottom trawls developed and introduced for the fleet of boats of Pesalai and Kalpitiya suited fishing conditions at the northern part of Palk Bay. Demonstration and extension programmes should be implemented in fishing centres of this aree.

The vessels used in the trials were in many ways obsolete. Consideration should be given to developing designs for an improved motorized trawler, which would be able to perform better on various counts: seaworthiness, fuel efficiency, handling of fishing gear and deck layout.

3. PRESENT STATUS OF DEMERSAL FISHERIES

BOBP engaged a national consultant to review previous BSL trials off Sri Lanka and to survey current activities of the commercial fleet. It also helped organize a crash island-wide field survey of active fishing craft and gear engaged in demersal fisheries. The following compilation has been made from information collected through these activities and from information available in other publications.

Environment: The continental shelf is narrow around most parts of the island, averaging 20-25 km except the north, northwest and northeast areas where it is broader. The shelf area of about 32,000 sq.km has an uneven rough bottom. It is studded with rocks and corals, particularly in the southern half of the island.

Areas of smooth bottom are found in shallow waters on the northwest coast, in Palk Bay, in the nearshore region off Pt. Pedro, off Hambantota, as an intermediate zone between the uneven and rough inshore bottom and the outer shelf edge, and north of Trincomalee, particularly between Boulder point and Mullaitivu, outside the 10 fm line.

Contrary to the general opinion that it has favourable bottom conditions for trawling, the Pedro Bank presents a variety of bottom conditions with a tendency towards smooth bottom only in the shallower parts. In the Gulf of Mannar, in the deeper 250-400 m depth, there is a plateau of near flat bottom of about 40 sq.km. Although the even flat bottom areas figure in such a long list, safe trawlable grounds are limited in practice to the upper northwest and north regions.

The island experiences both the monsoons-a stronger southwest monsoon from May to September and a weaker northeast monsoon from November to March. Off the east coast, currents are stronger during the northeast monsoon. And off the west coast, they are strongest.

during the southwest monsoon. In general, coastal currents off the east coast are stronger than those off the west coast. Those off the southern coast are among the strongest.

The thermocline is at its greatest depth during the northeast monsoon, at 100-125 m, and is at a shallow depth at 40-60 m during the southwest monsoon. This means that fish concentrations would be greater nearshore during the latter monsoon period, and resources may be moving further offshore during the northeast monsoon period.

Statistics: The country is divided into 13 coastal divisions. Estimates of catch and effort are recorded separately for the major types of fishing craft such as the 3½ tonners, the outboard motor craft and non-motorized craft. Breakdown of demersal fish catches is limited to four or five broad categories, hence species-wise records are not available. The organizational set-up for collecting catch figures needs to be strengthened and streamlined to provide a better and a more reliable picture of the status of the fishery. However, some ad hoc short term activities and past surveys/studies give us glimpses into the present demersal fishery scenario.

Fishing fleet: Four types of craft are engaged in demersal fisheries, i.e., traditional non-motorized, traditional motorized (with either inboard or outboard motors), 18' FRP boats propelled by 6-15 hp outboard motors, and 3½ ton (8.5 m) boats powered by 30-40 hp in-board motors. There are about 2150 traditional non-motorized fishing craft in demersal fisheries out of a total of 14,000 such boats in the Sri Lankan fishery; about 900 traditional motorized boats out of 3,800 boats; about 1,500 FRP boats out of 6,000; and about 1,600 3½ tonners out of a total of 3,300 such fishing craft. (Table 1).

Table 1

Types and numbers of fishing craft

Types of fishing craft	Total number of fishing craft[1]	Number of fishing craft engaged in demersal fisheries[2]
Traditional non-motorized	13963	2145
Traditional motorized	3791	898
18' FRP outboard motorized boats	5882	**1489**
3½ ton inboard motorized boats	3329	1613
Total	26965	6145

[1] Marine Small-Scale Fisheries of Sri Lanka : A General Description (BOBP/INF/6).

[2] Status of Demersal Fishery in Sri Lanka by R. Maldeniya (BOBP/WP/41).

Indigenous fishing craft are of three main types: planked craft (vallam), out-rigger canoes ***(oru)*** and log raft ***(kattumaram/teppam).*** The 18' FRP boats and 3½ ton boats are those introduced during the late 50s.

There are relatively more non-motorized traditional fishing craft than any other type of fishing craft in the northeast (Trincomalee – Mullaitivu), the south (Galle – Matara), and the east (Batticaloa – Kalmunai). Together, they contribute more than 60% of the total number of such fishing crafts in the fishery. The number of 18 footers in the northwest (Mannar – Chilaw) far outweigh those in all the other regions combined; the 3½ tonners are more numerous in the north-west, north (Jaffna) and west (Negombo to Colombo), and are so popular all along the western side of the island, north to south that they account for nearly 90% of such fishing crafts engaged in the demersal fishery. The largest number of motorized traditional fishing crafts is in the north, about two-thirds of the total engaged in the fishery.

Fishing' methods: The bulk (99 per cent) of the island's marine fish comes from the coastal fishery extending up to 40 km from the coast, i.e., on the continental shelf and a little beyond.

Trawling, bottom-set longlining, handlining, bottom-set gillnetting and trap fishing are the methods used for exploiting the demersal fishes. The types of fishing methods and their seasons at various places are indicated in Table 2.

Table 2

Types of demersal fishing methods and seasons of operation in different districts

HL — Handlining ; BSL — Bottom-set longlining ; **BSG** — Bottom-set gillnetting ; TR -Trawling ; TF -Trap fishing)

Place	Seasons of operation		
	Throughout the year	South-west monsoon (April-September)	North-east monsoon (October-March)
North west			
Mannar	BSL, BSG, TR, TF	—	HL
Puttalam	HL, BSL	BSG	—
Chilaw	HL, BSG, TR	—	—
West			
Negombo	HL, BSL, BSG, TR	—	—
Colombo	—	BSG	HL, BSL
Mutwal	TR	—	—
Southwest			
Kalutara	HL	**BSG**	BSL
Beruwala	—	BSG	HL, BSL
South			
Galle	BSL	**BSG**	HL
Matara	—	—	HL, BSL
Southeast			
Tangalle	—	**BSG**	HL, BSL
Pathanagala	—	—	HL, BSL
East			
Batticaloa	—	HL, BSL, BSG	—
Kalmunai	HL	BSG	BSL
Northeast			
Trincomalee	BSG, TF	—	HL
Mullaitivu	—	HL, BSL	—
North			
Jaffna	HL, BSL, BSG, TF, TR	—	—

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Trawling: **Trawling is almost confined to the north and northwest coasts since suitable trawling grounds for prawns are found only in these areas. Hence, Mannar alone contributes 82% of the total trawl catch, which by itself accounts for 32% of the total demersal fish production. It is carried out by exclusively the 3½ tonners. Among the other areas, only at Negombo do the non-motorized traditional craft, the large out-rigger canoes, conduct some trawling for prawns. Although trawling is carried out almost throughout the year, intense activity is witnessed only at Mannar.**

Handlining: **Handlining is the most widely used technique all around the island because of its advantage as an ancillary method. It accounts for 25% of the total demersal fish production. It is used mostly from non-motorized traditional craft and 18' FRP boats. Handlining is widely adopted in Chilaw and Trincomalee districts. In Puttalam, Chilaw, Jaffna, Trincomalee, Negombo, Kalutara and Kalmunai, it is carried out throughout the year. In Batticaloa and Mullaitivu, fishing is restricted to March-October, while in the remaining areas, the season is November to April.**

Bottom-set *gillnetting* (BSG): This method is favoured more in the north, northeast and north-west and contributes 25% of the total demersal catch. Jaffna alone accounts for 75% of the returns from BSG. In Mannar, Chilaw, Negombo, Trincomalee and Jaffna, it is conducted round the year. In other areas, the season is restricted to October-April except in Batticaloa, where fishing is conducted from April to September. BSG is carried out mostly by the 3½ tonners; the other important fishing craft are the 18' FRP boats.

Bottom-set /ung/ining: **Bottom-set longlining appears to be more popular in the northwest and the north followed by the south. The 3½ tonners bring in more catch as compared to the 18 footers; the others' contribution is very low. The share of BSL is 16% of the total. The largest BSL returns come from Jaffna; although Galle ranks next in importance, its share is only one-third that of Jaffna. The fishery extends throughout the year at Jaffna, Mannar, Puttalam, Negombo and Galle. Excepting Batticaloa and Mullaitivu, where the fishery extends from February to October, fishing is conducted in the other areas from October to April.**

Trap fishing: **Trap fishing is restricted to three northern districts — mostly in Jaffna, much less in Trincomalee and Mannar. It is carried out all through the year. The total contribution is only 2%-non-motorized traditional fishing craft of Jaffna account for most of it.**

It can be generally stated that fishing is carried out more or less throughout the year in most parts of the northern half of the island. At Batticaloa and Mullaitivu, on the east, fishing is limited to April-September (southwest monsoon period) ; in the remaining districts, fishing activity is witnessed during the other half of the year, October to April (northeast monsoon period).

Production: **A look at the country's total fish production for the 10-year period 1973-l 982, indicates that of the average production of 130,000 tonnes, demersal fisheries contributed about 38,000 tonnes or 29%.**

In district-wise production, Jaffna has been on top with an average yield of 12,000 tonnes, resulting from diversified fishing activities — bottom-set gillnetting, bottom-set longlining, bottom trawling and trap fishing in that order. Though in earlier years Trincomalee consistently ranked second, it has been replaced in recent years by Mannar, almost exclusively due to bottom trawling activity in Mannar. Negombo has been witnessing a drastic fall in production, a general decline is also evident in Colombo, Kalutara, Matara and Mullaitivu. Whether this decline is because the base of operation of the crafts has shifted or because of differences in the methodo-logy of data collection and estimation or some other cause, is not known.

Generally, the northern half of Sri Lanka, between 8º N and 10º N, so dominates demersal fisheries that it accounts for 81% of the total production.

Among the different types of craft, the 3½ tonners stand on top with nearly 60% of the total catch ; the non-motorized traditional boats and 18-footers account for 19% and 18% respectively. From the 3½ tonners, the major fishing methods are bottom trawling (predominantly at Mannar and Jaffna), and bottom-set gillnetting (chiefly at Jaffna). From the 18-footers, the catch is best at Chilaw through handlining and at Jaffna from bottom-set longlining. Handlining is the mainstay of non-motorized boats at Trincomalee and Kalmunai.

As for rates, the best yields are obtained from bottom trawling at Mannar; from bottom-set gillnetting at Jaffna and Chilaw; from bottom-set longlining at Pathanagala.

Species composition: Although more than 200 species belonging to 55 families have been recorded from the demersal group of families, about 30 species are the most common,

They include emperor fishes or breams (Lethrinidae), snappers (Lutjanidae), grunts and sweetlips (Pomadasyidae), pony fishes (Leiognathidae), sturgeons (Acanthuridae) and sharks, skates and rays. Although conventionally the carangids (jacks and trevallys) should be classified as pelagics, they are grouped in Sri Lanka under demersals because of their vulnerability to bottom fishing gear. The emperor fishes, snappers and groupers are collectively called 'rock fishes'. On an average the rock fishes form 38%, an equal amount is contributed by sharks and skates, and the balance by carangids and others.

The average production of prawns is about 3,500 tonnes, the figure for 1981 being around 5,000 tonnes. Lobsters used to be harvested at a level of a few hundred tonnes during the mid-70s. but following legislation on lobster fishing, production came down to 230 tonnes in 1979. After 1979 there is no information.

Edible oysters are harvested at a subsistence level. Pearl oyster fishery was irregular, the latest was in 1983 after a lapse of 25 years. In 1958, of an estimated stock of 258 million oysters, 4.5 million were dredged. In 1983, the returns were very poor; only 20,000 to 30,000 oysters were reportedly taken.

4. POTENTIAL

BOBP engaged the services of a national consultant to evaluate the status of demersal fish stocks and the potential for future development. With the findings of 'R. V. Fridjtof Nansen' as the basis and employing three different methods of stock assessment, it was concluded that there is scope for doubling the present yield from demersal resources.

The maximum sustainable yield (MSY) of demersals from the continental shelf was placed at about 76,000 tonnes as against the current level of exploitation of about 40,000 tonnes. Of the total MSY, the Palk Bay, Palk Strait and Pt. Pedro areas were credited with 30,000 tonnes and the remaining areas around the island with 46,000 tonnes. Of these, the MSY of the economic varieties of large demersals such as emperors, snappers and carangids was estimated to be in the order of 28,000-29,000 tonnes.

The potential yield (maximum sustainable yield minus the present yield) of 36,000 tonnes is estimated to consist of 13,000 tonnes of large demersafs and 23,000 tonnes of others. A rough pattern of these potential resources in different regions is indicated in Table 3, where the current and potential yield per sq.km are also shown.

Table 3 shows that the largest potential yield is obtained from the north; however, much of this additional resource is expected to be comprised of small demersals. The best areas for large demersals appear to be on the west and the south.

The level of potential resources itself is lowest on the east; there does not appear to be much scope in the Trincomalee – Mullaitivu belt.

From an unit area of one sq.km, the largest percentage of the potential is presently harvested in the west coast (65%) and in the east coast (64%). The lowest in the south (16%); in the north, the figure is 46%.

The current yield per sq.km. for all fish — both pelagic and demersal -is about 5.4 kg, that from the demersals is 1.2 kg, about 22% of the total. The sustainable yield per sq.km. from all fish is found to be 7.8 kg, of which the demersals are expected to contribute 2.3 kg, about 29% of the total.

Table 3

Estimated maximum potential yield of demersal fishery resources as compared to the present yield (in tonnes)

Region	Area[1] (sq.km)	Annual[2] yield in 1982	Annual[3] sustainable yield	Potential yield[3]		Yield per sq.km (kg)		
				All demersals	Large demersals	Present	Sustainable	Potential
		(Figures rounded to nearest thousand)						
North (North of Mullaitivu, Palk Bay, Palk Straits and Pedro Bank)	13064	14000	31000	17000	3000	1.1	2.4	1.3
West (From Mannar to Matara)	9747	19000	30000	11000	6000	2.0	3.1	1.1
South (Hambantota district)	3215	1000	6000	5000	3000	0.3	1.9	1.6
East (Amparai district to Mullaitivu district)	6361	6000	9000	3000	1000	0.9	1.4	0.5
All areas	32387	40000	76000	36000	13000	1.2	2.3	1.1

[1] Saetersdal, G.S. and G.H.P. de Bruin (Ed) — Report on a Survey of the Coastal Fish Resources of Sri Lanka. August-September 1978.

[2] R. Maldeniya (BOBP/WP/41).

[3] K. Sivasubramaniam (BOB P/WP/41).

5. RECOMMENDATIONS

BOBP's attempts at indicative fishing trials should be followed up with activities aimed at knowing more about the exact locations and periods of fish concentration in areas accessible to small-scale fishery. More knowledge may also be desirable on such aspects as materials of lines, hook type and size, snood length and spacing, bait species etc., for bottom-set longline. The economic feasibility of employing low-cost echosounders and line hauling devices of foreign or local manufacture has to be ascertained. Hence further trials have to be undertaken to provide better indications of the most effective gear assemblage and tactics.

Bottom-set longlining can be helpful as a means of obtaining supplementary income during the lean season for driftnet fishery. The bulk of operational costs goes towards fuel and bait. While smaller boats with low power engine could cut down fuel cost, an efficient organizational set up for supply of good quality bait at reasonable prices may help make the operation more economical. Steps to obtain better prices for the fish (perhaps a state-run guaranteed price scheme) and identify the correct locations of rocky grounds would all be necessary for further development of this activity, which is now at a comparatively low level. This would also help reduce pressure on exploitation of pelagic stocks and restrain seasonal migration of fishing craft and

fishermen to the east and southeast during the lean season for pelagics in other parts of the island.

From the operational standpoint, success depends on fishing during the night and in the early morning, before dawn; a line setting with about 1000 hooks, and a soaking time of about 1½ hours. Wide gap hooks have recorded better hooking rates, but the cost is high and they are difficult to operate. So the kirby or round bent hooks could be used. A catch rate of 10 kg per 100 hooks or a daily catch of about 70 kg would be attractive enough for future development of this fishery. The catch will in general be dominated by large demersals, hence the need for tapping these resources requires no emphasis.

It has been reported that there are no economical bottom-set longlining operations at Trincomalee (may be because of inadequate coverage of landings during the brief survey period). Though indicative fishing trials here demonstrated favourable catch rates compared to those obtained in Negombo, the low price prevailing for demersals at Pudawakattuwa (north of Trincomalee) tended to reduce the economic viability of the operation. Fishermen preferred the fishery for pelagics which got them better prices. Some incentives may be required for bottom-set longlining as a promotional measure, especially to improve marketing. Perhaps a guaranteed price scheme could be one such incentive. It may also be necessary to discourage commercial scale trawling in that area, to prevent even temporary reduction of bottom-set longline catch rates.

Although the fishing trials with bottom-set gillnets have shown that large-mesh gillnets can be more productive than the conventional smaller meshed nets, more trials for a longer period are necessary before follow-up action can be taken.

For the development of Pedro Bank, the identification mission fielded by BOBP recommended rather cautiously that the resources level may justify an effort of only trawlers of 20 m length and powered by 300-400 shaft horsepower engines. The resultant catch may be around 2,000-3,000 tonnes per annum, which at first glance may not appear to be attractive either in terms of food supplies or in terms of employment, However, a beginning with two identical boats (for pair trawling when necessary) employed on commercially-oriented exploratory fishing would provide the necessary field data for a resolute planning for the future.

The BOBP has successfully carried out fishing trials with high-opening bottom trawls for boats ranging from 9 to 12 m in length and 30 to 70 hp in the northwest coast of Sri Lanka. The results have been very good and resulted in the introduction of new, diversified, more productive high-opening fish and shrimp trawls. Introduction of these trawls in the northern part of Sri Lanka should be considered.

Further trials could also be carried out with multiple hooks in handlining operations, Handlining is common all around the island and if application of multiple hooks is successful, the cumulative effect will be promising. It may be recalled that R. V. Fridjtof Nansen recorded a good concentration of deepwater demersals at and near the continental edge right round the island. On this basis, the review of the status of demersal fishery arranged by BOBP suggested that there were good prospects for deepwater multiple hook lining and bottom-set longlining.

Future development of surplus yield levels of demersal resources on the shelf should be aimed area-wise in the small-scale sector. The areas are, in order of priority:

(i) between Negombo and Hambantota
(ii) between Mannar and Negombo, and
(iii) between Hambantota and Batticaloa.

The development of the resources in the Palk Bay/Palk Straits depends on finding better utilization for pony fishes and other small varieties which are abundant in that area.

In the Trincomalee – Mullaitivu area, although it has been reported that there does not appear to be much scope, bottom-set longlining trials should be pursued in view of the successful trials at Trincomalee.

The primary interest being the exploitation of emperor fishes, snappers, jacks and trevallys, the depth range of 20 to 60 m appears to be the most productive in the areas identified earlier.

With limited scope for further expansion of trawling, a combination of passive fishing techniques will have to be adopted to achieve a reasonable coverage of the potential fishing grounds and a production level close to the estimated maximum potential yield. Specifically, the western region of Chilaw, Negombo, Colombo and Galle appears to be promising for bottom-set longlining during January to May; BSL may also have prospects on the Batticaloa coast during April to September. Incidentally, these months represent lean periods for pelagic species in the respective areas. Encouragement of bottom-set gillnetting during October to May appears justified in the Hambantota bank area as well as at Galle, Kalmunai and Batticaloa.

In the southern half of Sri Lanka, between Colombo and Batticaloa, there seems to be scope for redeployment of effort, especially by the 18 footers and the motorized traditional boats; if this is not possible, careful introduction of more such boats could be tried in the south and south-east region during the northeast monsoon period and in the southwest during the southwest monsoon period.

It was suggested during the review of the status of demersal fisheries, that besides squids and cuttle fish, the more easily available species of scads, bullet tuna, frigate tuna and little tuna were equally good as bait. Future trials to augment supply of bait fish could take this into account.

Appendix

DIARY OF BOBP ACTIVITIES ON DEMERSAL FISHERIES

Activity	Duration	Brief description and results
1. Identification phase	Jan. '79 to Sep. '79	Preparation of draft description of different activities, finalization of the document in consultation with the Ministry of Fisheries, recruitment of consultants, arrangements for boats, supply of bait, fishing gear and equipment.
2. Bottom-set longlining	Oct. '79 to March '80	First set of fishing trials along the southwest coast, mainly off Panadura and Galle. Catch rates were low, attributable to certain operational and environmental problems, exploratory nature of investigations, experimentation with different types of gear, and scattered availability of fish. Results of operations reported in BOBP/WP/6. Vertical bottom-set line trials with automatic reels and artificial rubber bait were not successful.
	June '80 to July '81	Undertook the next set of similar trials on the east coast (Kalkudah) with two boats in August. Catch rates were slightly better than those during earlier trials, but still raised doubts about commercial viability. Operations with another two boats started at Silvathurai in November but had to be discontinued because of cholera outbreak in the area. Activities were therefore shifted to the Negombo area in December. Catches were good especially during March-April, encouraging entry of commercial operators. Comparative studies at Colombo in collaboration with local manufacturers on the catching efficiency of monofilament and multifilament longlines. The catch rate of monofilament lines was three times that of multifilament.

		Aug. '81 to Aug. '82	A detailed paper on the trials was prepared (BOB P/WP/16). Encouraged by the results of BOBP trials, 24 commercial boats started operations at Negombo. For wider dissemination it was decided that BOBP might provide the necessary lines and hooks to selected fishermen at cost. Assistance was given to Ministry of Fisheries to continue comparative fishing trials with monofilament and multifilament longlines and with wide gap hooks against straight and kirby hooks. Monitoring of all operations at Negombo was done by national counterparts. Fishing trials with different types of hooks showed that wide gap hooks caught more fish than the straight and kirby hooks, but the cost of the former being twice that of the latter, the results did not appear to favour a switch to wide gap hooks. Indicative trials conducted at Trincomalee confirmed the economic viability of operations from this part as well.
		Dec. '82 to June '83	Fishing operations from south of Colombo, supported and monitored by NARA staff, showed good results. Similar encouraging returns were obtained from trials at Dehiwala, Panadura and Ratmalana where BOBP provided assistance in fishing technology and supplied fishing gears to fishermen (BOBP/WP/40). Since further trials or technical development would not significantly increase catch rates, the activity was phased out during the year by transferring the findings to the training and extension divisions for follow up.
3.	Bottom-set gillnetting	Jan. '80 to Sep. '80	Fishing trials to compare the performance of traditional smaller meshed gillnets and larger meshed experimental ones fabricated by BOBP were conducted at Ambalangoda with a local fisherman's boat. Average catch rate with the experimental gear was twice that of traditional gear; the former caught adult and bigger-sized fish while the latter caught juvenile and smaller-sized varieties (Manuscript report).
4.	Trap fishing	Aug. '82 to Oct. '82	Trials conducted with different types and shapes of traps from bases at Colombo and Trincomalee. The results were poor and ruled out the need to continue the activity (BOBP/WP/42).
5.	High-opening bottom trawling	June '82 to Oct. '85	Fishing trials were conducted inshore south and north of Mannar Peninsula, with 3½ tonners, and in Dutch Bay with 11 tonners. Catch rates with experimental trawls were higher than with the traditional trawls. Hence implemented an extension programme for constructing new trawls at cost for fishermen/boat owners of Pesalai, Gulf of Mannar and Kalpitiya Dutch Bay. Resulted in replacement of most of the traditional trawls, Good prospects for similar development and extension programme lie in the area north of Palk Bay. (Report under preparation).
6.	Review of demersal fisheries	Dec. '80 to Aug. '81	Engaged a national consultant to review previous trials of bottom-set longlining off Sri Lanka and to make a survey of the current activities of the commercial fleet.

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	The main findings were: BSL has good prospects on the south and northwest coasts; besides squids and cuttle fishes, the easily available species of some scads, bullet tuna, frigate tuna and little tuna were equally good as bait; at and near the continental edge round the island, there were good prospectsfor deepwater multiple hook handlining and bottom-set longlining; bottom-set gillnetting, though having limited use, could be extended for capture of skates on sandy and muddy bottom : since distant water trawling grounds are limited, only a small number of large trawlers could be employed (Manuscript report).
Mar. '81 to August '81	To advise the Ceylon Fisheries Corporation on ways and means to improve the performance of their large trawlers, a master fisherman-consultant was provided (Manuscript report).
Aug. '82 to March '83	An evaluation of the status of demersal fish stocks and the potential for further exploitation was conducted through a review of all past surveys under the direction of a national consultant. The significant outcome is that the yield from demersal resources could be doubled from the present level of 40,000 tonnes to 76,000 tonnes; however, only less than one-third of the surplus potential would come from valuable large demersals; better development prospects lie in the southern half, in the area between Negombo and Trincomalee and as a small-scale fishery (BOBP/WP/41).
Sep. '82	On the suggestion of BOBP, a crash island-wide field survey of active fishing craft and gear engaged in demersal fisheries was conducted (BOBP/WP/41).

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Publications of the Bay of Bengal Programme (BOBP)

The BOBP brings out six types of publications:

Reports (BOBP/REP/. . . .) describe and analyze completed activities such as seminars, annual meetings of BOBP's Advisory Committee, and projects in member-countries for which BOBP inputs have ended.

Working *Papers* (BOBP/WP/. . .) are progress reports that discuss the findings of ongoing BOBP work.

Miscellaneous *Papers* (BOBP/MIS/. . .) concern work not originated by BOBP staff or consultants — but which is relevant to the Programme's objectives.

Newsletters (Bay of Bengal News), issued quarterly, contain illustrated articles and features in non-technical style on BOBP work and related subjects.

Infomation Documents (BOBP/INF. . .) are bibliographies and descriptive documents on the fisheries of member-countries in the region.

Manuals and Guides (BOBP/MAG/. . .) are instructional documents for specific audiences.

A list of publications follows.

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1. Report of the First Meeting of the Advisory Committee. Colombo, Sri Lanka, 28-29 October 1976. (Published as Appendix 1 of IOFC/DEV/78/44.1, FAO, Rome, 1978)
2. Report of the Second Meeting of the Advisory Committee. Madras, India, 29-30 June 1977. (Published as Appendix 2 of IOFC/DEV/78/44.1, FAO, Rome, 1978)
3. Report of the Third Meeting of the Advisory Committee. Chittagong, Bangladesh, 1-10 November 1978. Colombo, Sri Lanka, 1978. (Reissued Madras, India, September 1980)
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16. Report of the Seventh Meeting of the Advisory Committee. New Delhi, India, January 17-21, 1983. Madras, India, March 1983.
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