BAY OF BENGAL PROGRAMME

DEVELOPMENT OF SMALL-SCALE FISHERIES

COMMERCIAL EVALUATION OF IND-13 BEACHCRAFT AT UPPADA, INDIA

BOBP/WP/26

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GCP/RAS/040/SWE

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1. INTRODUCTION

1.1 Traditional craft operating from open beaches account for the bulk of fish landings on the east coast of India. The difficulties of operating from surf-beaten beaches, the technical limitations of the existing craft and the constraints they put upon the expansion of the fishery and upon the scope for improvement in the wellbeing of the fishermen have been described many times. The requirements for a craftof better performance and economic potential are, briefly, that the new craft should have a surf-crossing performance comparable to that of the traditional kattumaram, with a minimum tendency to broach and capsize; it should be strong enough to withstand heavy landings on surf-beaten beaches, but at the same time be capable of easy and quick handling up and down the beach; and it should provide more protection for crew and catch than existing craft. Most important, it should possess greatercarrying capacity and be able to operate at greater distances from the coast in order to increase the catching potential, and these various requirements must be met without incurring added costs of construction and operation that would absorb all of any increase in earnings thus achieved.

1.2 The Bay of Bengal Programme designed and built a number of prototype beachcraft intended to meet these requirements and tested their surf-crossing and beachianding performance, as described in BOBP/WP/7: Technical Trials of Beachcraft Prototypes in India. The best of the orthodox boat designs, IN D—13, was selected for evaluation in commercial fishing conditions. This working paper describes the trials, and presents the results,

2. PLANNING AND CONDUCT OF TRIALS

2.1 The trial base

2.1.1 The base from which commercial trials would be carried out had to be for practical reasons accessible by road, near to workshop facilities and other infrastructure. Besides this, it had to be a typical representative fishing village possessing a fleet of traditional beachcraft, so that informed judgements, based on experience, could be made on the performance of the new craft as compared with the traditional. Uppada, 19 km from Kakinada in Andhra Pradesh, was chosen. Kakinada is a regional base for the Department of Fisheries; it has a well equipped Government boatbuilding yard with workshop facilities and a Fisheries Training Institute for future extension work.

2.1.2 In Andhra Pradesh, the traditional craft include the Nava, Teppa, and Masula. The Masula is not operated all the year round. The Teppa because of its small size and low cost is essentially an inshore craft operating small-mesh gillnets and sometimes handlines. The Nava varies in size up to 11 m; it is the large Nava that is used for large-mesh gillnetting and which is most nearly comparable to the BOBP beachboats in size and overall investment. Attempts have been made to mechanise the *nova,* but the design is inherently unsuitable; the space available in the traditional design is very restricted and the typical vessel is already very heavy.

2.2 Arrangements for conduct of trials

2.2.1 Three motorised boats of the BOBP IND—13 design were provided for evaluation (a description of IND—13 is found in Section 3).

2.2.2 With the help of the Government fisheries service, three masterfishermen were recruited for the BOBP boats; they were Bhanu, Samulu and Narayana.

2.2.3 The BOBP boats were equipped with the same type and quantity of gear as the local *navas,* and like them fished the year round with large-mesh driftnets for seerfish and tuna.

The nets for the BOBP boats were made by local labour in Uppada — mostly by womenfolk— from locally purchased nylon yarn. The catches were to be sold at the beach.

2.2.4 The understanding with the masterfishermen of the BOBP boats was that they would fish diligently, keep all the proceeds of sales of fish and meet such expenses as crew wages. gear repairs and costs of fuel. The masterfishermen were free to choose their own crews and were left to make their own strategic and tactical decisions regarding fishing operations.

The commercial fishing activities which were to form the basis of the evaluation were planned to last one year.

2.3 Preliminary training

The crews of the three BOBP boats were trained in surf crossing by Mr. G. Gowing, BOBP specialist consultant in operating boats in surf conditions. They were also instructed in the operation and care of the engines.

2.4 Operations and records

Fishing operations began in November 1980, two of the IND-13 craft having been delivered by then, the third began fishing two months later. Daily records of operations, inputs and sales were maintained up to March 1982 for the three IND-13 craft and alsoforthree local *novas.* Later, the operations of additional *navas* commanded by masterfishermen who expressed interest in acquiring a BOBP boat were also recorded.

2.5 Supervision

The trials were supervised and serviced by Mr. S. B. Sarma, Inspector of Fisheries, with the support of the Office of the Regional Deputy Director of Fisheries, and the assistance of the Fisheries Training Institute and the Government boatbuilding yard.

The Inspector of Fisheries was responsible for recording the data in a form prescribed by BOB P. He was also responsible for providing assistance in diesel supply, engine and boat repairs and he served as a link between the fishermen and the BOBP. Periodic visits were made by BOBP staff to attend to mechanical problems and to ascertain the progress of the trials. Repairs to the boat were carried out at the Government boatbuilding yard at Kakinada; engines were serviced by representatives of the engine manufacturer or by privately hired mechanics.

3. CRAFT AND GEAR

3.1 The BOBP craft

Three boats of the IND—13 design (see BOB P/WP/7) were constructed in Madras by M/s. India Sea Craft, to BOBP specification and under BOBP supervision. Appendix 1 is a general arrangement drawing of this craft. They were built of marine plywood and all seams were taped with fibreglass reinforced plastic (FRP).

The engines were Lombardini 523 single-cylinder diesels delivering a maximum of 4.8 HP at 1500 RPM. They were installed in watertight engine boxes developed by BOBP (see BOBPJ WP/7). Each engine drove a propeller 260 mm dia x 170 mm pitch.

The three boats were transported to Kakinada by road and were rigged with local lateen type sail rigs at the Government boatbuilding yard.

3.2 Navas

The traditional craft, the operations of which were recorded, were typical *novas,* built of heavy teak planking (Appendix 2).

3.3 The gear

The specification of the nets used for fishing is given in Appendix 3.

Right: IND-13 crew prepare to launch the boat. Below: The boat crosses the surf. The boat performed much better than the traditional nava during commerciaf fishing trials using the same amount of fishing gear.

Net-mending on the shore. About three quarters of Uppada's population of 8,000 engage in fishing and related activities. Below: Women are active in fish marketing.

4. RESULTS

4.1 Operations, costs and earnings

4.1.1 The summary of monthly landings and earnings of the three BOBP boats is given in Table 1. BOBP III did not come into service until January 1981.

4.1.2 The running costs of the BOBP boats over the first year (November 1980—November 1981) are presented in Table 2.

4.2 Technical assessment

Operating three boats for over a year in commercialfishing gave a good deal of valuable experience of the IND—13 design and the propulsion unit. The main comments were as follows:

4.2.1 *Boat*

- It was felt that with a full complement of gilinets and equipment like mast, oars and sail, the internal space was inadequate for the crew to rest.
- Although surf crossing was relatively dry during the calm season, a lot of water was taken over the bow when crossing heavy surf.
- Leaks developed at some joints and through the holes for the screws retaining the false keel. Though not serious, they involved tiresome bailing.
- IND—13 under sail was not as fast as a *nava.*
- Hauling in the nets while standing on deck was not comfortable.
- The hull itself showed little signs of wear after a year's operation, but the keel chafing strips had to be renewed.

4.2.2 *Propulsion unit*

(a) The engine chosen for the BOBP boats was an air-cooled industrial type of diesel engine of low weight. This light engine, though it gave adequate power for surf crossing and general free running, was not capable of continuous trouble-free operation at the power required in rigorous sea fishing conditions.

The main problems encountered were:

- Frequent starting problems due to inadequate filtration of the diesel fuel resulting in clogged nozzles.
- Frequent wearing out of shaft oil seals resulting in oil leakage and danger of engine seizure.
- Fracture of exhaust and air inlet flange studs.
- Fracture of engine holding down feet.
- Fracture of fuel tank holding down straps.
- Necessity for frequent piston ring changes and valve grinding.
- Faulty governor and throttle control as a result of corrosion.

<b) Problems with the propeller shafts were mainly due to the difficult service conditions. The most serious was the rapid wear of the shafts in way of the stern bushing through sand abrasion.

4.3 Socio-economics

4.3.1 *Background*

Uppada is one of the better developed villages of the region as regards vessels, gear, marketing facilities and communications. The fishermen already exploit grounds further offshore than do the men of neighbouring villages. They enjoy the support of a fisheries extension officer in the service of the Government of Andhra Pradesh whose tasks include collection of statistics, provision of financial aid, distribution of craft, nylon twine and so on, and assistance to the district collector in social welfare programmes.

There are approximately 8,000 inhabitants, three quarters of whom are fisherfolk, one-tenth farmers, one-tenth teachers, priests and others not directly engaged in production and five per cent weavers. The fisherfolk comprise two castes: 5,400 belong to the Vadabalija and 600 to the Agnikulakshatriyas. Ten per cent of the fisherfolk are engaged in agriculture as well as fishing. The traditional caste associations still function, as do the traditional headmen (Urupedda). They exercise control over fishing operations in the village, collection of shares from the catch, enforcement of fishing holidays, etc. The two headmen of the two communities have at the same time a strong economic position as fish traders and middlemen, which conveniently fits in with their social and political functions.

There appear to be no major conflicts between the two communities of fisherfolk in Uppada, or between Uppada and the neighbouring villages. However, conflicts exist between the traditional Uppada fishermen and the mechanised trawlers operating from Kakinada, with which they compete on the same fishing grounds. As a result, the prawn catch has decreased rapidly in Uppada and is no longer a major source of income.

4.3.2 *Initial acceptance*

The initial interest evinced by the villagers in the boat trials was very limited. It was even difficult to recruit three teams for the trial boats; the masterfisherman of one boat had to be selected from another village. The attitude of the caste association was not favourable but because the trials were sponsored by the Government they agreed to cooperate. The association enforced the normal fishing holidays during the trials.

4.3.3 *Selection of masterfishermen and crew*

Two of the masterfishermen chosen for the BOBP boats owned boats of their own while the masterfisherman of the third trial boat had lost his own boat during the last cyclone. They were selected by the local Government Fisheries Officer without involving the caste association or cooperative society. The crews were selected by the masterfishermen and consisted of relatives. Because of this, no information could be obtained on the system of sharing net earnings.

Changes in the crews occurred now and then, the reasons adduced being family conflicts, etc.

4.3.4 *Reactions of community*

When it was seen that the BOBP boats took good catches, were seaworthy and provided more comfort for the crew, the fisherfolk formed a better opinion of them. Envy and competition were then manifest: mechanisation became a matter of status. Some fishermen purchased outboard engines for traditional craft to demonstrate that they too could afford a mechanised boat. Because of the unsuitability of the engine or the installation, these attempts soon came to an end.

4.3.5 *Socio-economic impact*

Among the members of the cooperative society there was a great demand for mechanised beachcraft to be supplied under a loan/subsidy scheme.

At the end of the trials all three masterfishermen showed interest in taking over the trial boats under such a scheme. Only one, however, was prepared to contribute at least a part of the savings he had accumulated during the trial period as a down payment. Two teams did not develop any savings habits even though their earnings must have been extraordinarily high, since the catch

was much better than with the traditional craft and all maintenance and major repair costs had been taken care of by BOBP.

The attitude that the risks should be borne by some one else perhaps springs from the natural inclination of the fishermen to take advantage of favourable loan and subsidy schemes, instead of investing their own money; but scepticism about engine performance and the weak infrastructure facilities such as workshops may have also influenced this attitude.

4.4 Performance of Navas during trial period

4.4.1 Making valid comparisons of the performance of two fishing vessels or groups of fishing vessels is notoriously difficult, even when the vessels are of exactly the same design. In most fisheries, there are wide variations in the annual landings and gross earnings between boat and boat, between crew and crew and, above all, between one masterfisherman and another.

In the trials at Uppada, records were also kept of the performances of some of the local *navas.* In view of the small number of boats, the fairly short experimental period, and the possible variation of performance between individual vessels and masterfishermen, caution must be exercised in drawing firm conclusions from any comparisons between the recorded performances of the BOBP boats and the *navas* selected for study.

A comparison of Tables 1 and 3 will for instance reveal that on some occasions, the *navas* did just about as well as the BOBP boats and often *onenavo* did betterthan one or more of the BOBP boats. Indeed it might be possible to find a *nave* that enjoyed higher gross earnings during the period of study, or higher profit, than any of the BOBP boats. On the other hand, the masterfishermen and crews of the BOBP boats were not necessarily the best in the district. Moreover, allowances have to be made for lower performance while they were becoming familiar with the BOBP boat and engine, and while they were determining the best locations to fish to take the most advantage of the greater speed and range of the mechanised boat. Also, in some months records were taken of the operations of more than three *novas,* and Tables 3, 4, and 5 have been compiled by selecting the three best performers in each month of all the *navas* studied.

4.4.2 Table 3 summarises landings and earnings of the three *navas* corresponding to the data in Tables 1 for the BOBP boats.

4.4.3 The motorised BOBP boat can be operated with one crew member less than the corresponding *nova* with the same quantity and type of fishing gear.

4.4.4 On average, the BOBP boats achieved a higher number of days at sea in a year than did the *novas* (Table 4). The IND—13 design is partly decked, the *nova* is an open boat; it is possible that the fishermen were able to take the BOBP boat through heavier surf than that in which they are prepared to risk a *nova.*

The other explanation for the bigger catches of the BOBP boats (Table 5) is that they were able to range further in search of good fishing and at times operated in areas that the *novas* could not reach.

4.4.5 There were slight differences in the composition of the catches between the BOBP boats and the *novas,* presumably because they exploited different fishing grounds. These differences are taken into account automatically in the records of gross earnings, and may be part of the reason for the differences in average values, month by month. Over the whole period of the study, however, the average value of the landings (Rs/kg) is the same for the BOBP boats as it is for the navas (Table 5).

4.4.6 The BOBP boats, being motorised, incur costs which the non-motorised *navas* do not incur. Although the fishermen operating the BOBP boats seemed to enjoy both higher gross earnings and higher net incomes, they would incur greater financial risks if they themselves owned the boats, because the capital invested in a BOBP boat is greater than in a *nova.* It must be borne in mind, however, that the useful life of a BOBP boat may be different from that of a *nova.* For the present, also, assumptions have to be made regarding the useful life of the engine when operating in commercial fishing conditions from a base such as Uppada.

Table 1

Landings and earnings of BOBP boats

Year/Month	BOBP I		BOBP II		BOBP III	
	(Kg.)	(Rs.)	(Kg.)	(Rs.)	(Kg.)	(Rs.)
1980/11	157	609	188	458	—	—
12	1896	4965	1978	5159	—	—
1981/ 1	1681	4497	1044	2852	1329	3869
2	**1177**	**6159**	1410	5931	2336	8045
3	**2827**	**7391**	**1086**	**4534**	**1513**	5395
4	945	4669	734	3792	1825	9152
5	1325	5508	224	1346	848	4155
6	405	1420	1004	3670	495	1704
7	1155	4392	1905	6136	1993	6669
8	891	3554	713	2771	576	2618
9	397	1752	380	1750	664	2450
10	614	2145	910	2737	683	2000
11	362	1840	149	948	575	3310
12	650	3485	383	2118	521	2785
1982/ 1	768	3822	727	3488	132	1640
2	**878**	**5460**	**580**	**3862**	**749**	**5060**
3	193	1310	161	1060	224	1680
Average/Month	960	3705	799	3095	964	4035

Table 2

Running costs of BOBP boats for first year of operation

Boat	BOBP I	BOBI' II	BOBP III
1. No. of fishing days	216	223	200
2. Fuel and oil (Rs./day)	10.45	13.30	13.68
3. Net repair (Rs./day)	15.60	12.57	11.17
4. Engine repair (Rs./day) ..	7.00	7.00	7.00
5. Hull repair (Rs./day)	3.50	3.50	3.50
6. Wages (Rs./day) ..	75.00	75.00	75.00
7. Food (Rs./day) ..	25.00	25.00	25.00
8. Total running costs (Rs./day) ..	136.55	136.37	135.35

Table 3

Landings and earnings of Navas*

Year/Month	Nava I		Nava II		Nava III	
	(Kg.)	(Rs.)	(Kg.)	(Rs.)	(Kg.)	(Rs.)
1980/11	109	475	106	424	—	—
12	1283	2866	1831	4142	78	290
1981/ 1	546	1625	674	1874	1158	3740
2	677	2550	580	2065	965	3617
3	431	2070	950	4437	1374	6690
4	242	1664	302	1566	840	4321
5	99	505	319	1770	473	2475
6	148	555	474	1518	933	3060
7	1048	3322	1191	2633	1762	4600
8	366	1120	574	2080	602	2056
9	192	740	316	1285	128	535
10	245	840	459	1365	318	795
11	157	470	127	610	136	795
12	433	2056	95	620	145	435
1982/ 1	625	2510	132	855	76	330
2	347	2502	566	3570	634	4355
3	180	1211	268	1820	150	1100
Average/month	419	1593	527	1920	611	2306

* In those months when the operations of more than three *navas* were recorded, the figures relate to the performance of the three best in that month.

Table 4

Number of fishing days

Year/Month	BOBP I	BOBP II	BOBP III	Nava I	Nava II	Nava III	Total	
							BOBP boats	Navas
1980/11	7	7	—	**5**	**5**	—	14	10
12	**24**	**26**	—	**17**	**23**	1	**50**	**41**
1981/ 1	22	20	18	15	18	21	60	54
2	**19**	**23**	**22**	**16**	**16**	**19**	**64**	**51**
3	25	25	24	20	24	26	74	70
4	20	17	23	10	15	17	60	42
5	**15**	**11**	**13**	**6**	**16**	**13**	**39**	**35**
6	10	23	16	9	18	22	49	49
7	16	19	25	18	16	17	60	51
8	17	12	13	13	17	13	42	43
9	**14**	**13**	**16**	**14**	**19**	**17**	**43**	**40**
10	17	15	16	13	17	8	48	38
11	12	9	13	5	7	7	34	19
12	**12**	**13**	**12**	**19**	**3**	**3**	**37**	**25**
1982/ 1	18	19	12	18	8	6	49	32
2	**16**	**16**	**20**	**12**	**18**	**21**	**52**	**51**
3	**9**	**13**	**13**	**13**	**22**	**14**	**35**	**49**
Monthlyaverage	16.1	16.5	15.0	13.0	15.4	13.2	47.6	41.2

Table 5

Summary of landings and earnings

Year/Month	Total landings—Kg.		Earnings—Rs.		Average value—Rs./Kg.		Ratio of earnings
	BOBP Boats	Navas	BOBP Boats	Navas	BOBP Boats	Navas	BOBP Boats/Navas
1980/11	345	215	1067	899	3.88	4.18	1.18
12	3874	3192	10124	7298	2.61	2.28	1.38
1981/ 1	4054	2378	3869	7239	0.95	3.04	1.55
2	4923	2222	20135	8232	4.08	3.70	2.44
3	5246	2755	17320	13197	3.30	4.79	1.31
4	3504	1384	17320	7551	4.94	5.45	2.29
5	2397	891	11009	4750	4.59	5.33	2.31
6	1904	1555	6794	5133	3.56	3.30	1.32
7	5053	4001	17197	10555	3.40	2.63	1.62
8	2180	1542	8943	5256	4.10	3.40	1.70
9	1441	636	5952	2560	4.13	4.02	2.32
10	2207	1022	6882	3000	3.11	2.93	2.29
11	1086	420	6098	1875	5.61	4.46	3.25
12	1554	673	8388	3111	5.39	4.62	2.69
1982/ 1	1780	833	8950	3695	5.02	4.43	2.42
2	2207	1547	14382	10427	6.51	6.74	1.37
3	578	598	4050	4131	7.00	6.90	0.98
Average	2603	1521	9911	5818	3.79	3.82	1.70

5. FOLLOW UP

5.1 Technical

The evaluation of the above results, including discussions with the fishermen using the boats, led to the conclusion that a modified design was necessary to overcome some of the shortcomings.

5.1.1 *Boot*

(a) A new design has been prepared incorporating the same layout as the test boat IND—13 but with the following modifications:

- increase in main dimensions to overcome shortcomings of crew comfort and storage space
- increased freeboard (depth) and sheer forward to minimise water over the bow
- a raised platform underdeck and a separate hatch for more comfortable net handling
- greater sail area to increase speed under sail.

(b) One prototype hull shell has been constructed in glass reinforced plastic (GRP) and fitted out.

Appendix 4 shows the general arrangement of the new design (IND—20) and the general appearance. Its surf performance has been tested by the consultant expert in surf crossing; the crew included fishermen who had experience of earlier prototype surf-crossing boats and the masterfisherman who had operated BOBP I during the Uppada trials of the three IND—1 3 boats. Handling and layout appeared to be entirely satisfactory. Further details about the IND—20 design and performance are given in a second working paper on trials of beachcraft prototypes which is under preparation.

5.1.2 *Propulsion unit*

The engine used in the test boats (IND—13) could not produce sufficient power at continuous rating without trouble in rigorous sea fishing conditions. However, the concept of pivoting the watertight engine-box so as to make propeller and rudder retractable proved an excellent solution to the problem of damage when beaching.

Various changes have been introduced in the IND—20 design, including the adoption of another make of air-cooled diesel engine of 8 HP (at 3,000 RPM with an integral reduction gear of 2: 1).

A separate Working Paper will give full details of the new engine installation.

5.2 Social

5.2.1 Acceptance of the new technology by the community might have been better if the village institutions had been involved right from the beginning. The same is true regarding the development of the saving habit among the team leaders and crew. On the other hand, this might have complicated the technical conduct of the trials.

5.2.2 An introduction programme should include a training/extension component and provision of infrastructure facilities. It should also take into consideration prevailing traditions and attitudes, and involve existing institutions.

This should include the following activities:

(a) Discussion of introduction programmes with caste councils and cooperative societies.

(b) Involvement of extension officers of the Fisheries Department.

(c) Training of the fisherfolk in the village itself for three hours per day over a period of 2 or 3 weeks. Staff from the Fisheries Training Institute, Kakinada should be involved in the training so that the fishermen can refer to people nearby if problems arise later on with the engine or boat. The training could take place on the beach or in the classrooms of one of the schools if it is conducted during school holidays. It should include engine handling, main engine repairs, use of engine for surf-crossing, boat handling, improved fishing gear and accounting. Fisherwomen should be involved in the accounting training because it is often they who look after financial matters in their families. The accounting training is necessary to facilitate savings for repairs to the engine, for diesel and lubricating oil (expenses that they did not formerly have to think of) and for paying back loans.

(d) To run an oil and diesel store and a small workshop, one or two young boys from the fishing communities should be trained as mechanics.

5.3 Economics

5.3.1 Estimatesofcostsandearningshavebeen made for the IND—20 design (Appendix 5). They are based on the experience with the IND—13 boats during the trials, and with the three *navas* studied during the period of the trials, with costs adjusted for the greater capital investment, higher fuel consumption and expected longer life of the IND—20 as compared with the IN 0—13. The conservative estimate is made on the assumption that IN 0—20 will not catch more fish than IND—13 despite its greater carrying capacity.

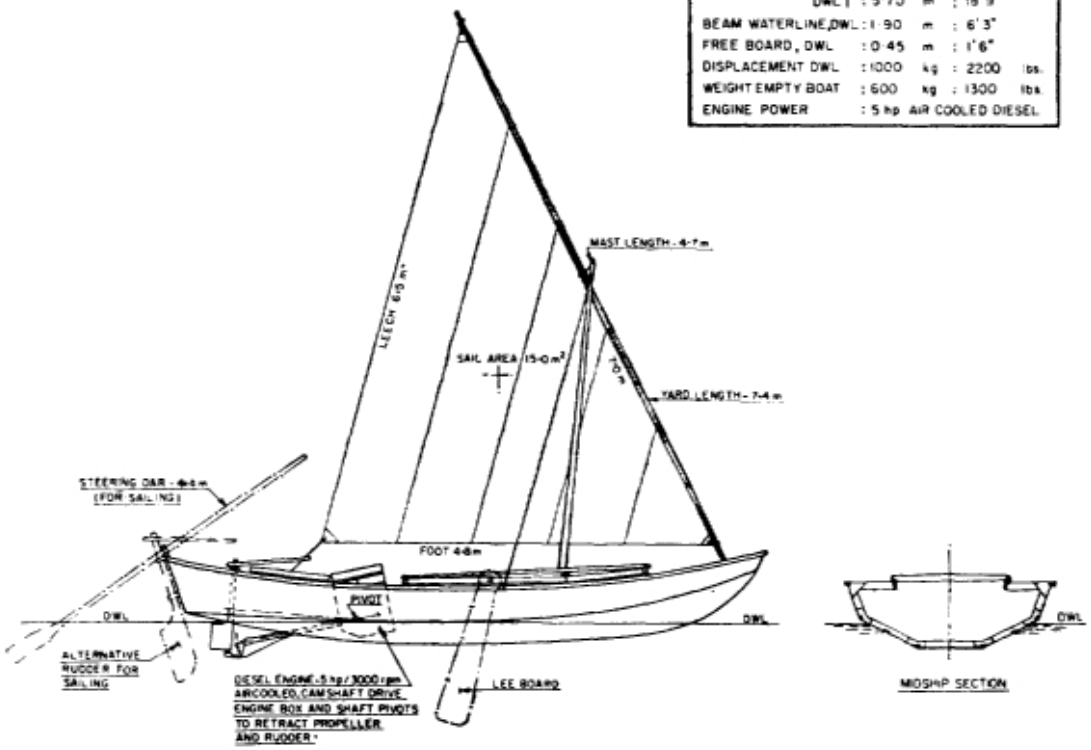
The costs and earnings estimates and comparisons take into account differences in numbers of crew, days at sea and catch composition as between the BOBP boats and the *novas.* The share system in the *naves* is assumed to be that half the net earnings (gross earnings *minus* food expenses) go to the boat, half to the crew. In the case of the mechanized boat, it is assumed that 40 per cent will go to the crew, so that costs associated with the engine can be recovered. Nevertheless, it appears as if the individual fisherman's share in an IND—20 might be more than the average for the three *navas* studied.

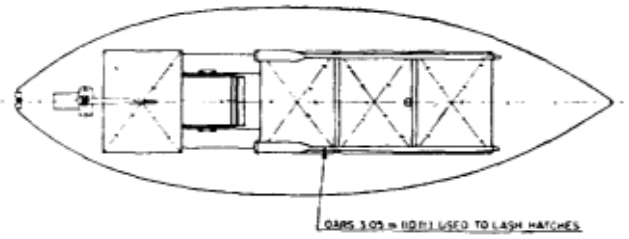
5.3.2 The resultant rate of return on the IN 0—20, although not very attractive from an investment point of view, considering a loan interest on capital of 12.5%, is acceptable. A fisherman without means, who would require the bulk of the investment capital as a loan would need a minimum repayment period of 8 years. This could be shortened to six if a DRDA subsidy of Rs. 3,000 per crew members could be obtained. Attractive features are the higher earnings as compared with the nava and the potential of a motorized craft.

5.3.3 Appendix 5 is an estimate; the reader may wish to substitute his own figures and assumptions. It should be borne in mind, however, that the comparison may be valid even if the absolute values of the assumed and derived figures are not entirely representative or up to date.

5.3.4 At this stage however, it may be wise to pay more attention to the additional range and potential of IND—20 as compared to the *nava* rather than to detailed financial comparisons based on limited experience. That experience, however, does suggest that the potential of IND—20 should be investigated in commercial operations on a bigger scale than the trials recorded in this working paper.

MAIN PARTICULARS				
LENGTH OVER ALL	: 7·40	m	: 24' 3"	
BEAM MAXIMUM	: 2·30	m	: 7' 6"	
DEPTH MOULDED	: 0·72	m	: 2' 4"	
CUBIC NO, L X B X D	: 12·2	m^2	—	
LENGTH WATERLINE DWL	: 5·70	m	: 18' 9"	
BEAM WATERLINE, DWL	: 1·90	m	: 6' 3"	
FREE BOARD, DWL	: 0·45	m	: 1' 6"	
DISPLACEMENT DWL	: 1000	kg	: 2200	lbs.
WEIGHT EMPTY BOAT	: 600	kg	: 1300	lbs.
ENGINE POWER	: 5 hp AIR COOLED DIESEL			



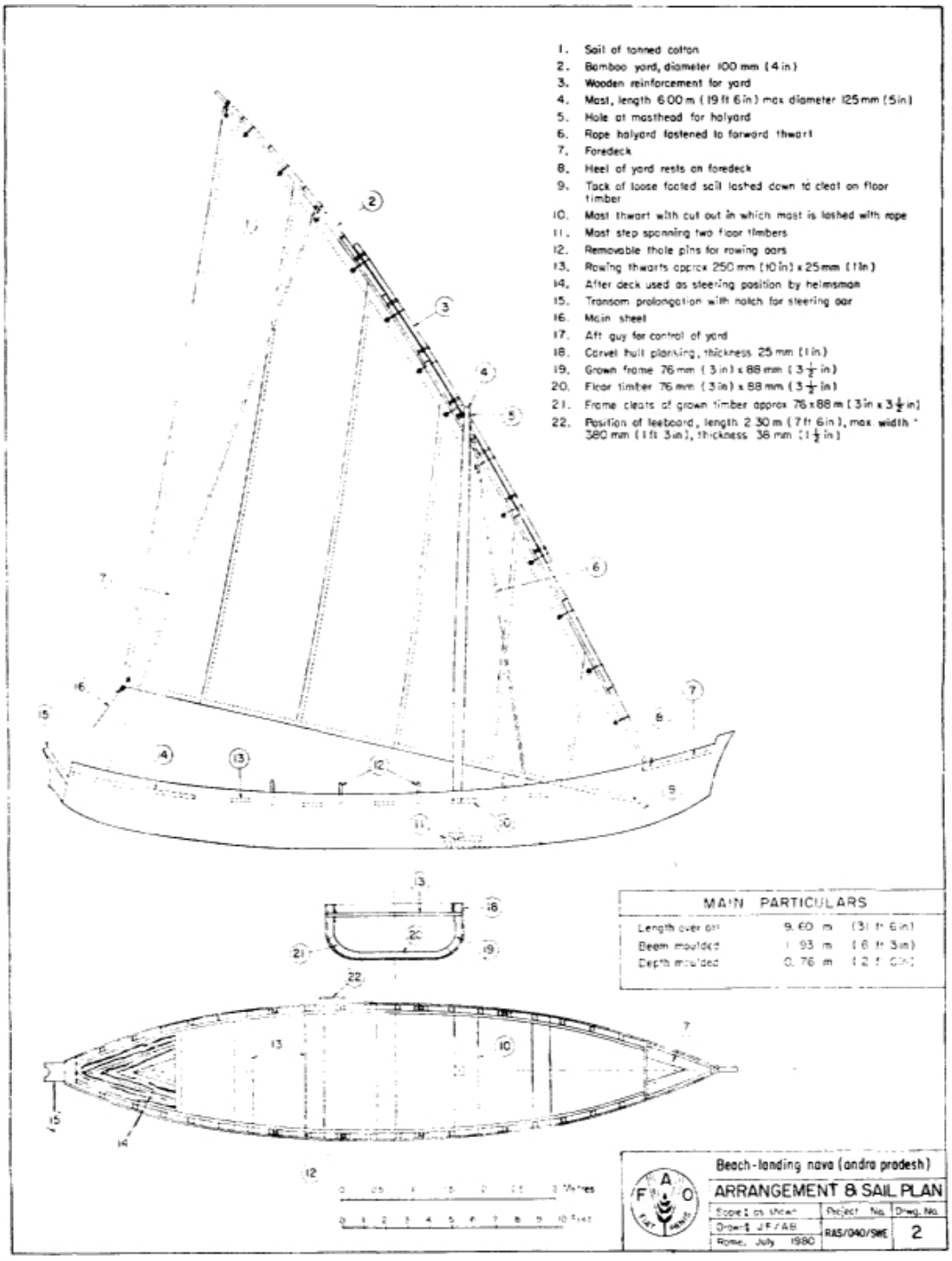


0 0·5 1·0 2·0 3·0 m

	7·4 m BEACH BOAT		
	GENERAL ARRANGEMENT		
SCALE : 1:20	BOAT NO.	DRG NO.	
DESIGN: Ø GULBRANDSEN GRAMSTAD, AUGUST 1980	IND-13	1	

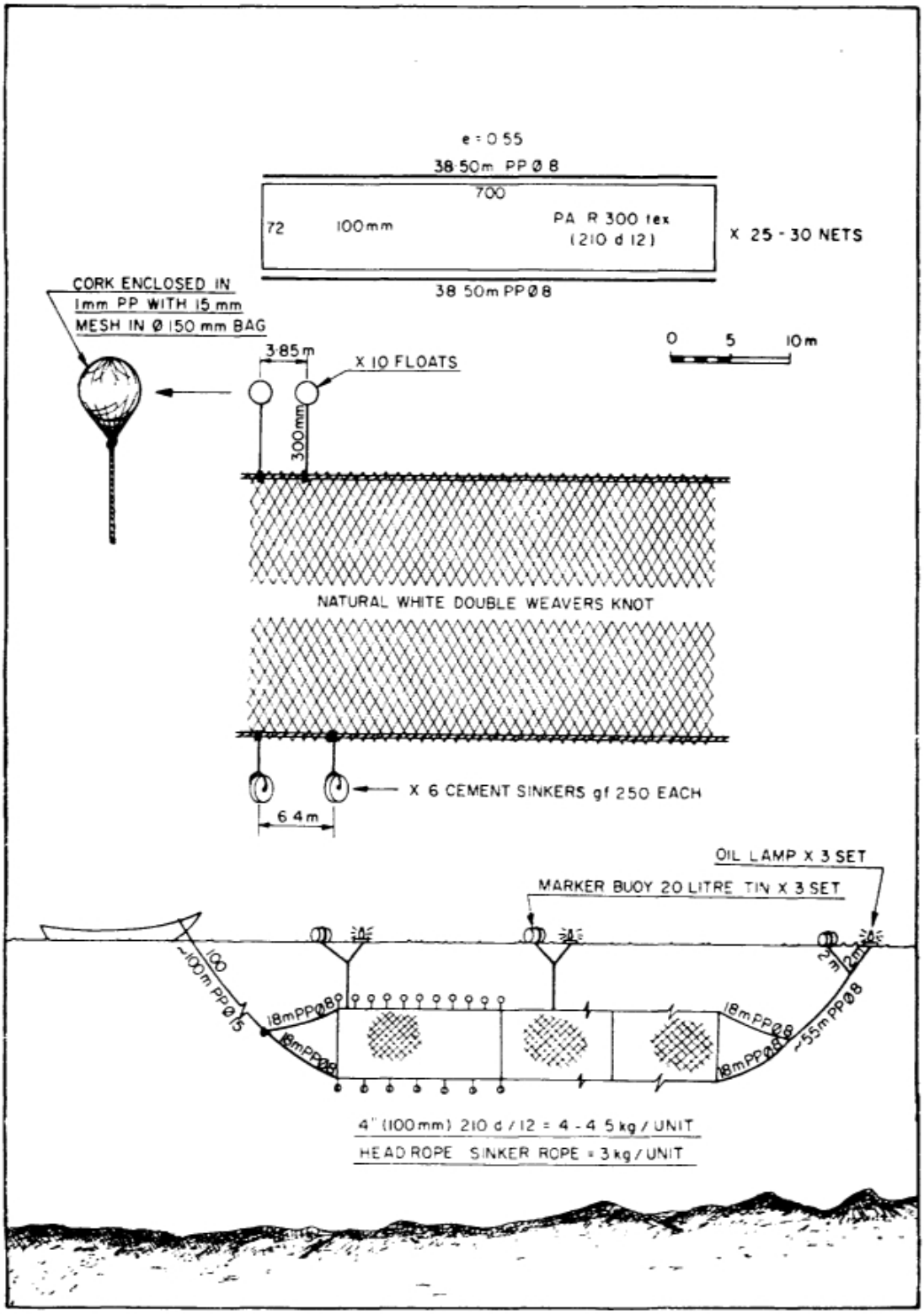
Appendix 2

GENERAL ARRANGEMENT OF THE NAVA



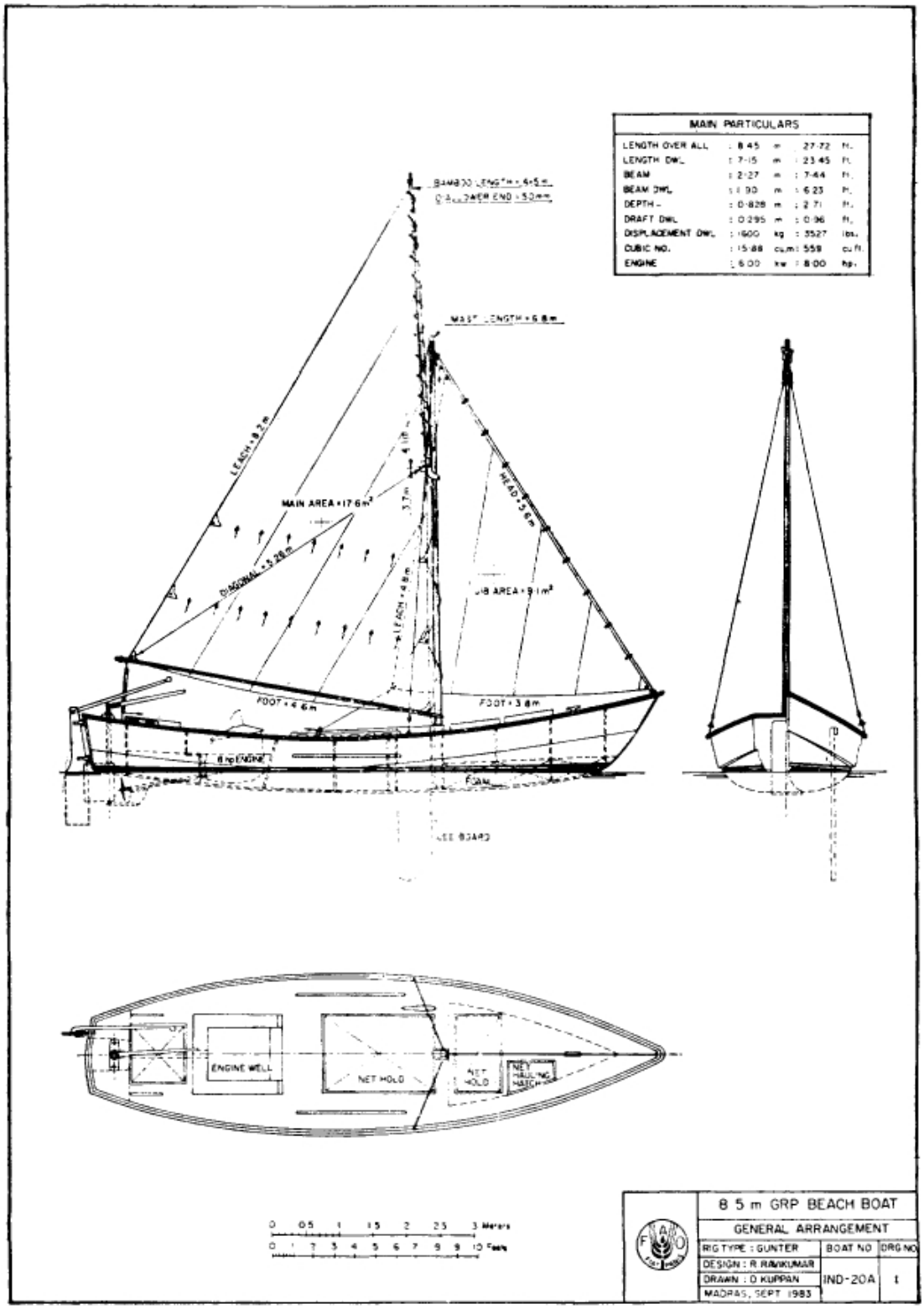
Appendix 3

SPECIFICATIONS OF NET USED FOR FISHING (UPPADA SURFACE DRIFTNET)



Appendix 4

GENERAL ARRANGEMENT OF IND—20



Appendix 5

ESTIMATES OF COSTS AND EARNINGS OF IND-20 BEACHCRAFT AND THE NAVA

	IND—20		NAVA
No. of crew	5		6
No. of fishing days	220		206
Catch per annum:			
Quantity (tonne)	12.8		7.7
Value (Rs.)	48,000		29,600
Investment (Rs.):			
Craft hull	30,000		12,500
engine	12,000		
sailrig	1,500		
Nets	20,000		20,000
Total	63,500		32,500
Operating cost (Rs.):			
Fuel and oil	5,316		
Food 5 Rs./crew member/day	5,500		6,180
Crew share at 40% of (Gross income—fuel, oil—food)	14,874		11,714
Gear repair and replacement	6,667		6,667
Engine repair	1,540		—
Hull repair	770		615
Insurance at 2%	1,270		650
Janatha insurance for crew	60		72
Total	35,997		25,794
Surplus before depreciation and interest (Rs.)	12,003		3,806
Depreciation (Rs.)			
Hull (15 years)	2,000	(10 years)	1,250
Engine (7 years)	1,714		
Sailrig (8 years)	**188**		
	3,902		1,250
Surplus after depreciation	8,101		2,556
Rate of return (%)	12.8		7.9

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