



BAY OF BENGAL PROGRAMME
DEVELOPMENT OF SMALL-SCALE FISHERIES



FISHING TRIALS
WITH SMALL-MESH DRIFTNETS
IN BANGLADESH

BOBP/WP/28

Mailing Address:
Post Bag No 1054
Madras 600 018
India

Cables: FOODAGRI
Telex: MS-211 FISH
Phone: 71284, 71887, 77760

Street Address:
81 St Mary's Road
Ashrafsapuram
Madras 600 018

BAY OF BENGAL PROGRAMME
Development of Small-Scale Fisheries

BOB P/WP/28
GCP/RAS/040/SWE

FISHING TRIALS
WITH SMALL-MESH DRIFTNETS
IN BANGLADESH

BOB P/WP/28

G Pajot
Fishing Technologist, BOBP

T K Das
Asst. Fishing Technologist
Directorate of Fisheries, Bangladesh

Executing Agency:
Food and Agriculture Organisation
of the United Nations

Funding Agency:
Swedish International
Development Authority

Development of Small-Scale Fisheries in the Bay of Bengal
Madras, India, March 1984

Small-mesh driftnets account for about one-third of the total marine catch of Bangladesh. This paper reports on the execution and the findings of experiments to improve the small-mesh driftnet fishery in Bangladesh. They were conducted between April 1981 and February 1982 by the project for small-scale fisheries development of the Bay of Bengal Programme (BOBP), in cooperation with the Marine Fisheries Department of the Bangladesh Government and CARITAS, a social service agency. The trials were part of a project to improve fishing gear and methods in Bangladesh. Other project activities include trawling, large-mesh driftnets, set bagnets and longlining.

The BOBP seeks to improve the conditions of small-scale fisherfolk and to assess and monitor fishery resources in the Bay of Bengal region. The FAO is the executing agency, while SIDA (Swedish International Development Authority) and UNDP (United Nations Development Programme) are the funding agencies.

This document is a working paper and has not been officially cleared either by the Bangladesh Government or by the FAO.

CONTENTS

	<i>Page</i>
1. Introduction	1
2. Conduct of trials	1
3. Findings	2
3.1 Efficiency of fishing gear	2
3.2 Economics	3
4. Comments	4
 <i>Tables:</i>	
1. Basic data of the trial nets	2
2. Catch rate by mesh size and month (kg per net-set)	3
 <i>Appendices:</i>	
1. Small-mesh driftnets commonly used in Bangladesh	5
2. PA-100: Nylon monofilament small-mesh driftnet used in the trials	6
3. PE-112: Polyethylene monotwist small-mesh driftnet used in the trials	7
4. PA-120: Nylon multifilament small-mesh driftnet used in the trials	8
5. Map indicating the location of the fishing area	9
6. Catch record of fishing trials with small-mesh driftnets, August 1981— February 1982	10
7. Catch composition and size of fish by month for 100 and 120 mm mesh PA nets, August 1981-February 1982	11
8. Costs and earnings of fishing trials, August 1981-February 1982	12
Publications of the Bay of Bengal Programme	13

1. INTRODUCTION

Driftnets, together with set bagnets, are the most important fishing gear employed in the estuarine and inshore marine waters of Bangladesh. The nets are categorized into two main groups: the small-mesh (90-120 mm stretched mesh) driftnet used mainly for capturing hilsa, pomfret, catfish, etc., and the large-mesh (180-200 mm stretched mesh) used when fishing for large species such as Indian salmon, jewfish, tripletail, snapper, shark, etc.

The small-mesh driftnets are the most common and widely used in estuarine waters during the southwest monsoon (or wet) season (July-September) and during the northeast monsoon (or dry) season (October-April) when they are used both as driftnets and as surrounding gillnets. It is estimated that they account for about one-third of the total marine catch of Bangladesh. The gear is therefore of utmost importance for the country in terms of fish production and employment and for the individuals engaged in fishery and their dependents.

Very little factual and quantitative information about the fishery is available. Casual observations during BOBP work to improve fishing gear and methods in Bangladesh suggested that technical modifications of the gear might improve the fishery as to financial return for owners and operators of the fishing units and the sustained economy of the fishery as a whole. The technical variables of major importance in this context are the mesh size and fishing gear material.

The nets commonly used have a mesh size varying from 90 to 120 mm. The material is almost exclusively nylon (PA monofilament). A fleet of nets consists of 35-70 pieces, each about 25 m in length, depending on craft, availability of nets and financial and operational considerations. Further details about the nets are given in Appendix 1.

In order to learn more about the fishery and identify possible improvements, experimental fishing trials were undertaken by the Marine Fisheries Department, Chittagong, with support from the BOBP during the 1981-82 fishing season, the results of which are presented in this working paper.

2. CONDUCT OF TRIALS

The fishing trials were carried out in cooperation with CARITAS, a social service agency, through its Kalidaha Fishing Project (KFP) at Jaldia near Chittagong. BOBP provided all the small-mesh driftnets for the trials. They were rigged by the fishermen under the supervision of an Assistant Fishing Technologist of the Marine Fisheries Department. KFP used the nets in normal commercial fishing operations.

Catches were sold or auctioned to local buyers at current market prices. All the proceeds of the fish sale went to KFP as compensation for services rendered in the course of the fishing trials.

Fishing data were collected on board the boat by an Assistant Fishing Technologist. KFP provided the data on the proceeds of sales and operational expenditures.

The fishing boat used for the fishing trials by the KFP was of a type commonly used for commercial driftnetting from Chittagong. It has a length of 11.5 m, breadth 2.5 m and draft 1 m. It has a fish hold of about 6 m³ and is powered by a 22 hp engine.

Driftnets: Three different types of nets were employed in the trials, the fundamentals of which are given in Table 1.

Table 1
Basic data of the trial nets

Symbol	..	PA-100	PE-112	PA-120
Material	..	nylon	polyethylene	nylon
Twine	..	R 150 tex (210 d6)	R 150 tex (0.45)	R 225 tex (210 d9)
Mesh size (mm)	..	100	112	120
Length of net (m)	..	70	56	70
No of nets		10	7	10

Further details of the nets are shown in Appendices 2-4.

Nets of the same mesh size were joined together and the three groups of different nets were connected and set together.

The fishing boat was based at Chittagong and the actual fishing was conducted west of Chittagong and south of Sandwip. See map in Appendix 5.

The duration of fishing trips varied from 2 to 11 days, the average being 6 days. A total of 117 fishing days was attained.

The trials started 9 August with the PA nets. The PE nets were added from 31 October which is the beginning of the winter fishing season.

The fishing season ended 14 February, 1982.

3. FINDINGS

3.1 Efficiency of fishing gear

The information obtained during the trials allows a quantitative comparison of the effects of different mesh sizes on the catching performance.

There is a clear indication that the catch rate goes down as the mesh size increases. The catch of the 120 mm mesh nets is about two-thirds that of the 100 mm mesh nets. The rate of the 112 mm mesh net falls in between the two. The latter is made of different material (PE) the effect of which is unknown; it could work in either direction. Table 2 gives a summary of the data recorded during the trials.

Table 2
Catch rate by mesh size and month (kg per net-set)

Month	Fishing effort		Catch rate (kg/net-set)		
	days	sets	PA-100	PE-112	PA-120
August	15	32	12.6	—	9.3
September	21	53	8.6	—	5.6
August-September	36	85	9.9	—	6.8
November	26	27	7.3	6.6	6.8
December	19	22	5.3	2.9	3.9
January	25	30	6.1	3.8	2.8
February	11	11	4.6	2.5	1.8
November-February	81	90	6.1	4.7	4.1

– A “net-set” is one soaking of a net of 70 m standard length (hung); the actual catches of the PE nets, which are only 56 m long, have therefore been adjusted accordingly.

– The November record includes the last day of October.

The difference in the catch rate is greater in terms of the number of fishes caught than of the weight and this is illustrated by the following catching indices for the winter period (November.. February).

Net	PA-100	PE-112	PA-120
Kg	1	0.77	0.67
Pieces	1	0.59	0.40

The difference is smaller during the August-September period. The complete catch record is given in Appendix 6.

The catch composition in the different nets is very similar. The only notable difference is that the PA-120 caught more of larger catfish and less of smaller mackerel than the other nets (Appendix 6). The catch composition varied considerably over the season; in August and September, nearly the entire catch consisted of hilsa; during the winter period, there was a mixed catch of hilsa, pomfret, mackerel, catfish and other species. The difference in the sizes of fish caught by the different nets was also very consistent through the season, except for the mackerel. Details are given in Appendix 7.

Qualitative observations of the nets during the trials did not lead to any conclusions about difference in performance. The PA-100 with thinner twine perhaps sustained slightly more damages but was sufficiently strong for the species caught.

The webbing of the trial nets was machine-made by single weaver’s knots while the nets commonly used are hand-braided with double knots. The single knots did not pose any problems and were in fact less prone to slippage; the fishermen expressed a preference for them.

3.2 Economics

The Kalidaha Fishing Project kept a record of the costs and the earnings of the fishing trials. The gross revenue over the entire trial period was Tk. 185,000 and the operating costs (fuel, ice, food, miscellaneous) were Tk. 80,000 leaving a net of Tk. 105,000 of which the boat got a

share of Tk. 63,000 and the crew Tk. 42,000. There are 10 crew members who thus get Tk. 4,200 each. The details of the costs and the earnings are given in Appendix 8, from which the following are noted.

The net revenue per fishing day in the August-September period is three times higher than that of the winter period, despite the fact that the operating costs are twice as high. The reason is the higher catch rates, as shown above in Table 2. A small contributing factor is also the fish price. The average price during August-September was 8.7 Tk/kg against 7.5 Tk/kg during the November-February period.

The high operating costs in the early period are attributed to the exorbitant cost of ice—57% of the operating costs. During this period the demand for ice is very high which the ice plants cannot meet. This results in both high prices and low quality.

4. COMMENTS

Although the trials produced findings of a certain interest, they have to be evaluated with prudence. So far the scope of the trial has been limited from many points of view, e.g. number of fishing units, time, fishing area, participants, etc. However, the operations were of a commercial nature and the results should, within the statistical limitations, be representative of the small driftnet fleet. The performance of five other boats was also monitored; three of them performed better and two were worse than the trial boat in terms of catching efficiency (kg/net-set). The other five boats used nets of 90—100 mm mesh made of tyre cord and nylon.

Of the preliminary conclusions the first and foremost is that the PE nets seem to be as good as the PA nets in terms of catch efficiency. The PE material has the advantage of being less expensive (about 20% in Bangladesh) than the PA material and it therefore seems worthwhile to further investigate the merits of the driftnet materials and their effects on the economics of the fishing operations.

One must remember though that the cost of the webbing of the driftnets is only a small portion (about 7%) of the total cost; the savings by using the cheaper PE material are therefore only about 1.5%. With such small margins it is important to ascertain that the PE nets are not less efficient in catching than the PA nets. The PE material is extensively used in India but there it costs only 50% of the PA material.

In further trials it would be necessary to directly compare the two materials by using different nets with identical mesh size side by side. In such trials the wear and tear of the different materials should also be taken into account and the trials may have to be extended over more than one season. Preferably more than one boat should be engaged in further trials to improve the validity of trial results.

Other aspects to be observed in further trials are twine thickness and hanging ratio. The (210 d6) of which PA T00 was made was found to be sufficient. This thickness would most likely also be adequate for mesh sizes up to 120 mm and possibly more in this fishery. The hanging ratio of 0.50 may be appropriate but it would be worthwhile trying more tight riggings, say 0.6 and 0.7 which might be more effective.

Another preliminary conclusion of significance is that the higher catches are obtained with smaller meshes. Many nets of 90 mm mesh are being used in the existing commercial fleet and the “maximum yield mesh” may be in the order of 90—100 mm. This is the prime criterion for the operator but may not be the best for the fishery as a whole.

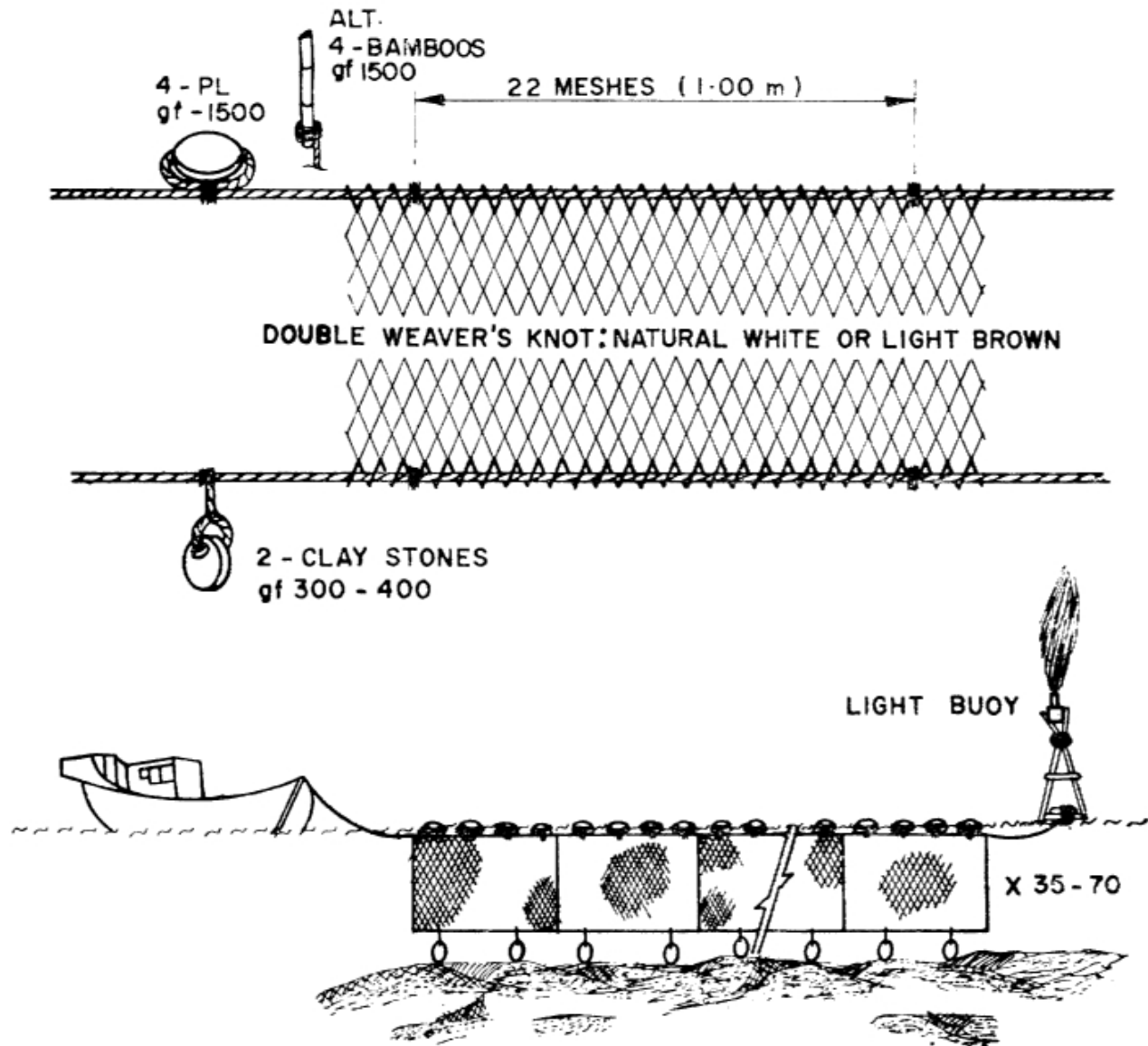
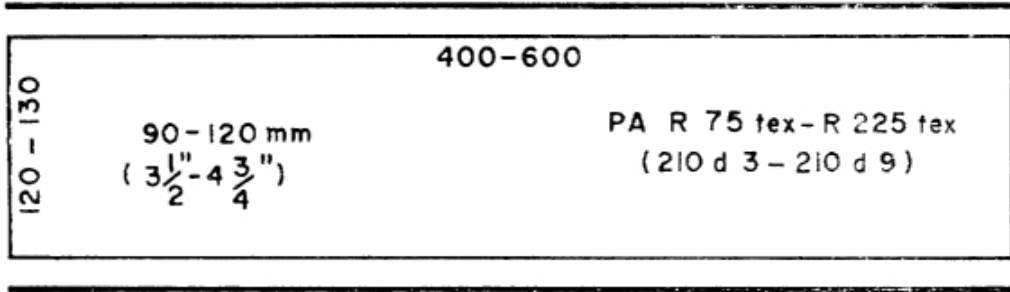
We have already seen above that the PA-i00 net catches 2.5 times as many fishes as the PA-i20 net—and they are of course smaller and possibly immature. With such little data at hand one should not speculate too much but try to obtain more data for analysis and interpretation. The fishery is very important and the authorities need to know more about it to improve the information base for further management measures, one of which might well be a minimum mesh size of the nets.

Appendix 1

SMALL-MESH DRIFTNETS COMMONLY USED IN BANGLADESH

E = 0.50 - 0.55

PA OR PP Ø 8 - 10 mm

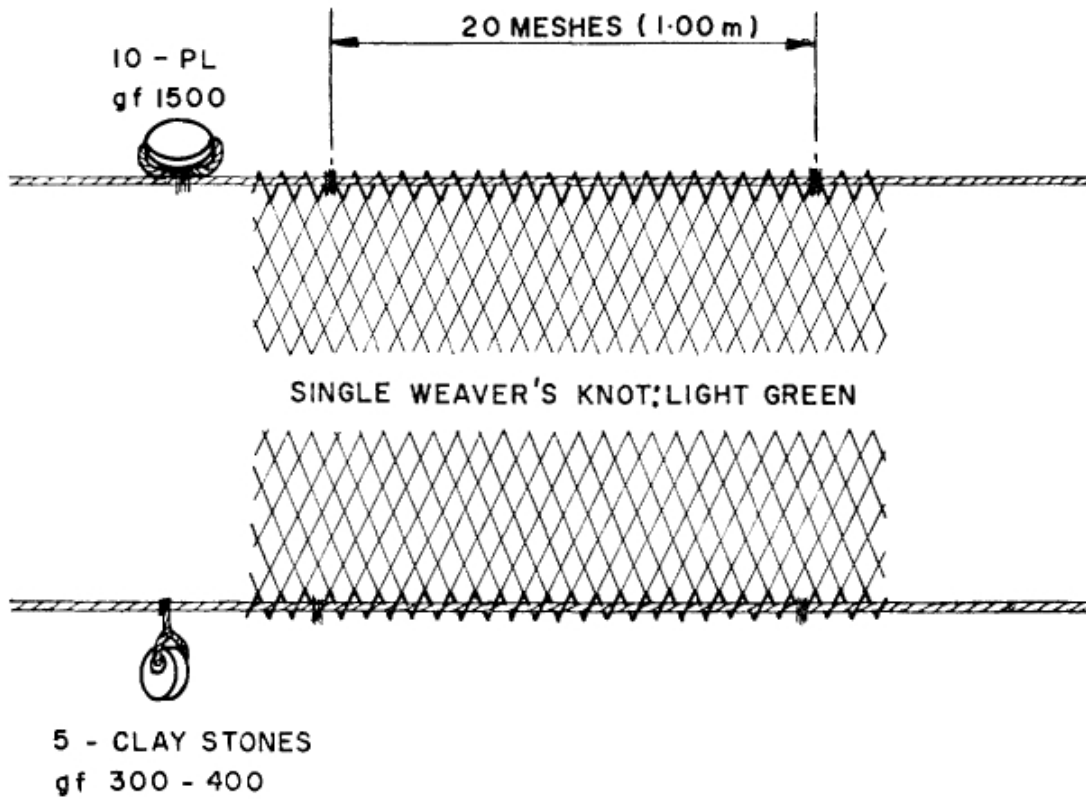
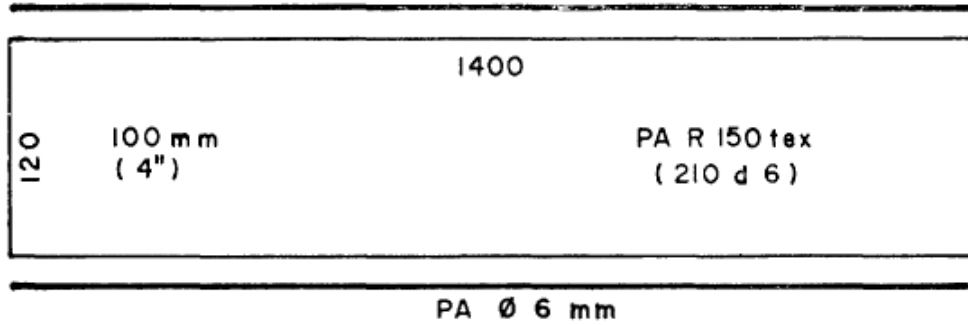


Appendix 2

PA-100: NYLON MONOFILAMENT SMALL-MESH DRIFTNET USED IN THE TRIALS

$$E = 0.50$$

70.00 m PA \varnothing 10 mm

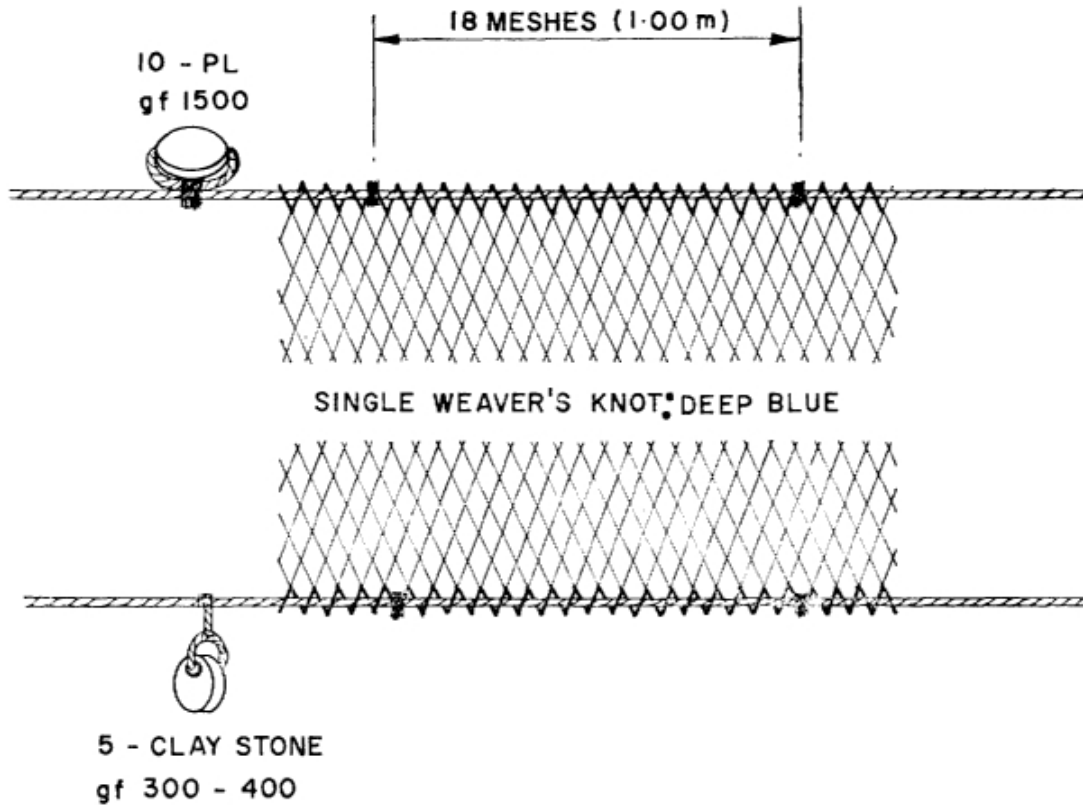
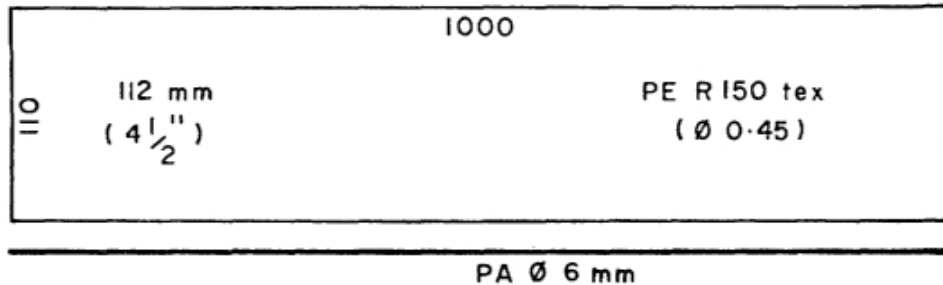


Appendix 3

PE-112: POLYETHYLENE MONOTWIST SMALL-MESH
DRIFTNET USED IN THE TRIALS

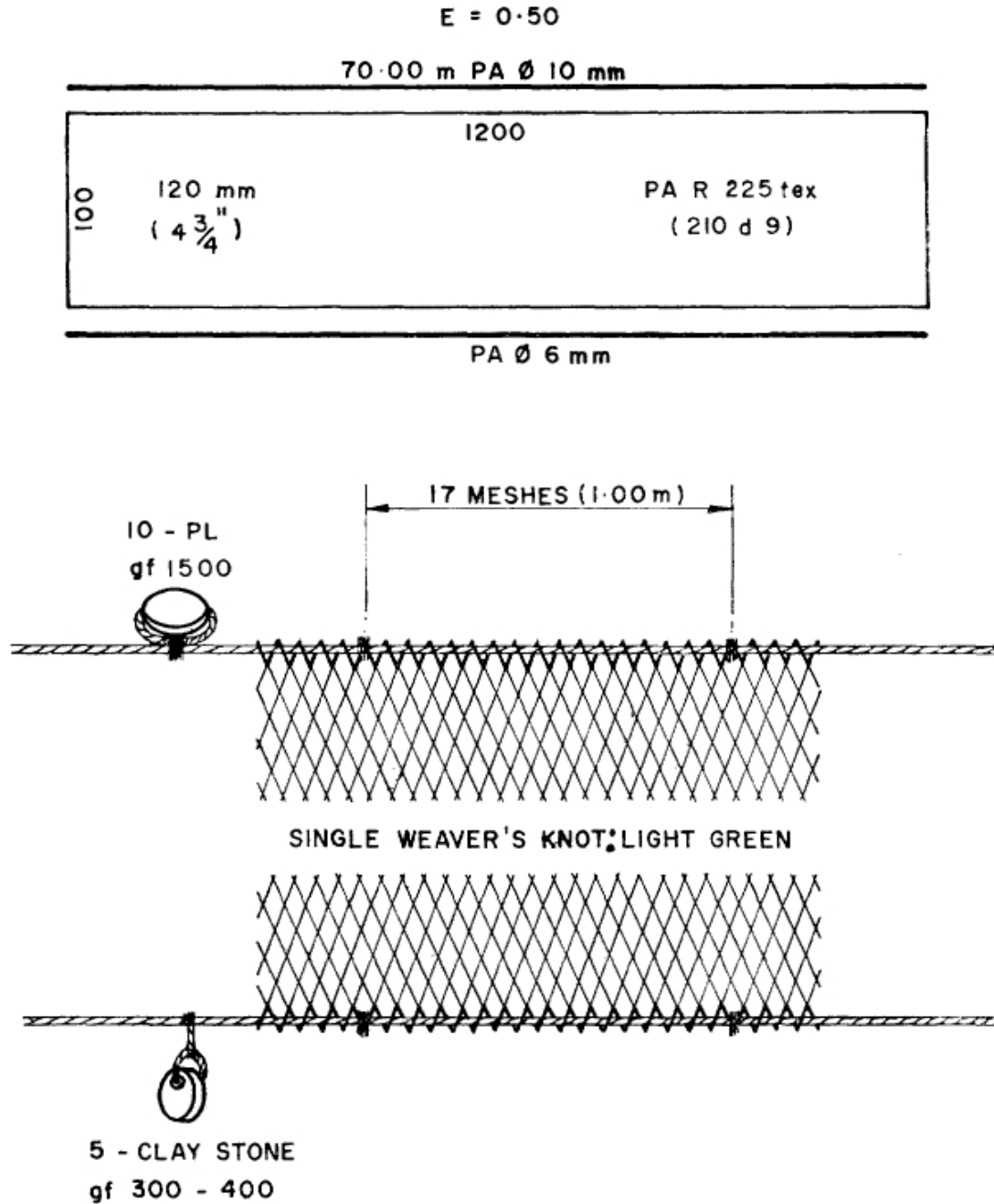
E = 0.50

56.00 m PA Ø 10 mm



Appendix 4

PA-120: NYLON MULTIFILAMENT SMALL-MESH DRIFTNET USED IN THE TRIALS





Appendix 6

CATCH RECORD OF FISHING TRIALS WITH SMALL-MESH DRIFTNETS, AUGUST 1981-FEBRUARY 1982

NET (material—mesh size)		PA—i00				PE—i12				PA—i20			
August-September (fishing days)		36				—				36			
Net-sets		687								687			
	Catch	kg	%	pcs	pcs/kg				kg	%	pcs	pcs/kg	
	Hilsa	6716	98	7315	i.i				4513	97	3887	0.9	
	Catfish	52	1	28	0.5				51	1	22	0.4	
	Others	46	1	252	5.5				80	2	238	3.0	
	Total	6814	100	7595	1.1				4644	100	4147	0.9	
[101	Catch/net-set	9.9	—	11.—				6.8	—	6.0	—		
November-February (fishing days)		81				81				81			
Net-sets		881				504				881			
	Catch	kg	%	pcs	pcs/kg	kg%	pcs	pcs/kg	kg	%	pcs	pcs/kg	
	Hilsa	926	17	1262	1.4	418	18	447	1.1	798	22	808	1.0
	Pomfret	1930	37	12674	6.6	863	36	5084	6.0	1168	32	6456	5.5
	Mackerel	866	16	3525	4.1	306	13	1265	4.1	301	8	967	3.2
	Catfish	442	8	492	1.1	198	8	184	0.9	603	17	337	0.6
	Others	1179	22	6413	5.4	603	25	1196	2.0	731	20	1246	1.7
	Total	5343	100	24366	4.6	2378	100	8276	3.6	3601	100	9814	2.7
	Catch/net-set	6.i	—	27.7	—	4.7	—	16.4	—	4.1	—	11.1	—

Appendix 7

**CATCH COMPOSITION AND SIZE OF FISH BY MONTH FOR
100 AND 120 mm MESH PA NETS, AUGUST 1981- FEBRUARY 1982**

(/n percentagel pcs per kg)

		Hilsa	Pomfret	Mackerel	Catfish	Others
August	PA—T00	98/1.0	00/0.0	00/0.0	1/0.3	1/0.2
	PA—120	96/0.8			1/0.3	3/0.2
September	100	99/1.1			1/0.7	0/20
	120	98/0.9			2/0.5	0/20
November	100	37/1.3	42/6.1	4/1.6	4/1.6	13/i.4
	'120	35/0.9	37/4.9	2/1.0	8/0.6	18/0.5
December	100	3/1.9	38/7.6	8/3.3	14/0.8	37/8.9
	120	5/1.5	35/6.2	7/2.4	34/0.4	19/2.3
January	100	10/1.5	33/6.4	26/4.2	8/1.1	23/4.7
	i20	17/1.3	25/6.1	19/3.8	14/0.7	25/2.1
February	100	5/i.4	19/7.5	44/4.8	9/1.6	23/2.4
	120	6/1.4	16/7.8	20/4.2	33/0.7	25/2.9

COSTS AND EARNINGS OF FISHING TRIALS, AUGUST 1981—FEBRUARY 1982

(in Taka)

[12]

Period	Fishing days	Operating Costs				Total	Gross revenue	Net revenue
		Fuel & Lubricants	Ice	Food	Misc			
09.08-13.08	5	1570	660	1397	136	3763	6614	2851
16.08-19.08	4	1100	630	447	313	2490	14358	11868
26.08-29.08	4	2100	1112	844	75	4131	12876	8745
30.08-31.08	2	550	5393	427	385	6755	11806	5051
01.09-04.09	4	550	4486	1023	1249	7308	10983	3675
09.09-12.09	4	450	3048	447	257	4202	8642	4440
13.09-15.09	4	545	2829	984	498	4856	17625	12769
17.09-21.09	5	450	2471	267	—	3188	3490	302
27.09-30.09	4	450	2300	563	50	3363	13631	10268
August-September	36	7765	22929	6399	2963	40056	100025	59969
31.10-05.11	6	2027	1412	1508	451	5398	17866	12468
08.11-15.11	8	2200	1450	564	25	4239	5331	1092
17.11-21.11	5	2335	1333	675	49	4392	12681	8289
24.11-30.11	7	1190	740	633	347	2910	3629	719
02.12-08.12	7	1100	957	853	91	3001	3335	334
14.12-23.12	10	1325	1543	866	195	3929	8747	4818
30.12-08.01	10	1190	1160	1303	1710	5363	11619	6256
13.01-23.01	11	1100	1160	1842	242	4344	10334	5990
26.01-02.02	8	1370	1020	1339	132	3861	8406	4545
06.02-14.02	9	310	1015	1081	—	2406	3153	747
November-February	81	14147	11790	10664	3242	39843	85101	45258
Total	117	21912	34719	17063	6205	79899	185126	105227

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, FAQ, 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)
4. Role of Women in Small-Scale Fisheries of the Bay of Bengal.
Madras, India, October 1980.
5. Report of the Workshop on Social Feasibility in Small-Scale Fisheries Development.
Madras, India, 3—8 September 1979. Madras, India, April 1980.
6. Report of the Workshop on Extension Service Requirements in Small-Scale Fisheries.
Colombo, Sri Lanka, 8—12 October 1979. Madras, India, June 1980.
7. Report of the Fourth Meeting of the Advisory Committee.
Phuket, Thailand, 27—30 November 1979. Madras, India, February 1980.
8. Pre-Feasibility Study of a Floating Fish Receiving and Distribution Unit for Dubla Char,
Bangladesh. G. Eddie, M. T. Nathan. Madras, India, April 1980.
9. Report of the Training Course for Fish Marketing Personnel of Tamil Nadu.
Madras, India, 3—14 December 1979. Madras, India, September 1980.
- 10.1 Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the
Bay of Bengal. Chittagong, Bangladesh, 16—21 June 1980.
Volume 1: Proceedings. Madras, India, September 1980.
- 10.2 Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the
Bay of Bengal. Chittagong, Bangladesh, 16—21 June 1980.
Volume 2: Papers. Madras, India, October 1980.
11. Report of the Fifth Meeting of the Advisory Committee.
Penang, Malaysia, 4—7 November 1980. Madras, India, January 1981.
12. Report of the Training Course for Fish Marketing Personnel of Andhra Pradesh.
Hyderabad, India, 11—26 November 1980. Madras, India, September 1981.
13. Report of the Sixth Meeting of the Advisory Committee.
Colombo, Sri Lanka, 1—5 December 1981. Madras, India, February 1982.
14. Report of the First Phase of the “Aquaculture Demonstration for Small-Scale Fisheries
Development Project” in Phang Nga Province, Thailand. Madras, India, March 1982.

15. Report of the Consultation-cum-Workshop on Development of Activities for Improvement of Coastal Fishing Families. Dacca, Bangladesh, October 27—November 6, 1981. Madras, India, May 1982.
16. Report of the Seventh Meeting of the Advisory Committee. New Delhi, India, January 17—21, 1983. Madras, India, March 1983.

Working Papers (BQBP/WP/....)

1. Investment Reduction and Increase in Service Life of Kattumaram Logs. R. Balan. Madras, India, February 1980.
2. Inventory of Kattumarams and their Fishing Gear in Andhra Pradesh and Tamil Nadu. 1. R. Merion. Madras, India, October 1980.
3. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka. G. Pajot. Madras, India, June 1980.
4. Inboard Motorisation of Small G.R.P. Boats in Sri Lanka. Madras, India, September 1980.
5. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Bangladesh. G. Pajot. Madras, India, September 1980.
6. Fishing Trials with Bottom-Set Longlines in Sri Lanka. G. Pajot, K. T. Weerasooriya. Madras, India, September 1980.
7. Technical Trials of Beachcraft Prototypes in India.
 - o Gulbrandsen, G. P. Gowing, R. Ravikumar. Madras, India, October 1980.
8. Current Knowledge of Fisheries Resources in the Shelf Area of the Bay of Bengal. B. T. Antony Raja. Madras, India, September 1980.
9. Boatbuilding Materials for Small-Scale Fisheries in India. Madras, India, October 1980.
10. Fishing Trials with High-Opening Bottom Trawls in Tamil Nadu, India. **G. Pajot**, John Crockett. Madras, India, October 1980.
11. The Possibilities for Technical Cooperation between Developing Countries (TCDC) in Fisheries. E. H. Nichols. Madras, India, August 1981.
12. Trials in Bangladesh of Large-Mesh Driftnets of Light Construction. G. Pajot, 1. K. Das. Madras, India, October 1981.
13. Trials of Two-Boat Bottom Trawling in Bangladesh. G. Pajot, J. Crockett. Madras, India, October 1981.
14. Three Fishing Villages in Tamil Nadu. Edeltraud Drewes. Madras, India, February 1982.
15. Pilot Survey of Driftnet Fisheries in Bangladesh. M. Bergstrom. Madras, India, May 1982.
- i6. Further Trials with Bottom Longlines in Sri Lanka. Madras, India, July 1982.
- '17. Exploration of the Possibilities of Coastal Aquaculture Development in Andhra Pradesh. So?eh Samsi, Sihar Siregar and Martono of the Directorate General of Fisheries, Jakarta, Indonesia. Madras, India, August 1982.

18. Review of Brackishwater Aquaculture Development in Tamil Nadu. Kasemsant Chalayondeja and Anant Saraya of the Department of Fisheries, Thailand. Madras, India, September 1982.
19. Coastal Village Development in Four Fishing Communities of Adirampattinam, Tamil Nadu, India. F W Blase. Madras, India, December 1982.
20. Further Trials of Mechanized Trawling for Food Fish in Tamil Nadu. G. Pajot, J. **Crockett**, S. Pandurangan, P. V. Ramamoorthy. Madras, India, December 1982.
21. Improved Deck Machinery and Layout for Small Coastal Trawlers. G. Pajot, J. Crockett, S. Pandurangan and P. V. Ramamoorthy, Madras, India, June 1983.
22. The Impact of Management Training on the Performance of Marketing Officers in State Fisheries Corporations. U. Tietze. Madras, India, June 1983.
23. Review of Experiences with and Present Knowledge About Fish Aggregating Devices. M. Bergstrom. Madras, India, November 1983.
24. In preparation
- 25.** In preparation
26. In preparation
27. In preparation
28. Fishing Trials with Small-Mesh Driftnets in Bangladesh. G. Pajot and T. K. Das. Madras, India, March 1984.

Miscellaneous Papers (BOBP/M/S/....)

1. Fishermen's Cooperatives in Kerala: A Critique. John Kurien. Madras, India, October 1980.

Newsletters (Bay of Bengal News):

January 1981, May 1981, September 1981, December 1981.
 March 1982, June 1982, September 1982, December 1982.
 March 1983, July 1983, September 1983, December 1983.

Information Documents: (BOBP/INF/....)

1. Women and Rural Development in the Bay of Bengal Region: Information Sources. Madras, India, February 1982.
2. Fish Aggregation Devices: Information Sources. Madras, India, February 1982.
3. Marine Small-Scale Fisheries of India: A General Description. Madras, India, March 1983.
4. Marine Small-Scale Fisheries of Andhra Pradesh: A General Description, Madras, India, June 1983.
5. Marine Small-Scale Fisheries of Tamil Nadu: A General Description. Madras, India, December 1983.