BAY OF BENGAL PROGRAMME

DEVELOPMENT OF SMALL-SCALE FISHERIES

Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka

BOBP/WP/3

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BOB P/WP/3
(GCP/RAS/040/SWE)

Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka

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Development of Small-Scale Fisheries in the Bay of Bengal
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PREFACE

This is the first report of a fishing gear improvement project aimed at upgrading small-scale fisheries in Sri Lanka. The document presents the rationale, the mechanics and the findings of experiments conducted over a 9-month period in 1979 to improve the most popular type of fishery in Sri Lanka the large-mesh driftnet fishery.

The experiments have led to definite conclusions about ways to lower the cost and raise the efficiency of the driftnet fishery. The document may therefore serve as a guide for specific extension work in the use of large-mesh driftnets by small-scale fishermen; it may also provide a basis for further experiments to improve the performance of these nets.

The fishing gear improvement project is an activity of the Programme for the Development of Small-Scale Fisheries in the Bay of Bengal (GCP/RAS/040/SWE). It is executed by the Food and Agriculture Organisation of the United Nations (FAO) and funded by the Swedish International Development Authority (SIDA). The Ministry of Fisheries, Sri Lanka, participates in the project as cooperating agency. On behalf of the Ministry, Mr. K. T. Weerasooriya, Research Officer in Fishing Gear Improvement, has served as technical liaison officer on the project.

The document is a working paper and has not been officially cleared either by the Sri Lanka Government or by the FAO.

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SUMMARY

Large-mesh driftnets play a pivotal role in Sri Lankas small-scale fisheries. They captured about 25% of all the fish Sri Lanka produced in 1978.

In view of the rising cost of these widely used nets, a nine-month experimental project was conducted in 1979 on making the nets less costly and more productive. Under the project, fishermen-cum-boat-owners in two fishing centres—Beruwala and Velvettiturai— used two kinds of nets: traditional nets and the modified nets supplied by the Bay of Bengal Programme. Comparative data on fish catch by species and weight for the two kinds of nets revealed that nylon nets of finer yarn—which are 25% cheaper than the traditional nets—raised the fish catch by 20 to 30 per cent during the experiments.

The other conclusions resulting from the experiments concern the ropes and floats used for driftnets. Polypropylene ropes and large cylindrical auxiliary surface floats are as good as — and cheaper than—the nylon ropes and small longitudinal floats used at present with large-mesh driftnets.

Following from the above, the ma!n recommendation is that the use of thinner nylon netting material, of polypropylene ropes and of large floats should be energetically promoted. Their manufacture and import should be encouraged.

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CONTENTS

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1 INTRODUCTION

Drift-netting has been a traditional method of capture of large pelagic and semi-pelagic species in the waters of Sri Lanka, both inshore and offshore, for decades. Two developments in the late 50's heightened their popularity. These were the gradual introduction of motorized fishing boats and the growing popularity of synthetic netting materials like polyamide (PA or nylon) multifilament, which gradually displaced netting materials from natural fibres. At present, large-mesh driftnets are the most widely used fishing tools for the capture of tuna and other large pelagic species in Sri Lanka. They accounted for a catch of 30,000 tonnes, or about 25% of the total production, in 1978. The fishery is concentrated along the west and the south coasts of Sri Lanka during the south-west monsoon period; along the east coast during the north-east monsoon; and in the north all the year round.

About 2,000 mechanized boats, mainly 26-28 feet long, are regularly engaged in large-mesh driftnet fishery. Some other types of craft also use large-mesh driftnets occasionally — about 500 mechanized boats, 17 to 18 feet long, and about 1,000 indigenous craft (the oru and the vallam).

Apart from the introduction of synthetic fibres, mainly nylon multifilament, little conscious effort has been devoted to upgrading driftnet fishery either by reducing cost or improving performance. The ever-rising costs of fishing gear based on petro-chemicals have made both strategies imperative. A project to test the efficacy of alternative low-cost netting materials was therefore undertaken. Its specific objectives were:

1. to compare the catching efficiency of different yarn sizes of nylon multifilament netting for large-mesh driftnets.
2. to identify other areas of gear improvement during the course of the experiments.

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2 TYPES OF LARGE-MESH DRIFTNETS MOST COMMONLY USED IN SRI LANKA

The construction of driftnets for large fish species has developed over the years by trial and error. As a result, net construction and the style of rigging vary according to the area and the fishermen.

The traditional large-mesh driftnets use a variety of polyamide materials of different properties. The standard length of a piece of netting is 500 meshes and depth varies from 50 to 150 meshes. Mesh sizes range from 100 to 180mm stretched mesh (4" to 7"). While sizes of netting yarn range from R 530 tex to R 760 tex (210 d 21 —210 d 30), the common range is between R 680 tex and R 760 tex (210 d 27—210 d 30). The colour of the netting material may be natural white, golden yellow, green, etc. For hanging the netting, polyvinylalcohol (PVA) or poly-propylene (PP) ropes of a diameter ranging from 8 to 12 mm are used. For floatation, different kinds of polyvinylchloride (PVC) floats (cylindrical, flat longitudinally grooved, spherical) are used, as also a fair amount of timber and synthetic foam material. Concrete weights or small boulders serve as sinkers.

A deep driftnet is usually composed of two pieces of netting which are horizontally joined together. For hanging the net, the framing lines are usually reeved so as to entangle fish rather than gill them; this method of hanging was perhaps originally meant to suit the weak tensile strength of the natural fibre netting material. The net is then loosely set on the rope and fastened tightly every 2-3 metres with a hanging ratio (length of rope/stretched length of netting) ranging from 0.5 to 0.6. Longitudinally grooved plastic floats, 150-180 mm, in length, are fastened on the top framing line at varying distances. The larger cylindrical or spherical plastic floats are used as surface floats for suspending the net and fastened with pendant lines of varied length. Sinkers, whenever used, are fastened with small pendant lines. (Appendix 3).

Normally, a fleet of nets is composed by tying each piece of net with top and bottom lines. The netting is laced loosely together so as to form a continuous wall spreading out vertically in the water. The total number of nets used per fleet varies from 20 units to 60 units depending on established practices, the availability of nets and the means of the operator.

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3 ALTERNATIVE NETS USED IN THE EXPERIMENTS

The new nets introduced for the nine-month experiments used finer netting yarn for the webbing than the traditional nets; mesh sizes of standard size (5" and 6") instead of the variety of sizes (4" to 7") normally used; ropes of PP instead of PVA; and large cylindrical PVC floats instead of small flat longitudinally grooved floats. The sinkers and the style of rigging, hanging, lacing were the same as for existing nets. Appendix 4 shows the design of the modified net.

Its specifications are spelled out below:

Netting yarn: thickness of 210 d 21

Ropes : made of PP. Nets mounted on

(a) single PP ropes of 10 mm diameter

(b) double opposite-twisted PP ropes of 6 mm diameter

Floats : Nets suspended with

(a) both kinds of floats together or

(b) with only the large cylindrical PVC floats.

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4 CONDUCT OF EXPERIMENTS

The experiments on the large-mesh driftnets were carried out under commercial fishing conditions. One advantage of this practice was that it facilitated quick feedback from fishermen of the area. The Programme entered into agreements with fishermen-boat owners in two fishing centres — Beruwala and Velvettiturai. Under these agreements, the fishermen were to operate the new nets along with their own nets, and prepare simple records of catches for both varieties. All proceeds from the sale of fish would accrue to the owner/crew of the boats.

Fishing area: The fishing trials were restricted to areas of Beruwala and Velvettiturai currently fished by motorized boats using large mesh driftnets and extending up to 40 miles offshore. The geographic locations are shown in Appendix 1.

Duration: The fishing trials began late February 1979 and continued till late December 1979. The number of fishing days totalled 180 in Beruwala and 130 in Velvettiturai.

Fishing Craft: The experimental boats were those commonly used in the two areas — i.e. a 28 feet-long 33. tonner made of fibreglass reinforced plastic and fitted with a 33 hp engine, in Beruwala; and a 32-feet long Jaffna boat of wood, also fitted with a 33 hp engine, in Velvettiturai. Photographs of the two boats are shown in Appendix 2.

Fishing gear: Ten new nets were issued to each boat; they were used simultaneously with traditional nets (25 in Beruwala, 55 in Velvettiturai). The new nets were set in between the traditional ones as shown in Appendix 5.

Data collection: The crew of the boats were given simple recording forms to fill in. These forms furnished details of daily fish catch by species and weight for both kinds of nets. The data were monitored and collated every week by technical officers of the Ministry of Fisheries.

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5 FINDINGS

(a) *Thinner twine is superior to thicker twine*

The experiments showed that nets of thinner twine (21 ply) catch more fish than nets of thicker twine (27 ply.) The thinner variety caught 20% more fish in Beruwala and 30% more in Velvettiturai. (See tables 1A and 2A).

The 21-ply net is equal to or better than the 27-ply net for all species of fish. It is surprising, though, that it is much better than the 27-ply net for species like sharks and skates. In Beruwala the 21-ply net caught 40% more shark, in Velvettiturai 50% more shark, than the 27-ply net. The reason for this phenomenon is not known.

No other significant changes in catch composition between the 21-ply and the 27-ply nets were identified, either totally or by month. Tables 2A and 2B indicate the monthly catch records per netset.

Observations during trials indicated no evidence of excessive wear and tear or damage to the lighter netting. Some repairs were necessary; they were satisfactorily carried out with a very small amount of mending yarn.

The experiment clearly underscored the higher catching efficiency of webbing of finer yarn. Since it is cheaper as well, it is "twice blessed".

(b) *Polypropylene rope is cheaper than polyvinyl alcohol rope*

Trials with different types of framing line materials — polyvinyl-alcohol and polypropylene (PP) — clearly indicated that PP is as effective as PVA in framing the large-mesh driftnets, and less expensive. One can use single PP rope — or even better, two small PP ropes (0.6 mm) of opposite twist, which further reduce cost — without significant loss in strength. The use of two small ropes also facilitates the rigging and avoids entangling or rolling of nets along the framing line.

(c) *The use of larger cylindrical floats is cheaper than the use of smaller longitudinally grooved floats*

Experiments showed that the cost of buoyancy-providing material could be brought down quite a bit by replacing small longitudinally grooved floats with larger cylindrical auxiliary surface floats. (A single large float provides as much buoyancy as several small floats). This will also facilitate depth adjustment of the fleet of nets.

(d) *Fishermen like the new nets*

The experiment was conducted in cooperation with local commercial fishermen, using their boats and partly their fishing gear. It was a fruitful experience: the fishermen were keenly interested, very cooperative and most helpful: their so-called "reluctance to change" was nowhere in evidence; on completion of the experiment, the fishermen wanted to buy the modified gear at market value.

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(e) *The new nets would save costs and raise incomes*

A complete set of nets of the traditional type, say 40 pieces, costs about Rs. 40,000. On the modified nets one would make savings on the webbing (20%), ropes (50%) and floats (10%). The initial savings on the nets would be about 25% i.e. Rs. 10,000 for one set. This would reduce yearly costs on nets by about Rs. 3,000. Since 2,000 mechanized boats are engaged in large-mesh driftnet fishery, the total annual savings to Sri Lanka fisheries from the new nets could be as much as Rs. 6 million.

Even more significant than the reduced cost is the increased catch effiency secured by the finer nets. The yearly gross revenue of an average catching unit in the large-mesh driftnet fishery is assumed to be about Rs. 100,000. On the basis of data provided by tables 1A and 2A, with particular reference to major commercial species, the extra income from the new nets would be, say, 10% or Rs. 10,000. Thus, 2,000 motorized boats would derive an additional income of Rs. (2,000 x 10,000) or Rs. 20 million.

Other Observations

Mesh size: It was noted that a large number of different mesh sizes—from 120 mm to 170 mm, mostly with quarter inch intervals—are being used for driftnets. There is no advantage in using so many different sizes. By "standardization" to say three sizes — 5", 6" and 7" — certain manufacturing and distribution advantages could probably be attained.

Rigging: The hanging ratio (length of framing line/stretched length of netting) of 0.60 seems workable. However, a less tight hanging ratio of 0.50-0.55 may ensure better enmeshing or entangling of fish, without affecting easy removal of catch from the net.

The horizontal lacing of two pieces of nets to achieve the required depth is an unnecessary complication: it also make the gear slightly more expensive. Each piece of net should be made 1,000 meshes long and 50-120 meshes deep as required.

Knots: The double weaver's knot (also called double English knot), which is predominantly in use in Sri Lanka, ensures good knot stability. However, a single English knot, which significantly reduces the initial cost of webbing, might be sufficiently stable.

Colours: Nets of various colours are being used by fishermen without any apparent technical justification. If fewer colours are used, certain manufacturing advantages would be attained resulting in cheaper nets.

Light buoys: Fishermen, particularly in the south-west of Sri Lanka, frequently incur heavy losses because their nets are damaged or cut loose by passing ships. Buoys commonly used for protecting fishing gear from hazards at sea cost approximately Rs. 300-400 each and are readily available in various countries. For easy adoption, low cost and availability, local manufacture is advisable.

Net haulers: No net-hauling devices are in use in the small-scale fisheries sector in Sri Lanka. The fishery could be made more effective by employing such devices, but their economic feasibility is uncertain. Cheap, locally manufactured haulers are perhaps the only answer.

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Economic viability: In an effort to observe and record the economic viability of large-mesh driftnets, the performance of the Beruwala boat (28 feet long, 3½ tonnes in weight) using a full complement of fishing gear, was monitored continuously for nine months. The data presented in the table below given an idea of how profitable large-mesh driftnets can be.

EARNINGS OF A 3½ TONNE DRIFTNETTER FROM BERUWALA (March-December 1979)

1.	Value of landings	Rs. 125,421
2.	Running costs: fuel, others	Rs. 19,465
3.	Crew share: 2/5 (gross earnings - running cost)	Rs. 42,382
4.	Maintenance and repairs of engine and hull	Rs. 5,000
5.	Replacement and repairs of nets	Rs. 11,000
6.	Capital cost: (annuity 10 years, 10% interest)	Rs. 16,000
7.	Total cost	Rs. 99,847
8.	Net income	Rs. 25,574

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6 RECOMMENDATIONS

- The manufacture, import and use of thinner and more cost-effective PA netting material, PP rope and floats should be promoted through an extension programme. Those who are in charge of the programme should maintain close contact with different segments of the industry—fishermen, extension workers, training instructors, fishing gear manufacturers and importers, Government officials. The programme would include demonstrations, crash courses, and publication of technical literature as appropriate.
- To further improve large-mesh drift netting, comparative fishing trials should be held with cheaper netting materials such as polyethylene.
- The possibility of local manufacture of suitable and viable netline haulers should be explored.
- The use of signal light buoys should be promoted wherever applicable in small-scale fisheries and the possibility of manufacturing them locally should be investigated.
- Manufacturers and importers of nets should be persuaded to use fewer mesh sizes and fewer colors.

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Table 1-A

CATCH RECORDS OF EXPERIMENTAL FISHING IN BERUWALA

Boat: St. Jude No. WS 167	Locality: BERUWALA			Period: March-December 1979		
Unit	1			2		
Material	PA Multifilament			PA Multifilament		
Mesh size	120-125 mm (43/4"-5")			125mm (5")		
Netting yarn size	R 680 tex (210 d 27)			R 530 tex (210 d 21)		
No. of days	183			176		
Net sets	2513			1594		
Species, Groups of Species	Catch			Catch		
	Pcs.	Kg.	Per net set (kg)	Pcs.	Kg.	Per net set (kg)
Skipjack	301	803	0.32	203	51 3	0.32
Yellowfin	299	1139	0.45	157	733	0.46
OtherTunas	2570	2421	0.96	2865	1675	1.061
Seerfish	56	254	0.10	119	212	0.13
Shark	32	1054	0.42	24	690	0.43
Marlin, Sail fish, Spear fish	15	826	0.33	23	881	0.55
Skate	8	602	024	8	757	0.47
Miscellaneous	95	526	0.21	65	281	0.18
Total	3376	7625	3.0	3394	5742	3.60

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Table 1-B

MONTHLY RECORDS OF EXPERIMENTAL FISHING IN BERUWALA

Kg/netset

Month	March		April		May		June		July		August		Sept.		October		November		December	
Twine size (210d....)	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27
Skip Jack	0.40	0.38	0.21	0.61	1.65	1.13	0.22	0.24	0.43	0.55	—	0.78			0.10	0.11	0.38	0.18		
Yellowfin	0.74	0.15	0.19	0.17	0.68	0.52	1.00	1.14	0.64	1.26	0.10	0.21			0.65	0.47	0.13	0.25	0.63	1.24
OtherTuna			0.11	0.10	0.16	0.12	0.11	0.14	1.08	1.19	4.66	0.56			2.10	2.92	0.47	0.37	0.56	1.23
Seer Fish			—	0.10			0.12	0.08	0.17	0.14	—	0.57			0.12	0.10				
Marlin/sail fish/sword fish	1.17		0.15	0.59	0.29	0.55	—	0.83	0.53	0.12					0.55	1.47	0.72	—	1.52	0.33
Shark	0.18		0.49		0.72	1.10	0.49	0.23	0.75	1.16	—				0.27	0.22	0.88	0.20	—	—
Skate	0.15				—	0.10	0.99	0.95			4.74				0.82	0.45	—	0.35	1.10	1.10

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Table 2-A

CATCH RECORDS OF EXPERIMENTAL FISHING IN VELVETTITURAI

Boat: No. 2066-2061 -21 05	Locality: Velvettiturai	Period: March-December 1979

Unit	1			2		
Material	PA Multifilament			PA Multifilament		
Mesh size	120-130 mm (4 3/4-6″)			125-150mm (5-6″)		
Netting yarn size	R 680 tex (210 d 27)			A 530 tex (210 d 21)		
No. of days	130			130		
Net sets	5374			1400		
Species, Groups of Species	Catch		Pernetset (kg)	Catch		Pernetset (kg)
	Pcs.	Kg.		Pcs.	Kg.	
Seer fish		2575	0.48		635	0.45
Jack		661	0.12		199	0.14
Travally		1275	0.24		617	0.44
Tuna species		1594	0.29		497	0.35
Shark		2397	0.45		945	0.67
Marlin, Sail fish, Spear fish		671	0.12		190	0.13
Rockfish		980	0.18		400	0.28
Skate		593	0.11		237	0.17
Total		10746	2.00		3720	265

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Table 2-B

MONTHLY RECORDS OF EXPERIMENTAL FISHING IN VELVETTITURAI

Kg/netset

Month	March		APril		May		June		July		August		Sept.		October		November		December	
Twine size (210d....)	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27	21	27
Seerfish	0.51	0.41	0.40	0.27	0.99	1.10	0.63	0.71	0.72	0.76	0.33	0.33	0.20	0.19	0.53	0.26			0.30	0.40
Jack	—	—	—	—	0.88	0.70	—	—	—	—	—	—		—	0.25	—			0.48	0.36
Travelly	—	—	1.13	0.50	1.00	0.67	0.30	0.18	0.30	0.10	—	—	0.10	—	0.43	0.10			1.00	0.47
Tuna	0.72	0.10	0.10	0.10	—	—	0.10	0.08	1.10	0.92	0.29	0.12	0.47	0.32	0.20	0.30			—	—
Shark	—	—	—	—			—	—	0.75	0.39	—	0.16	3.00	2.64	—	0.10			0.68	
Swordfish	—		—	—	—	—	0.05	0.47	0.38	0.10	—	0.11	0.55	0.34	0.43	0.19			—	—
Rockfish	0.10		0.12	0.10	0.16	0.30	0.16	0.25	0.23	0.23	0.40		0.10	—	0.34	0.30			1.00	0.46

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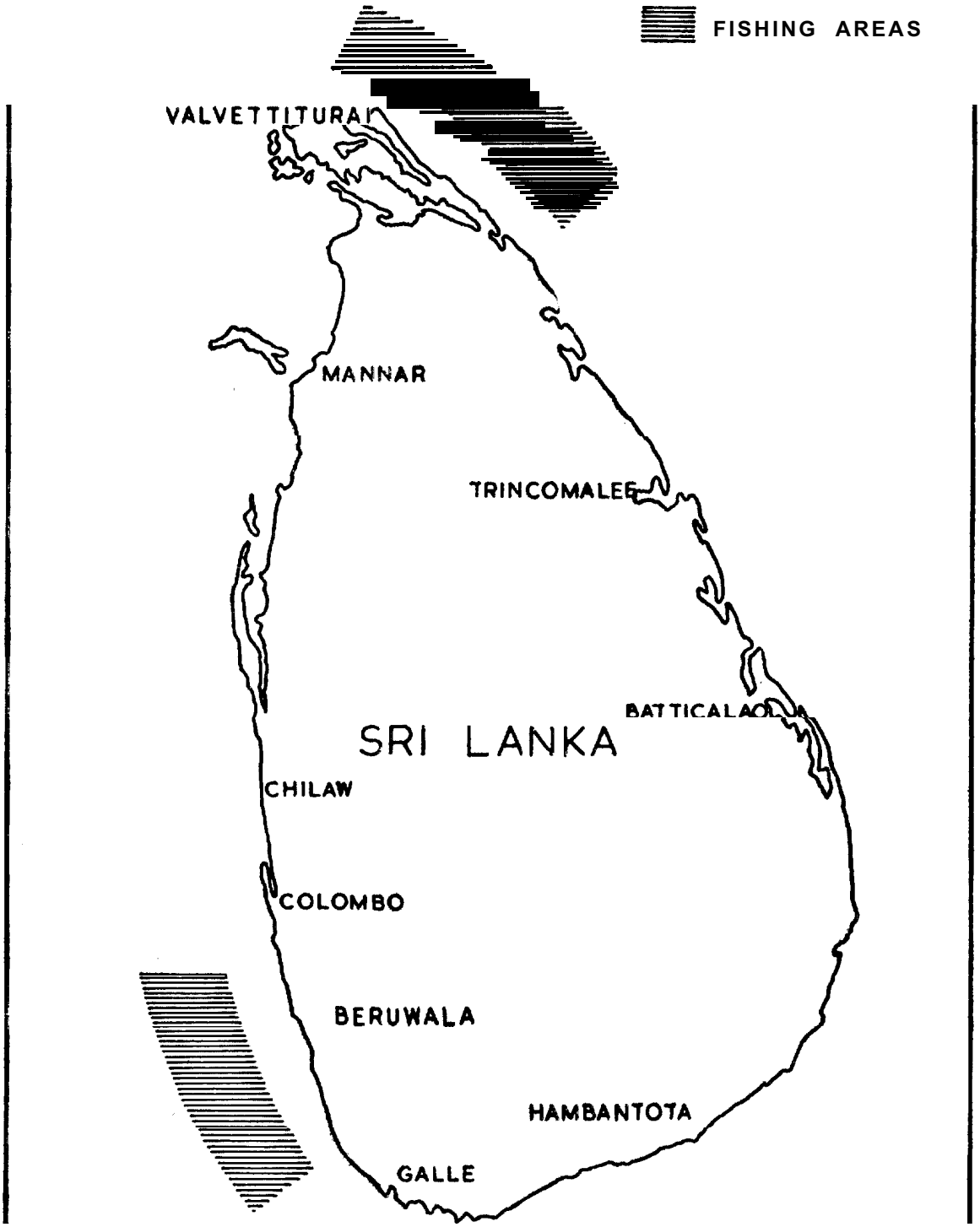
APPENDIX-I MAP OF SRI LANKA



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Appendix 2: Photographs of Boats used for the Fishing Experiments

The photographs shown here were used for the fishing gear improvement project.

Top: The 28-feet-lon9 3½-tonnemade of fibreglass reinforced plastic and fitted with a 33—H.P. engine, that was used in Beruwela.

Bottom: The 32-feet-long "Jaffna" boat, made of wood and fitted with a 33-H.P. engine, that was used in Velvettiturai.

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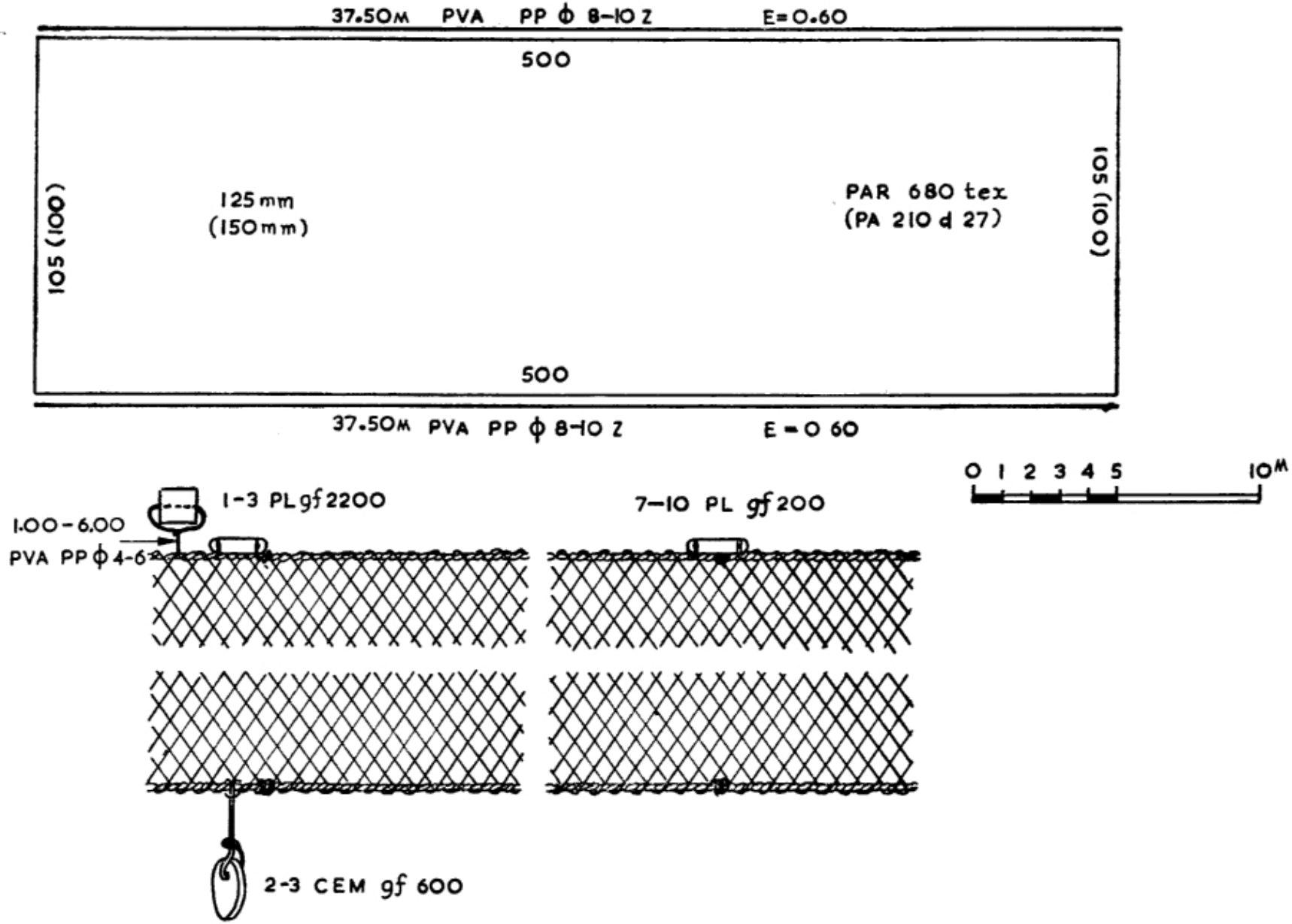
APPENDIX_3: TRADITIONAL LARGE MESH DRIFINET



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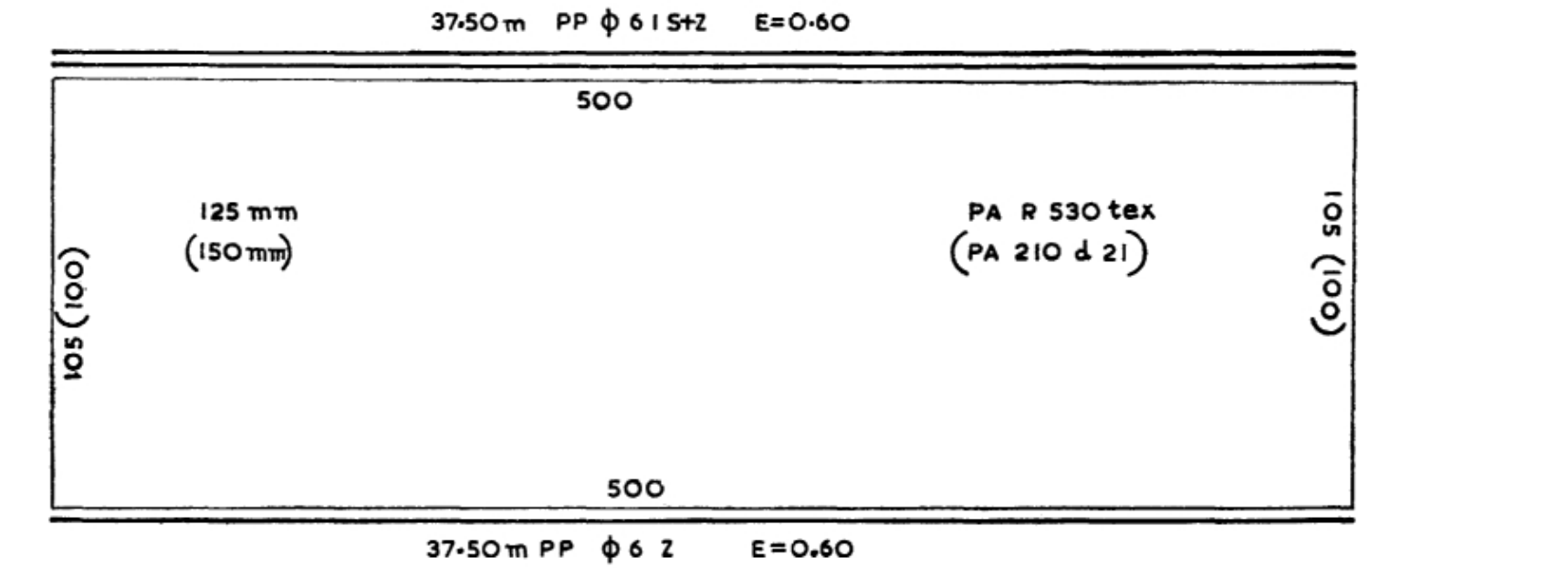
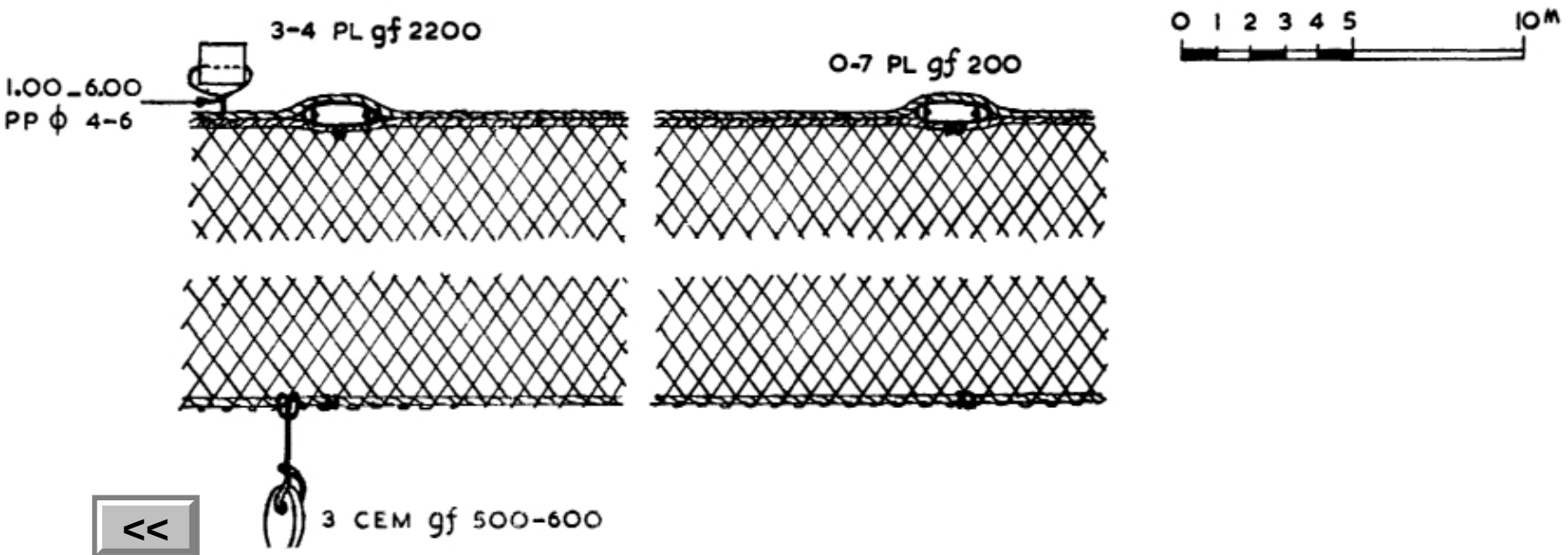
APPENDIX_4 IMPROVED LARGE MESH DRIFINET





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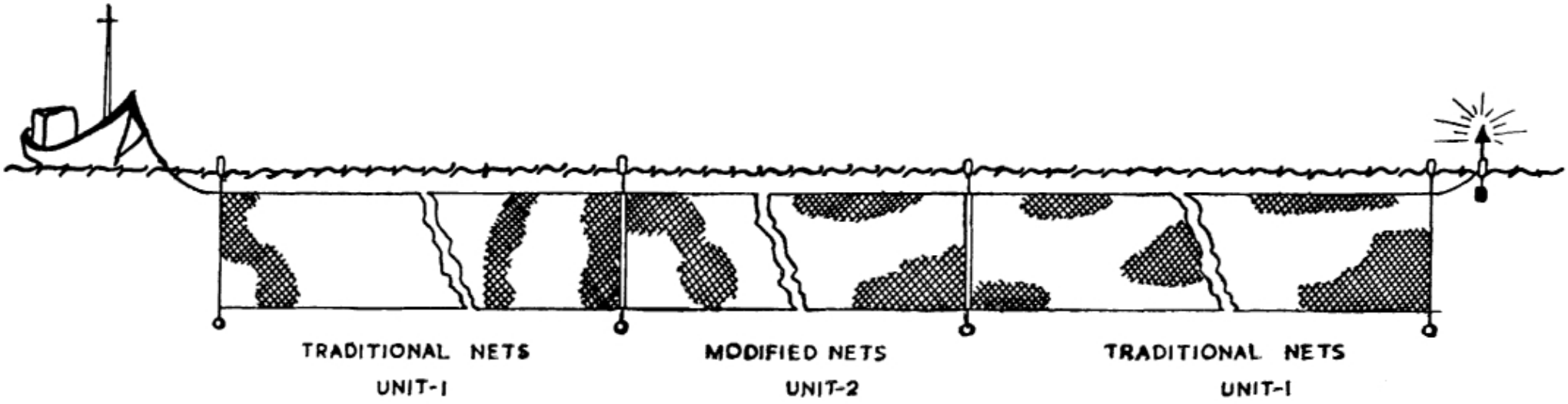
APPENDIX_5 : FLEET OF FISHING NETS



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PUBLICATIONS OF THE BAY OF BENGAL PROGRAMME (BOBP)

Development of Small-Scale Fisheries (GCP/RAS/040/SWE)

Reports (BOBP/REP/....)

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, 7-10 November 1978. Colombo, Sri Lanka, 1978.
4. Role of Women in Small-Scale Fisheries in Countries Bordering the Bay of Bengal. (Final report in preparation)
5. Report of the Workshop on Social Feasibility in Small-Scale Fisheries Development, Madras, India, 3-8 September 1979. Madras, April 1980.
6. Report of the Workshop on Extension Service Requirements in Small-Scale Fisheries, Colombo, Sri Lanka, 8-13 October 1979. Madras, June 1980.
7. Report of the Fourth Meeting of the Advisory Committee, Phuket, Thailand, 27-30 November 1979. Madras, February 1980.
8. Pre-feasibility Study of a Floating Fish Receiving and Distribution Unit for Dubla Char, Bangladesh. Madras, April 1980.

Working Papers (BOBP/WP/....)

1. Investment Reduction and Increase in Service Life of Kattumaram Logs. Balan, R. Madras, February 1980.
2. Inventory of Kattumarams and Their Fishing Gear in Andhra Pradesh and Tamil Nadu, India. (In preparation)
3. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka. Madras, June 1980.

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