

Bay of Bengal Programme

Post-Harvest Fisheries

DESIGN AND TRIAL OF ICE BOXES

FOR USE ON FISHING BOATS IN KAKINADA, INDIA

BOBP/WP/67



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**DESIGN AND TRIAL OF ICE BOXES
FOR USE ON FISHING BOATS IN KAKINADA, INDIA**

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During 1988–89, the BOBP's post-harvest fisheries project designed and tested an ice box for use on-board traditional fishing boats in Kakinada, Andhra Pradesh. Seven boxes were constructed and a design made of fibre reinforced plastic and polyurethane foam was found to be suitable. Information on catches and prices was obtained from these vessels to facilitate a study of technical and financial viability.

When used for preserving high value fish (particularly seerfish), ice can increase incomes by about 20%. The increased income enables the boat owner to pay for a box within one to three years. The 350 navas in Kakinada which employ a work force of over 2,000 men constitute a potential market for ice boxes.

This paper describes the development of the ice box and the trials to determine technical and financial viability during 1988 and 1989. The project forms part of a wider programme to encourage the use of ice on-board fishing boats in the Bay of Bengal and improve the quality of fish landings.

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The Bay of Bengal Programme (BOBP) is a multi-agency regional fisheries programme which covers seven countries around the Bay of Bengal—Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand. Its main goal is to develop, demonstrate and promote technologies, methodologies and systems to help improve the living standards of small-scale fisherfolk communities.

This document is a working paper and has not been cleared by the government concerned.

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SUMMARY

- 1. The ODA/BOBP post-harvest project designed and tried out an ice box for use on board traditional fishing boats in Kakinada, Andhra Pradesh. Seven boxes were constructed, and a design made of fibre reinforced plastic and polyurethane foam was found very suitable.**
- 2. Ice boxes and ice were provided to eight boats for various periods during 1988/1989.**
- 3. Information was collected from these boats which allowed for technical and financial viability to be studied.**
- 4. When used for preserving high value table fish (particularly seerfish) ice can increase income by about 20%. This enables the boat owner to pay for the box within one to three years and increase his own and his crew's income considerably. There is a potential for provision of ice boxes to about 350 boats employing a work—force of over two thousand men.**
- 5. Ice boxes of ODA/BOBP design are now in commercial production and an extension and demonstration programme is under way.**
- 6. A subsidy scheme by the Andhra Pradesh state government for the purchase of ice boxes is being initiated.**

I. INTRODUCTION

1.1 Background

Navas - the traditional fishing vessels

Kakinada on the Andhra Pradesh coast is one of the busiest fishing ports on the Bay of Bengal. It is home to a fleet of over five thousand wooden fishing boats known as navas. These boats are double ended, almost flat bottomed and plank built onto U-shaped frames. They range from 5 to 12 metres in length and traditionally have been sail powered with a lee board and stern tiller. The design is such that, with their smooth bottom, the boats are able to come in relatively close to the gently shelving beaches around Kakinada. More recently some of the larger boats (about 8–12m long) have installed inboard motors. This has required the incorporation of a fixed rudder and skeg to protect the propeller, and a central keel. This development has enabled these boats to fish further from base, spend longer time at sea, and be more flexible in their operations, but has necessitated the use of deep water creeks and river mouths for mooring. It is estimated that by the beginning of 1990 about two hundred and fifty of the larger Kakinada navas had been motorised, an increase from about one hundred a year earlier. The vast majority of this rapidly growing motorised fleet base themselves in Kakinada, where there are suitable creeks for mooring and supplies of fuel etc. In addition, there are an estimated one hundred motorised navas operating further south between Machilipatnam and Netlore.

Normal fishing practice

Most of these navas operate drifting gill nets of 5–6 inch mesh at night time. Depending on the state of the moon the nets are either top or bottom set. Soaking times are usually from dusk to dawn and so last around twelve hours.

Normal catch composition

The bulk of the catch is seerfish (*Scomberomorus* spp) and a mixture of other species such as jew fishes (*Sciaenidae*), pomfrets, shark, Indian salmon (*Polynemus* spp), barracuda (*Sphyraena* spp) and bill fishes (marlin, swordfish and sail fish). Seerfish is one of the most popular marine fish in southern India, and in fresh condition commands high prices in the main urban centres such as Madras. There is a thriving trade in fresh seerfish brought from many parts of the east coast of India to Madras. In Kakinada there are a large number of fish traders sending iced seerfish to Madras by train and there is healthy competition among them for first sale on the beaches. Until recently, Nava fishermen reckoned to sell 50% of their catch to this market, the rest being suitable only for the local fresh fish trade or for salting and drying.

Incentive for the use of ice

The competition is such that if a fisherman can land his fish in good fresh condition he stands to get top prices. Until recently all fishermen were landing fish from their navas without ice and the quality of the fish was very variable. Because the fishing nets are in the water for up to twelve hours the earliest caught fish are often dead in the water for long periods and are therefore badly spoiled by the time they are landed.

1.2 The Potential for the Use of Ice

The benefit of using ice

Using ice could have the following benefits.

1. All fish landed could be in good condition and command high first sale prices.
2. Boats could stay at sea longer without the catch deteriorating.
3. Boats can land their fish at any time of day without catch deterioration. Fish can be kept until the next day if landing is too late for the first market of the day.
4. During multi-day fishing trips, the fish from early catches can be kept fresh rather than salted.

The effect of the use of ice on traditional gill/netting practice

In order for ice to be of any real benefit to the nava operators it would be necessary for a change to be made in traditional fishing operations. Traditionally, soaking periods for the gill net are from dusk to dawn, approximately twelve hours. The earliest caught fish can be dead in the water for between six and twelve hours and therefore badly spoiled before hauling of the net.

To overcome these problems and to make the use of ice worthwhile for the earliest caught fish, it is necessary for fishing habits to change and for nets to be hauled in and reset at intervals during the night. The fish can then be removed early from the net and stowed in ice for preservation. It was recommended that a maximum set net time of four hours be adopted when using ice. This means that no fish will be at sea temperatures (approx. 27°C), and therefore spoiling, for more than five hours (allowing for hauling time) and ice will thus be fully beneficial in preserving quality.

Effect of new practices on fishing effort

From discussions with nava owners, it appeared that they sometimes operate a two haul/night system to take account of changing light patterns, weather conditions and fishing grounds and that they could see no real problems in introducing the system as a matter of routine, as long as the financial rewards were encouraging. In practice therefore it has been possible to have two settings per night (allowing for hauling and resetting the net at mid point). This practice has reduced the effective fishing time (i.e. the time the net is in the water) by approximately two hours and may therefore have reduced the weight of the fish caught. Although this has not been seen as a problem by the ice box users.

However, resetting the net allows it to be changed from bottom to top set, or vice versa, should the lighting conditions change during the night and different fishing grounds can be tried thus taking advantage of different habits of the targeted fish.

1.3 Aims

Under these circumstances it was thought that fisherman would benefit by using ice at sea to preserve their catch. To this aim a programme was initiated to design, test and evaluate an insulated fish/ice box for use on board the navas.

1.4 Objectives

1. To design a box suitable for use on board navas as a storage container for ice and fish. The box would be designed as a semi permanent structure rather than a transport container with ice being taken to the boat for stowage and fish removed from the box for sale at the landing.
2. A number of boxes would be constructed at BOBP expense, loaned to nava owners and ice would also be provided for trials and evaluation.

2 THE FISH/ICE BOX

2.1 Design of the Fish/Ice Box

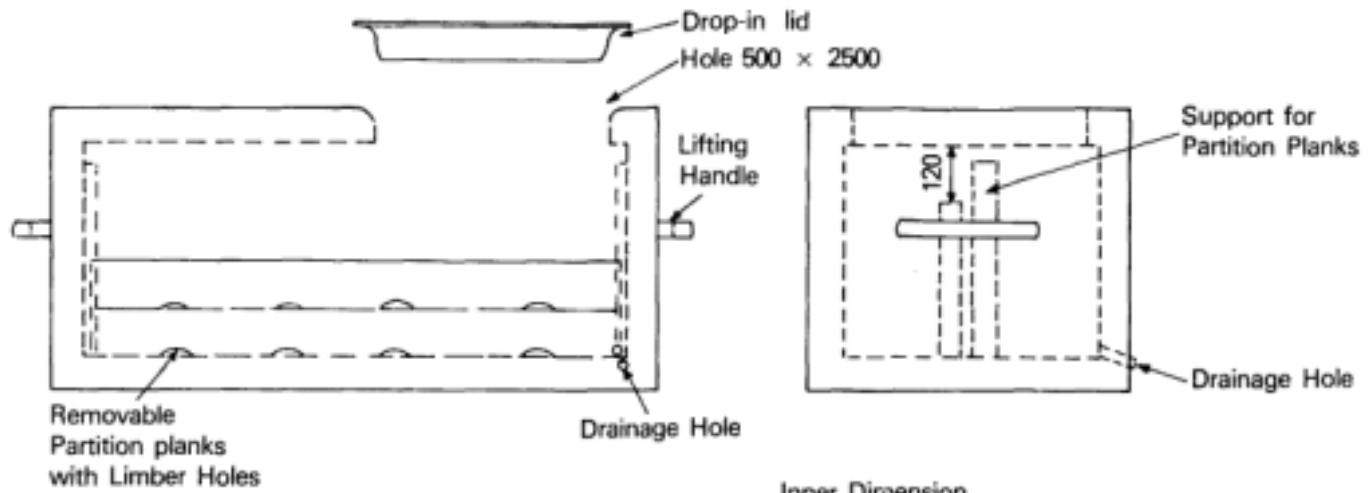
Criterion for the design of a fish/ice box

The design of the box took into consideration the following factors.

1. The capacity requirements and types of fish being caught by the boats.
2. The space available on-board and stability of the boat.
3. The high ambient temperatures and the need to conserve ice.
4. The need to occasionally, but not regularly, remove the box from the boat for maintenance of the boat and/or box.
5. The additional capital, running and maintenance costs for the fishing operation.

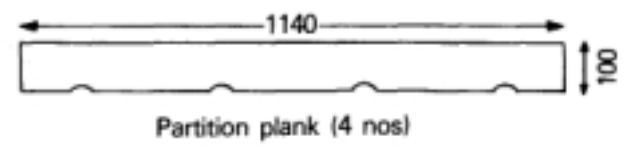
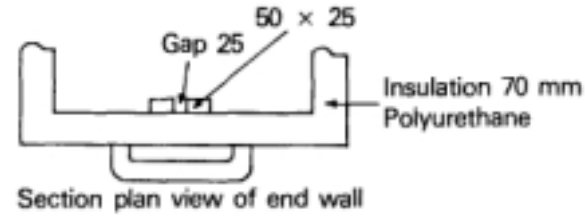
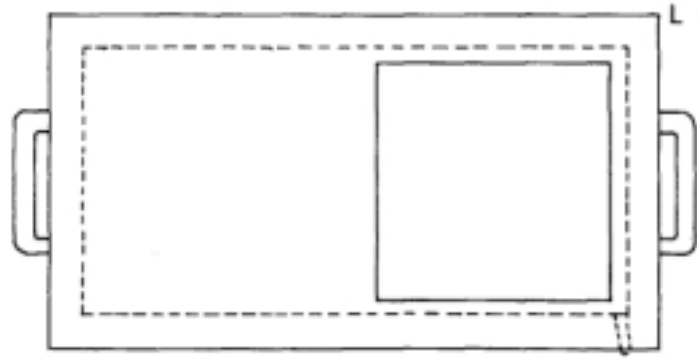
2.2 Final Design for the Fish/Ice Box

After a number of prototypes the final standard design for the boxes was developed. (Figure 1).





Inner Dimension
 L = 1150 W = 550 H = 450

Outer Dimension
 (Approx)
 L = 1300 W = 700 H = 600



All dimensions in mm unless otherwise stated

 	FISH/ICE BOX FOR NAVAS		
	Scale : 1 : 10	Drwg No.	Design No.
	Design : ODA Post harvest fisheries project		
	Drawn : RKA, BOBP		
	Madras May 1989.		

Construction materials

The main trials have been made with boxes constructed of fibre reinforced plastics (FRP) laminated directly onto 70mm thick polyurethane foam. This sandwich construction gives a wall thickness of roughly 75mm and external dimensions as follows.

Length	1300mm
Width	700mm
Depth	600mm

Internal Dimensions

The box is cuboid with the following internal dimensions.

Length	1150mm
Width	550mm
Depth	450mm

Both internal and external surfaces of the box are smoothed with a gel coat to give an easily cleaned surface.

Lid

Access to the box is through a square hole 500mm x 500mm located in one end of the top surface. A simple drop in lid, insulated and constructed in the same way as the box, fits into this hole.

Internal divider

In order that ice alone and ice/fish mixture can be kept separated the boxes are fitted with removable boards which divide the inside longitudinally. The four wooden boards are approximately 10mm thick by 100mm deep and slot into channels internally moulded into the ends of the box.

Drainage

A single brass 10mm diameter plug is fitted through the box at the bottom of one side of the box at the lid end. This is constructed so that it is at the lowest point when the box is on the boat and it has a screw-in stopper so that drainage can be regulated.

Handles

Carrying handles are provided at each end to assist in lifting the box on and off the boat.

2.3 General Design Considerations

Capacity of the box

The box is designed so as to be able to carry sufficient ice and fish for normal operations. It has a nominal capacity of 175–200 kg ice/fish mixture. In practice the navas catch an average of 30–40kg per trip ranging from 0 to 200kg, but can occasionally catch very large quantities. On these occasions the box will not be big enough for the entire catch. The box is designed specifically for storage of seerfish, this being the most important species to the industry. It is realised that it is not large enough to store large shark, bill fishes, etc.

Stowage of the box

The box is designed to be stored on board the boat below the thwarts. It is not envisaged that the box would be removed from the boat on a regular basis.

The use of alternative construction materials

The possibility of using materials cheaper than FRP was also studied. Using the same standard design a box has been constructed and tested. It was made from a wooden outer shell, with insulation of 70mm expanded polystyrene, and a galvanised iron sheet lining. This had the same internal dimensions as described above and incorporated the other design features. This box has proved to be suitable for use as planned, but it is envisaged that it will deteriorate quickly and need replacing much sooner than the FRP boxes. The final design of FRP box weighed approximately 40kg whereas this wooden version weighed about 150kg. The cost was roughly 50% of the FRP box price.

3 BOX USE

3.1 Information

information collected

Over the period from October 1988 to December 1989 eight different navas made use of boxes and ice provided under the programme. In return for the use of the box and provision of ice the nava owners provided the project with information on which the following analysis could be based. This information included:

1. Fishing time and effort.
2. Catch by species, number, weight and price paid at first sale.
3. Comparative top and bottom prices for the same species of fish landed at the same time and place.
4. Amount and value of ice used.

This information was collected on a daily basis from each boat and entered onto a data sheet. The information then was analysed.

Assumptions used in the analysis of the information

The following assumptions have been made in this analysis based on information gathered locally.

1. The non-iced fish income is based on an average of the top and bottom prices being paid for the species at the same time and place multiplied by the weight of that species caught by the nava using ice.
2. The local practice is that the gross income is divided on a share basis between the boat owner and crew. The boat owner's share off 60% of the income has to pay for all the expenses involved in the operation of the boat, including capital costs, depreciation, maintenance, fuel, ice, food, etc. The other 40% is divided among the crew members. It has been assumed therefore that 60% of the incremental benefits from using ice have to cover the additional costs of the ice box, and its maintenance and depreciation. The other 40% is equally divided between the crew members who will obviously benefit if use of ice provides more income.
3. It is assumed that the boxes have a useful life of five years only and then have no residual value. In practice it is likely that they will last for considerably longer than this, maybe up to ten years.
4. It is also assumed that the initial purchase of the box will be at full cost (Rs. 6,050).

3.2 Fishing Data

Data collected

Although eight boats were involved in the programme at various times only three boats – navas 1, 2 and 4 – used ice and the ice boxes for a full year, and are therefore able to provide a complete year's worth of data on which to base a full economic analysis. It is the information from these three boats that are used in the following analysis. Details of the catches of these three navas, sale price and ice used are given in Tables 6, 8 and 10. Tables 7, 9 and 11 provide a financial analysis for each boat.

Table 1 : Periods of ice **box** use by navas

<i>Nava</i>	<i>Start date</i>	<i>End date</i>	<i>Period of use</i>
	5.10.88	31.12.89	15 months
2	21.12.88	31.12.89	12 months
3	1.12.88	30. 4.89	5 months
4	1. 1.89	31.12.89	12 months
5	2. 3.89	31.12.89	10 months
6	6. 5.89	31.12.89	8 months
7	28. 8.89	31.12.89	4 months
8	2.11.89	31.12.89	2 months

3.3 Nava I

Specification and fishing areas

This boat is one of the largest motorised navas in the fleet, measuring 12.3m and fitted with a 40hp three cylinder engine. The boat usually carries sixty nets made up as one unit. The net is nominally 12 fathoms long by 5.5 fathoms deep with 5.5—6 inch mesh. The boat usually has a crew of six or seven. Although based in Kakinada, the owner of the boat and his regular crew spend much of their time fishing and landing their catch away from Kakinada when local fishing is poor.

By spreading his effort to other areas during slack periods in Kakinada itself, this owner has a higher average catch than other boats that operate solely from Kakinada.

Table 2 : Fishing areas for Nava 1 (1988-1989)

<i>Month</i>	<i>Fishing area/ Landing</i>	<i>Month</i>	<i>Fishing area/ Landing</i>
Oct 88	Bhyrapalem/ Vodalarevu	June 89	Kakinada
Nov 88	No fishing	July 89	Kakinada
Dec 88	Vodalarevu	Aug 89	Kakinada
Jan 89	Vodalarevu	Sept 89	Kakinada/ Vodalarevu
Feb 89	Bhyrapalem/ Kakinada	Oct 89	Antharvedi
Mar 89	Kakinada	Nov 89	Vodalarevu
Apr 89	Kakinada	Dec 89	Machilipatnam/ Antharvedi
May 89	Kakinada		

Financial Analysis

It can be seen from the data and financial analysis in Tables 6 and 7, that the incremental costs and benefits to the unit of using ice and investing in an ice box even at full cost are well worth while. In this instance the box can be paid for in about one year's use and the gross income to the boat owner can increase by over 2%. From this he has to pay for the ice and box maintenance but still makes a net profit of over 12%. The crew members stand to gain an increase in income of over 20% by working on this box if it continues to use ice. (See Table 3).

Table 3 : Increase in income by using ice

(Nava 1, 1989)

	Totals	Owner share	Crew share
Income (Rs):			
with ice	100,177	60,106	40,071
without ice	82,784	49,671	33,134
Increase (Rs)	17,393	10,436	6,937
Maintenance & ice costs (Rs)		4,321	0
Net Income (Rs)		6,115	6,937
% Increase in Net Income		12.3%	21.0%

3.4 Nava 2

Specification and fishing activity

This boat measures 11.4m, is fitted with a 20hp engine and normally carries a set of forty nets of the same type as nava 1. During 1989 it spent most of its time fishing from Kakinada, with a short period fishing from Bhyrapalem during March.

The boat has made use of the greater flexibility that the use of ice brings. During January and February, for instance, the boat spent some time voyage fishing, that is spending more than one

night at sea. On two occasions the voyages were each of two nights' duration, on two other occasions of four nights' duration. The fish at the end of these periods could still be sold fresh at top prices. The use of ice during this type of operation is obviously essential if fish is to be landed fresh. Boats which undertake voyage fishing but do not use ice, usually take salt to sea so as to split and salt the early caught fish for the salt/dried fish market. The price paid for this fish is very much lower than for good quality fresh fish, and lower than that for poor quality fresh fish.

Financial analysis

In this case the pay back period on the box is under three years when full purchase price is included. (See Tables 8 & 9). The increase in gross income however, is nearly 19% which represents substantial benefits to the boat owner and crew members. (See Table 4).

Table 4: **Increase in income by using ice**
(Nava2, 1989)

	<i>Totals</i>	<i>Owner's Share</i>	<i>Crew Share</i>
Income (Rs):			
with ice	57,678	34,607	23,071
without ice	48,508	29,105	19,403
Increase(Rs)	9,170	5,502	3,668
Maintenance &Ice(Rs)		3,337	0
Net Income (Rs)		2,165	3,668
% Increase in Net Income		7.4%	18.9%

3.5 Nava4

Specifications and fishing area

This boat is one of the smaller motorised navas in the fleet being only 8m long and with a single cylinder 8hp engine. The normal crew consists of five people (including the owner) and it carries a set of thirty units of netting. Twenty two of these nets are the normal 12 fathoms long, with eight being 16 fathoms. The fishing effort is therefore equivalent to about forty standard units. The boat operated solely from Kakinada during 1989 and only on one occasion spent two nights at sea during one trip.

Financial Analysis

The boat operated at near full capacity during the early part of the year but between late June and November very little fishing was undertaken, with no fishing at all in July. (See Tables 10 and 11). In spite of this, the use of the box still shows positive benefits and the financial analysis indicates that the box should be paid for in about two years. The crew members stand to increase their income by over 23% and the boat owner will increase his income by over 11%. (Table .5).

Table 5: **Increase in income by using ice**
(Nava4, 1989)

	<i>Totals</i>	<i>Owner's Share</i>	<i>Crew Share</i>
Income (Rs):			
with ice	44,218	26,531	17,687
without ice	35,755	21,453	14,302
Increase (Rs)	8,463	5,078	3,385
Maintenance &icecost(Rs)		2,600	0
Net Income (Rs)		2,478	3,385
% Increase in Net Income		11.5%	23.7%



Below: Nays crew in Kakinada about to load ice box.

Left: Box has been fitted on to the Nays.

Right: Demonstration and extension of the ice box in fishing villages around Kakinada.





3.6 Navas 3,5,6,7&8

Financial analysis

As can be seen from Table I the other navas involved in the programme used an ice box for less than a year and the results of their involvement are not included here. Preliminary analysis of the benefits of using ice by these boats, multiplied up to account for a full year also give very favourable indications of financial viability. With the exception of the owner of nava 3. all the box users were very impressed with the benefits that ice gave to their operations.

4 GENERAL CONCLUSIONS

4.1 Advantages of Using Ice

Technical advantages

Using ice at sea allows nava owners to land all their fish in prime condition. It is apparent that fish merchants in Kakinada are willing to pay top prices for iced fish and often these prices are above those for good quality non-iced fish. The demand from merchants is such that some have arranged to buy iced fish direct from the boat owners at fixed top prices, and at any time of the day. This has meant that ice users have not been tied to the early morning auction system and have a guaranteed market for their fish. The use of ice has also meant that more boats are willing to spend more than one night at a time away from base on more distant fishing grounds, as they can keep fish fresh for a number of days and still get top prices. On a number of occasions during the trials navas kept fish off ice from one day to the next to take advantage of better prices when they were too late for the market or there was a glut of fish on the first day.

Financial Advantages

From the information gathered, it has been possible to make an assessment of the financial advantages of using ice on navas. The advantages vary from boat to boat depending on the amount of gear carried, the initiative of the boat owner and crew and to a certain extent on luck. In the worst case it appears that the boat owner stands to make a substantial extra income, being able to pay back the cost of box purchase in about 2–3 years. In the best cases, profits are up by over 20% with pay back periods on the box of about one year. It is estimated that the boxes will last at least five years and probably ten without major repairs.

The financial analyses presented above are based on the full cost of ice box purchase at Rs. 5,500 + 10% tax (i.e. Rs. 6,050). It can be seen that at full cost, and assuming no residual value, the advantages are considerable.

Indian fishermen associate any government-supported innovation with subsidy schemes either through national or state government channels. This means that fishermen expect a subsidy and are unwilling to accept new technology without government backing. The BOBP have argued that subsidies are not necessary but in spite of this the Andhra Pradesh State Fisheries Department is initiating a scheme for a subsidy on a number of boxes to be sold during 1990/91.

Social advantages

According to local custom, box purchase will be the responsibility of the nava owner, who under the normal share system, covers all costs from 60% of the income to the boat. The other 40% of income is shared among crew members who therefore stand to gain about 20% more income by working on ice-using navas. Each nava carries a crew of between three and seven men. Since there are about three hundred and fifty motorised navas in operation at present, there is a potential to substantially increase the income of over two thousand relatively poor fishermen.

4.2 Discussion

The use of ice at sea is not a new technology but in certain circumstances its full potential has not been realised. By the application of old technology to a new situation very real progress can be made towards helping the poorer members of the fishing community. This programme has illustrated that new knowledge and invention are not always necessary to bring about development. This is a case where technology widely adopted elsewhere has not been taken up, presumably because its advantages have not been demonstrated under local conditions.

The next step is to embark on a programme of extension and training to bring the message to more fishermen and it is hoped that many fishermen will benefit in days to come.

Table 6 : Summary of Nava 1, 1989

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nor	Dec	Total
No. trips	20	22	24	21	24	18	15	9	10	18	21	20	232
W1 fish caught (kg)	835	1,995	922	635	429	346	443	310	292	542	481	381	7,611
Value: Rs													
Iced	3,696	8,490	9,441	5,845	7,986	4,302	5,665	5,081	1,928	1,118	1,300	2,826	57,678
Not Iced	3,006	7,639	7,957	4,665	5,979	3,422	5,124	4,645	1,749	868	1,164	2,291	48,509
Wi. Ice' used (kg)	475	800	1,250	1,250	1,350	850	1,000	750	600	600	500	600	10,025
Value Ice used (Rs)	133	224	380	350	378	238	280	210	168	168	140	168	2,837

Table 7 : Financial Analysis of Nava 1 (1989 figure)

Year	0	1	2	3	4	5
<i>Costs</i>						
1. Box	6,050					
2. Ice		3,821	3,821	3,821	3,821	3,821
3. Maintenance		500	500	500	500	500
4. Total costs	6,050	4,321	4,321	4,321	4,321	4,321
<i>Gross Revenue</i>						
5. Iced-Fish Revenue		100,177	100,177	100,177	100,177	100,177
<i>Lost Income</i>						
6. Non Iced Fish		82,786	82,786	82,786	82,786	82,786
<i>Change in Gross Income</i>						
7. Income with box less income without box		17,391	17,391	17,391	17,391	17,391
8. Income to boat owner (60% share)	-6,050	10,436	10,436	10,436	10,436	10,436
<i>Net Income</i>						
9. Net income (gross-costs)	-6,050	6,115	6,115	6,115	6,115	6,115
10. Change in net income (discounted at 10%)	-6,050	5,559	5,053	4,594	4,176	

Net Present Value (10% discount rate): Rs. 17,129

Pay-back period on box: Approximately one year

Note: Lost Income = Average price from non-icing navas

Table 8: Summary of Nava 2, 1989

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
<i>No. irips</i>	12	16	26	21	25	16	20	17	12	10	9	16	200
<i>Wt. fish</i>													
caught (kg)	332	791	849	358	800	266	401	311	192	50	97	174	4,621
Value: Rs													
Iced	3,696	8,490	9,441	5,845	7,986	4,302	5,665	5,081	1,928	1,118	1,300	2,826	57,678
Not Iced	3,006	7,639	7,957	4,665	5,979	3,422	5,124	4,645	1,749	868	1,164	2,291	48,509
<i>Wt. Ice</i>													
used (kg)	475	800	1,250	1,250	1,350	850	1,000	750	600	600	500	600	10,025
Value ice													
used (Rs)	133	224	380	350	378	238	280	210	168	168	140	168	2,837

Table 9: Financial Analysis for Nava 2 (1989 Figures)

Year	0	1	2	3	4	5
<i>Costs</i>						
1. Box	6,050					
2. Ice		2,837	2,837	2,837	2,837	2,837
3. Maintenance		500	500	500	500	500
4. Total costs	6,050	6,337	3,332	3,337	3,337	3,337
<i>Gross Revenue</i>						
5. Iced Fish Revenue		57,678	57,678	57,678	57,678	57,678
<i>Lost Income</i>						
6. Non Iced-Fish		48,509	48,509	48,509	48,509	48,409
<i>Change in</i>						
<i>Gross Income</i>						
7. <i>Income with box less</i>						
income without box		9,169	9,169	9,169	9,169	9,169
8. <i>Income to boat owner</i>						
(60% share)	-6,050	5,501	5,501	5,501	5,501	5,501
<i>Net Income</i>						
9. <i>Net income (gross-costs)</i>	-6,050	2,164	2,164	2,164	2,164	2,164
10. <i>Change in net income</i>						
(discounted at 10%)	-6,050	1,969	1,790	1,627	1,479	1,345

Net Present Value (10% discount rate): Rs.2,159

Pay-back period on box: Between 2 and 3 years.

Notes : Lost Income = Average price from non-icing navas

Table 10: Summary of Nava 4, 1989

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Dec	TOTAL	
No. trips	17	25	18	24	18	12	0	5	4	5	12	6	56
Wt. fish caught (kg)	198	536	422	586	358	308		70	37	26	209	294	3,044
Value: (Rs)													
Iced	2,750	7,844	6,091	8,090	4,450	3,375		1,440	837	625	3,380	5,336	44,218
Not Iced	2,157	6,748	5,014	6,404	3,219	2,331		1,350	710	501	2,880	4,443	35,757
Wt. Ice used (kg)	500	1,200	900	1,300	950	950		150	250	300	700	600	7,800
Value Ice used (Rs)	140	252	252	364	266	266		42	70	84	196	168	2,100

Table 11: Financial Analysis for Nava 4 (1989 Figures)

Year	0	1	2	3	4	5
Costs						
1. Box	6,050					
2. Ice		2,100	2,100	2,100	2,100	2,100
3. Maintenance		500	500	500	500	500
4. Total costs	6,050	2,600	2,600	2,600	2,600	2,600
Gross Revenue						
5. Iced Fish	44,218	44,218	44,218	44,218	44,218	
6. Non-Iced Fish		35,755	35,755	35,755	35,755	35,755
Change in						
Gross Income						
7. Income with box						
less income without box		8,463	8,463	8,463	8,463	8,463
8. Income to boat owner (60% share)	—6,050	5,078	5,078	5,078	5,078	5,078
Net income						
9. Net income (gross - costs)	—6,050	2,478	2,478	2,478	2,478	2,478
10. Change in net income (discounted at 10%)	—6,050	2,252	2,048	1,862	1,692	1,538

Net Present Value (10% discount rate): Rs.3,342

Pay-back period on box: About 2 years

Notes : Lost Income = Average price from non-icing navas

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/WPL...) are progress reports that discuss the findings of ongoing BOBP work.

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

Miscellaneous Papers (BOBP/MIS/...) concern work not sponsored by BOBP— but which is relevant to the Programme's objectives.

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

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

A list of publications since 1984 follows.

Reports (BOBP/REP/...)

17. Report of Investigations to Improve the Kattumaram of India's East Coast. Madras. India, July 1984.
18. Motorization of Country Craft, Bangladesh. Madras. India. July 1984.
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Quarterly