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FORV *SAGAR SAMPADA* AND DEVELOPMENT OF DEMERSAL TRAWLS FOR INDIAN EEZ — A STATUS PAPER ON PROSPECTS AND CONSTRAINTS

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ABSTRACT

A summary of R&D programme on the harvest technology of the demersal resources of EEZ leading to the development of the new concept of high speed demersal trawling as the most suitable method for the exploitation of low density multi-species tropical demersal fishery resources, light Bobbin Trawl for the exploitation of the rich demersal fishery resources of hard, uneven and even rocky areas of the Indian EEZ otherwise not accessible for trawling and multipurpose Hybrid Trawl for squid and cuttle fish is presented. The design details and performance of the three high speed demersal trawls, Cift HSDT I, II & III, Cift Bobbin Trawl and Cift Hybrid Trawl are discussed.

How the inherent constraints of sharing the facility of a primarily biological and oceanographic research vessel and the fixation of priorities on the above line have affected the R&D programmes on the harvest and post harvest technology of fish is discussed in detail and suggestions are made to minimise these constraints.

INTRODUCTION

FAO (1977) has estimated an annual potential yield of World Fisheries to range from 240 to over 455 million tonnes and aimed at 130 million tonnes from the then 70 million tonnes range by the turn of the century with a total investment cost of US $ 30,000 million at an input rate of US $ 1,500 million over a period of 20 years from 1980. Most of the technology input being readily available, what is needed is the adoption of policies and programmes especially by developing countries like India with a vast area of EEZ for the judicial exploitation of the resources.

It is rather disheartening to record that even after a decade of our declaration of the EEZ, we have still not even touched the fringe of our EEZ outside the traditional coastal area of nearly 0.2 million sq km i.e. 10% of the EEZ. It is also worth metioning here that 99% of the national marine fish production of nearly 1.8 million tonnes is from the traditional coastal area and hardly 1% is the contribution of nearly 90% of the EEZ with an estimated potential yield of 2 million tonnes annually.

Thanks to the Department of Ocean Development, Government of India and Dr. S. Z. Qasim former Secretary, Department of Ocean Development in particular, the situation is steadily changing with the acquisition of the two prestigeous research vessels ORV *Sagar Kanya* during 1983 and subsequently FORV *Sagar Sampada* during 1984 basically designed and equipped for oceanographic and biological research and exploration of the EEZ. However, due to the inherent constraints in sharing the limited facilities of FORV *Sagar Sampada* made available to Indian Council of Agricultural Research for fishery development purposes, it was not possible to have much headway in the fishing technology aspects of the EEZ. Addition of a third research vessel, an FTRV alongwith FORV & ORV can go a long way in an overall development and exploitation of the living resources of the EEZ.

Even though, different types of demersal trawls were used for survey and limited exploitation of the demersal fishery resoruces along the continental shelf and slope by sister institutions like FSI and IFP, they were all imported designs of very heavy trawls suitable for temperate regions with entirely different fishery and fishing conditions. These nets are desinged for an optimum trawling speed ranging between 2 and 3 knots with heavy materials and ground ropes to cope with bulk catches of a few commercially important slow swimming demersal fishery resources of high population density. However, for the commercial exploitation of the comparatively active, multi species, low population density tropical fishery resources like ours, these designs are not suitable.

It is in this context that Central Institute of Fisheries Technology, Cochin has taken up the

challenge of developing suitable demersal trawls for the commercial expolitation of the deep sea demersal fishery resources of the EEZ leading to the perfection of high speed demersal trawling, a concept still in the developmental stage elsewhere, as the most suitable design for commercial exploitation. The Institute has taken up development of Bobbin Trawl for the exploitation of the rich and varied demersal fishery resources of vast areas of hard, uneven and even rocky patches of the EEZ not suitable for conventional trawling and development of High Speed Multipurpose Hybrid Trawl for the exploitation of squid and cuttle fish. A summary of the salient features of the gear and performance from FORV *Sagar Sampada* is disucssed.

High speed demersal trawling

Commercial exploitation of active, multispecies low population density fishery resources like ours requires encountering of fish at a high speed. To attain a high speed trawling system especially for the exploitation of demersal fishery resources problems are many. They are,

i. The power requirement to increase the speed of a ship is far from proportional to the increase in speed.

ii. The resistance of the trawl increases more than proportionately to the increase in speed.

iii. An increase in the speed necessitates an increase in the scope ratio and use of heavy otter boards and ground rope leading to a further increase in the power consumption.

iv. Fishing power of a trawler, depends upon the "area swept" by the gear which is proportional to its "gape" and to the speed of towing.

v. The speed of water inside the trawl and perhaps also infront of it is less than the speed of tow due to the resistance of webbings, thereby enabling greater chance of escape of fast swimmers. The amount of water strained being the criterion of fishing power, it is evident that a large trawl towed at a slow speed might have the same straining capacity of a small trawl at a high speed. Hence a smaller trawl, with light material, larger meshes, with appropriate angle of attachment of webbing at the wings, trawl mouth and belly region to get a smooth catenery of the framing rope and a smooth tapering along the belly facilitating even distribution of stress along the entrie net to allow a wide opening of mesh from square to diamond shape from wing to cod end is the main feature of a high speed demersal trawl. Due to the even distribution of force all along the net from wing to cod end, it opens horizontally and vertically to the optimum thereby facilitating smooth water flow and herding of fish to cod end without gilling at any part of the net. Taking into consideration of all the above facts, CIFT has developed three high speed demersal trawls Cift HSDT-I, II & III with a common belly but with different configuration at the trawl mouth.

Cift HSDT-I

Scientists responsible **: K. K. Kunjipalu, B. Meenakumari & T. M. Sivan**

Cift HSDT-I is basically a two seam demersal trawl. The design details are presented in Figs. 1& 2. The gear was tested from FORV *Sagar Sampada* on 24-6-1986 and continued upto 7-10-1987 at depth ranging between 50 and 380 m at a speed ranging between 3.5 and 4.5 k. A total of 57 operations of 50 hr duration landed 59.6 tonnes of demersal fin and shell fishes resulting in an overall catch/hr of 1.152 t. Of the 57 hauls, 35 were aimed at biological sampling wihout any consideration of the productivity of the ground and the total catch for the above 35 hauls of 30 hr duration was only 4.57 t resulting in a catch per hour of 0.119 t. The pre-commercial feasibility studies of 22 hauls of 20 hr duration landed 55.03 t recording a catch per hour of 2.75 t. A maximum catch of 10 t/hr was recorded on 29-7-1987. The normal catch ranges between 0.5 and 2.5 t per hour with occasional catches of 9.5 and 3.5 t per hour respectively on 8-9-1986, 4-8-1987 and 4-7-1987. The catch consisted of *Nemipterus* sp., horse mackerel, mackerel, *Priacanthus* sp., perches, cephalopods and deep sea prawns and lobsters. The main feature of the net is its easy manoeuvrability to a limited height from the bottom.

Cift HSDT-II

Scientists responsible **: B. Meenakumari, K.K. Kunjipalu & T. M. Sivan**

Cift HSDT-II, is also basically a two seam demersal trawl but with different configuration at the mouth and wing region. The design details are presented in Figs. 3 & 4. The gear was tested on 26-6-1986 from FORV *Sagar Sampada* and continued up to 18-9-1987. A total of 40 hauls of 39 hr landed 24.96 t resulting in an overall catch per hour of 0.65 t. Twenty three hauls of 23 hr earmarked for biological sampling landed 3.15 t resulting in a catch/ hour of 0.146 t and pre-commercial feasiblility studies of 16

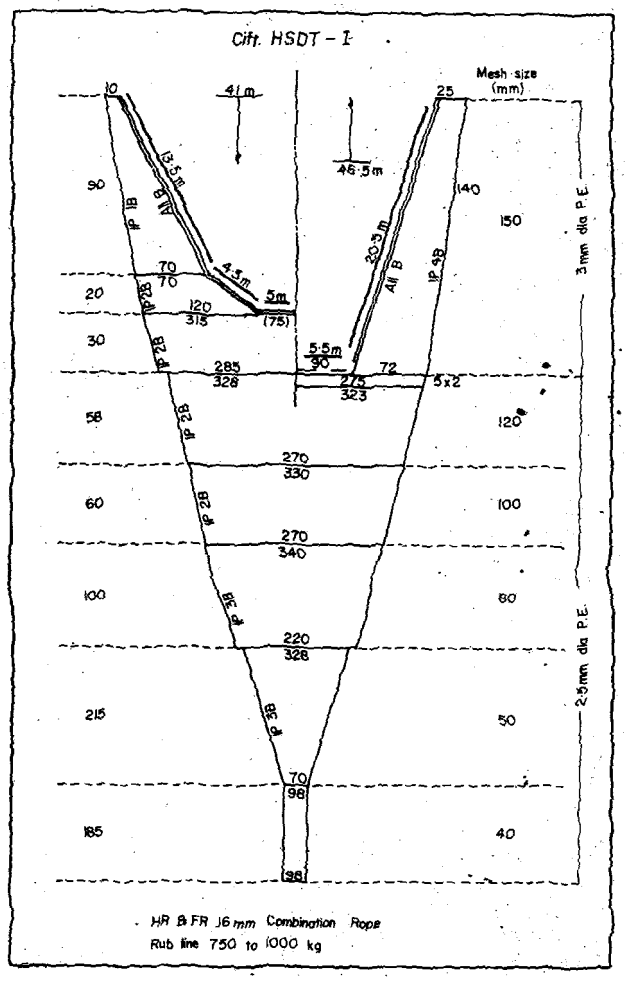

Fig. 1. Design of High Speed Demersal Trawl : Cift HSDT - I.

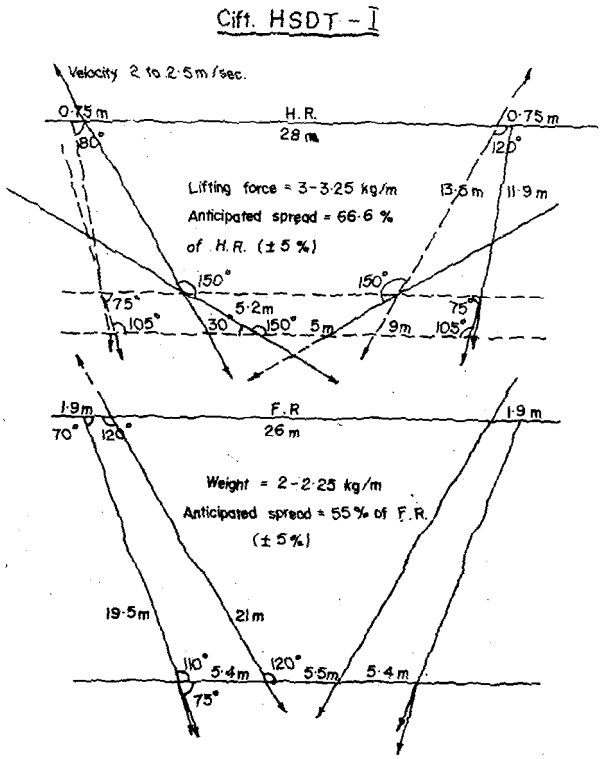

Fig. 2. Orientation of wings at the trawl mouth of Cift HSDT - I.

hr landed 21.8 t resulting in an average catch per hour of 1.36 t. The maxmium catch recorded was 4 t/hr on 1-8-1987 with repeated catches of 2.5 t/hr on 28-6-1987, 1-7-1987 and 14-9-1987. The catch ranged between 0.5 and 2 t per hour. The catch consisted of *Nemipterus* sp., *Priacathus* sp., perches, mackerel, cephalopods, prawns and lobsters. The operational details are same as in the case of Cift HSDT- I.

Cift HSDT- III

Scientists responsible : B. Meenakumari, K. K. Kunjipalu & T. M. Sivan

Cift HSDT-III is basically a four seam type of demersal trawl with 3 bridle arrangement. The design details are presented in Figs. 5 & 6. The gear was operated from 4-8-1986 to 19-2-1988 form FORV *Sagar Sampada*. The ground and operational details are same as in the case of Cift HSDT-I & II. A total of 60 hauls of 42 hr duration landed 57.8 t. A total of 24 hr was utilized for biological sampling and landed 4.17t resulting in an average catch per hour of 0.171 t and 21 hauls of nearly 18 hr of pre-commercial feasibility studeis landed 53.36 t resulting in a catch/ hour of 3.03 t. Cift HSDT-III has the maximum adaptability to sea bottom and has recorded the maximum catch of 12 t/hr of deep sea prawns and lobsters on 17- 2-1988 at 315 m depth off Quilon, followed by 7 t and 5 t per hour on 15-2-1988, 4.5 t/ hr on 13-2-1988 and 2 t/hr on 12-2-1988 and 13-2-1988 from the same area. The normal catch ranged between 0.5 and 2.5 t per hour. The catch consisted mainly of deep sea prawns, lobsters, deep sea fishes, *Nemipterus* sp. *Priacanthus* sp. and perches.

The rigging and performance details of HSDT series are given in Figs. 7 & 8 and Table 1. The average catch per hour of 1.086 t for 131 hours of trawling can be considered as very good performance with the limited freedom of operation due to biological sampling and fixing of stations without any consideration of fish abundance. The actual cost of the gear wil be between Rs. 70 to 75 thousand per net whereas for an imported gear it is more than double.

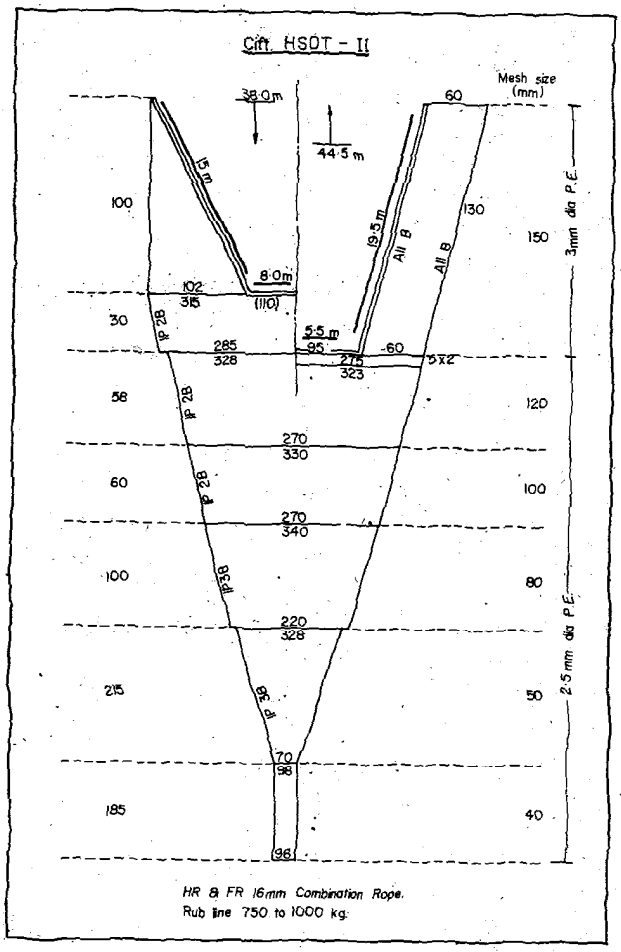

Fig. 3. Design of High Speed Demersal Trawl : Cift HSDT - II.

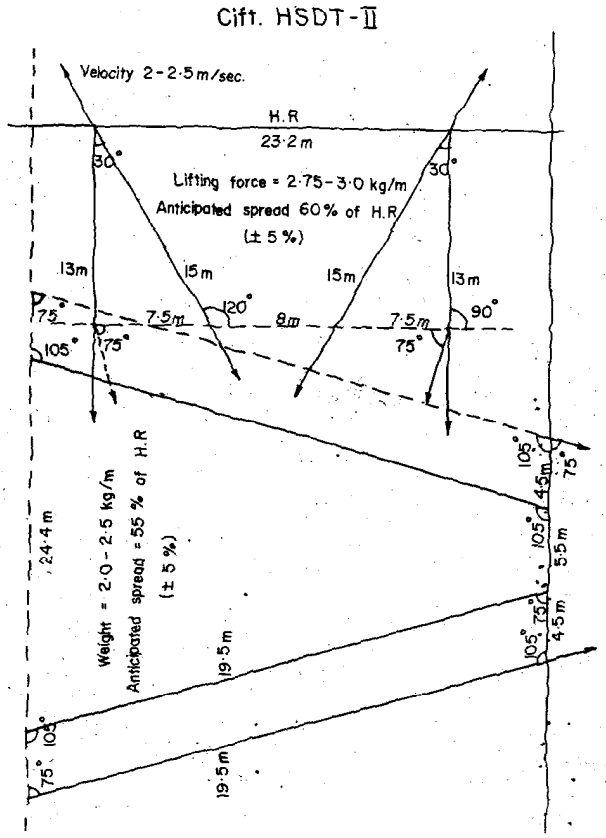

Fig. 4. Orientation of wings at the trawl mouth of Cift HSDT - II.

Cift Bobbin Trawl

Scientists responsible **: B. Meenakumari, M. R. Boopendranath & Pravin Puthran**

Earlier attempts of exploitation of the demersal resources of hard, uneven and rocky areas of Indian EEZ made by imported gear and expertise could not make any headway and most of the imported gear are lying still in the godowns of FSI, PFP and IFP either discarded or without being used. The same was the condtion of the Bobbin trawls imported along with FORV *Sagar Sampada*. However, the scientists of CIFT have designed a light bobbin trawl and rigged with imported rubber discs and bobbin spacers availiable with the erstwhile PFP as suitable bobbins were not available. The design details and foot rope assembly of Cift Bobbin Trawl are given in Figs. 9 - 12.

The gear was tested and put into operation from 15-12-1987 from FORV *Sagar Sampada* along the Wadge Bank area. The very first trial operation has landed 1 tonne of rock cod (*Epinephelus* sp.) in one hour of trawling. The second haul, again of one hour duration landed 0.75 t of rock cod and the susbsequent catches ranged between 0.2 and 0.5 t/hr. The maximum catch of 1.7 t in one hour haul was recorded on 29-5-1988 consisting of 80% of *Priacanthus* sp. It is proposed to have intensive and extensive trial fishing and pre-commercial feasibility studies after rigging the gear with bobbins of our specification imported under Danish aid along Andaman and Wadge Bank areas. The foot rope assembly of the Cift Bobbin Trawl is shown in Figs. 10 and 11.

Cift High Speed Multipurpose Hybrid Trawl for squid

Scientists responsible **: B. Meenakumari, M. R. Boopendranath, Pravin Puthran & T. M. Sivan**

The high Speed Multipurpose Hybrid Trawl for squid was originally designed for operation from 23/25 m shrimp trawlers for the exploitation of neritic squid and cuttle fish as a diversified fishing,

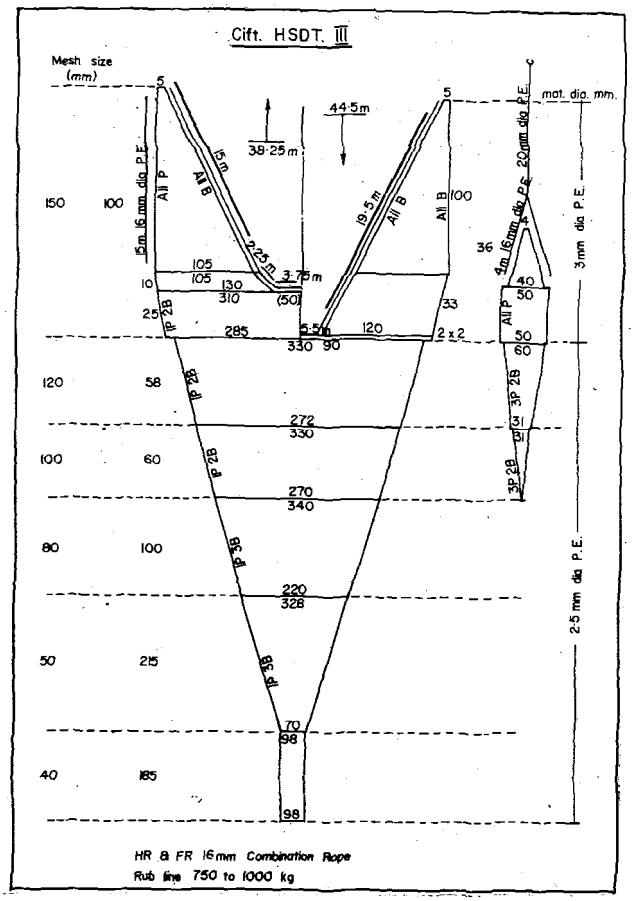

Fig. 5. Design of High Speed Demersal Trawl : Cift HSDT - III.

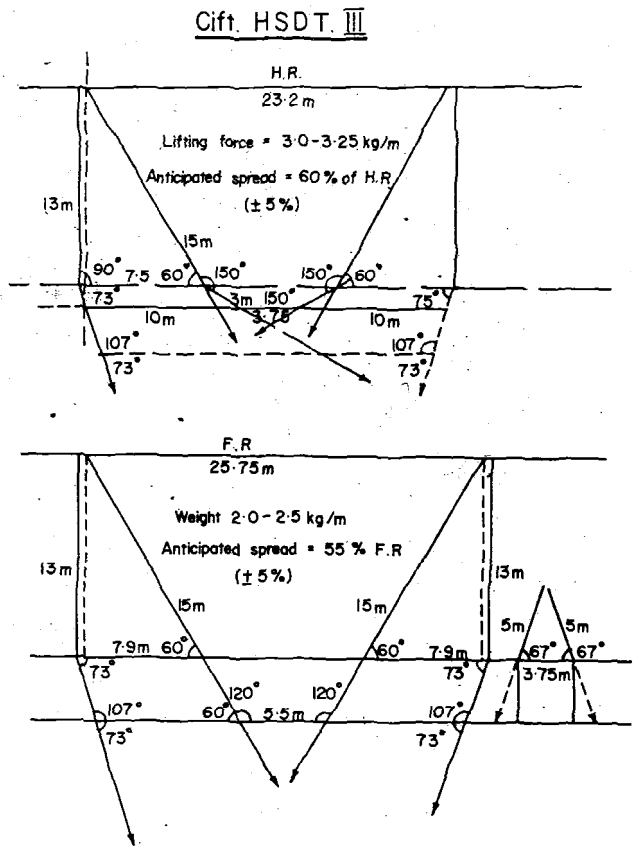

Fig. 6. Orientation of wings at the trawl mouth of Cift HSDT - III.

as demersal and pelagic/midwater trawl. The net is also suitable for operation as pair trawl and is being tested from medium class vessels at Veraval. This net was also tried from FORV *Sagar Sampada* as demersal trawl using rub line on 11-12-1987 along Wadge Bank area resulting in a catch rate of 0.25 - 0.5 t per

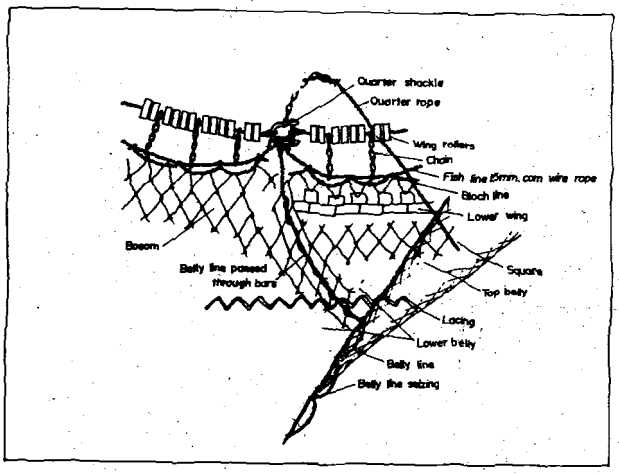

Fig. 7. Belly- line assembly of High Speed Demersal Trawls.

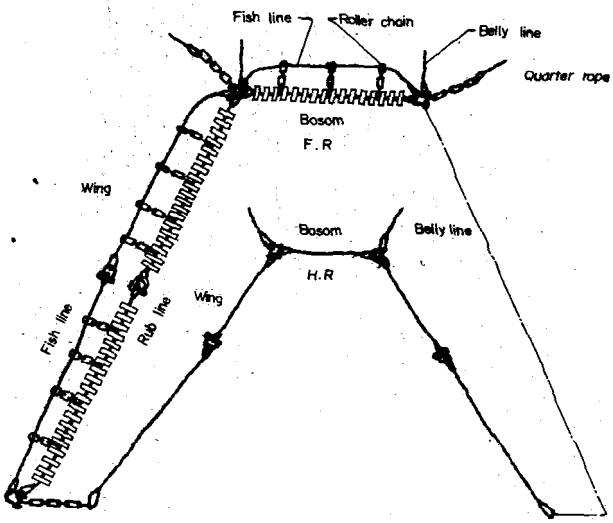

Fig. 8. Head and foot rope assembly of Cift High Speed Demersal Trawls.

TABLE 1. *Summary of fishing performance of Cift HSDT series from FORV Sagar Sampada (24-6-1986 to 19-2-1988)*

Gear	Details of fishing efforts				Details of fishing efforts utilised for biological sampling				Details of pre-commerical feasibility study				Remarks
	No. of hauls	Duration (hrs,mts)	Catch (t)	Catch per hour (t)	No. of hauls	Dura-tion (hrs,mts)	Catch (t)	Catch per hour (t)	No. of hauls	Dura-tion (hrs,mts)	Catch (t)	Catch per hour (t)	
Cift HSDT - I	57	50, 00	59.6	1.152	35	30, 00	4.57	0.119	22	20, 00	55.03	2.75	Record catch of 10 t/hr
Cift HSDT - II	40	39, 00.	24.96	0.65	23	23, 00	3.15	0.146	17	16, 00	21.80	1.36	Record catch of 4 t/hr
Cift HSDT - III	60	42, 05	57.80	1.37	39	24, 20	4.17	0.171	21	17, 40	53.36	3.03	Record catch of 12 t /hr
Total of the series	157	131, 05	142.36	1.086	97	77, 20	11.89	0.153	60	53, 40	130.19	2.426	

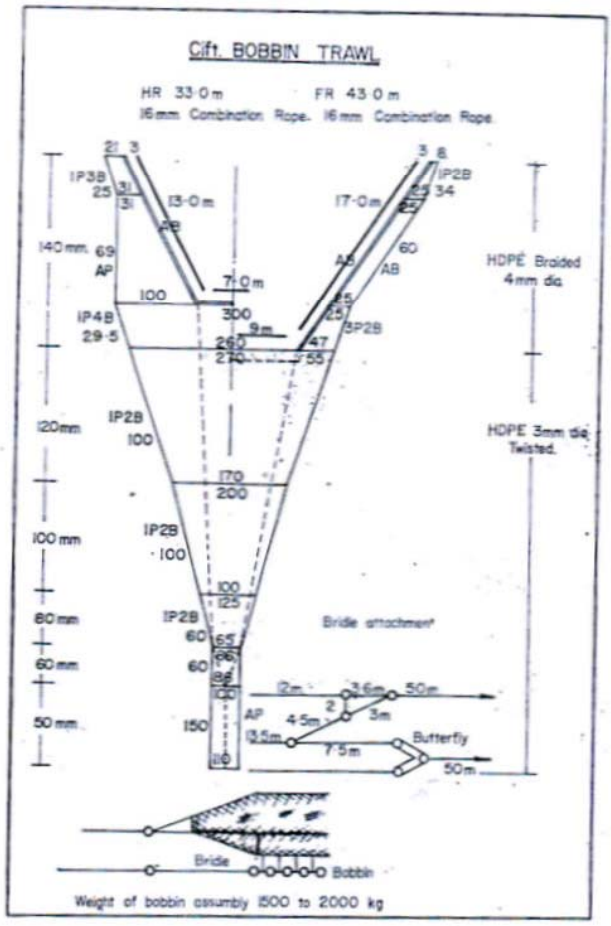

Fig. 9. Design of Cift Bobbin Trawl.

hour of rock cod and other perches. The poor catch was due to escape of fish. The design details of the modified gear is given in Fig. 13. It is proposed to operate the gear as both demersal and mid-water / pelagic trawl during day and night to study its efficiency as a squid trawl for Indian EEZ.

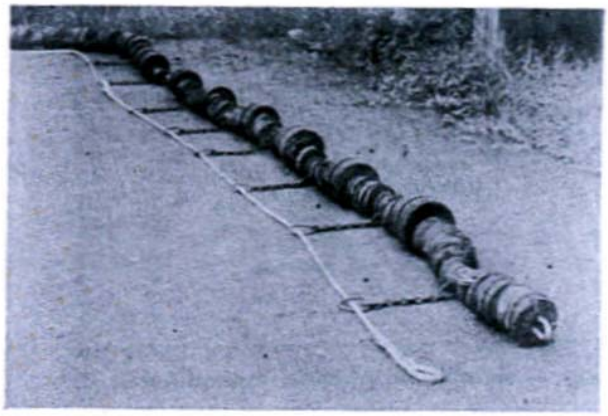

Fig. 10. Foot- rope assembly of Cift Bobbin Trawl.

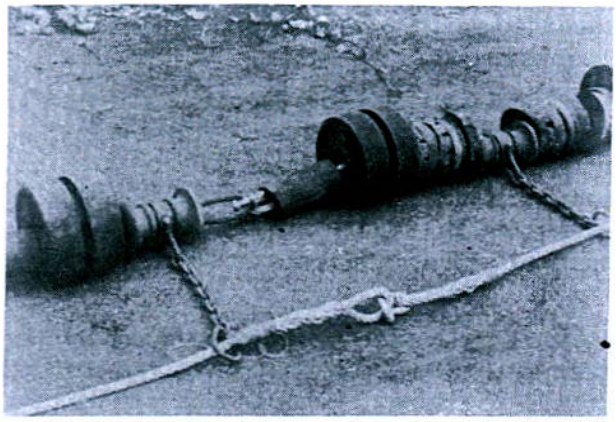

Fig. 11. Foot- rope assembly Cift Bobbin Trawl - another view.

In additon to the above, the secientists of the Institue are engaged in developing two designs of rectangular demersal trawls which are likely to be tested during the last quarter of 1989.

Constraints

The concept of sharing facilities of oceanographic or biological research vessels for fishery technology reserach comprising of harvest and post harvest technology of fish has got its own inherent design constraints. They are usually jam packed with sophisticated oceanographic and biological equipments, facilities, laboratories *etc* . without much fishing facilities, fish hold capacity, proper fish handling and processing facilities and consequently not much fit for any fishing technology work. The work schedule of such research vessels are also conflicting in the sense that everything is pre-planned, whereas for a fishery technology work, the programmes cannot be preplanned and fixing of priorities starts from survey and identification of resource. Hence most of the time is wasted, as many of the stations happen to be either non-productive or not suitable for fishing.

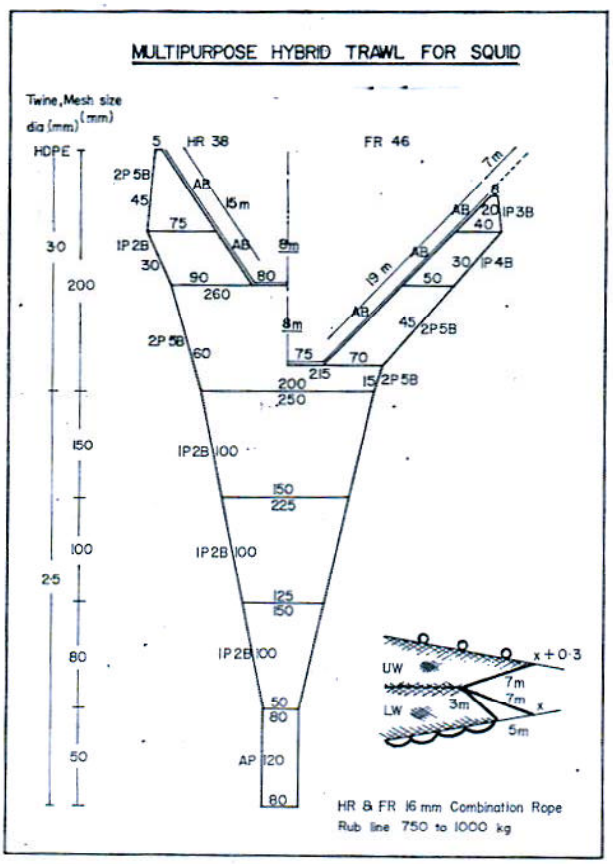

Fig. 13. Design of Cift Multipurpose Hybrid Trawl for squid fishing.

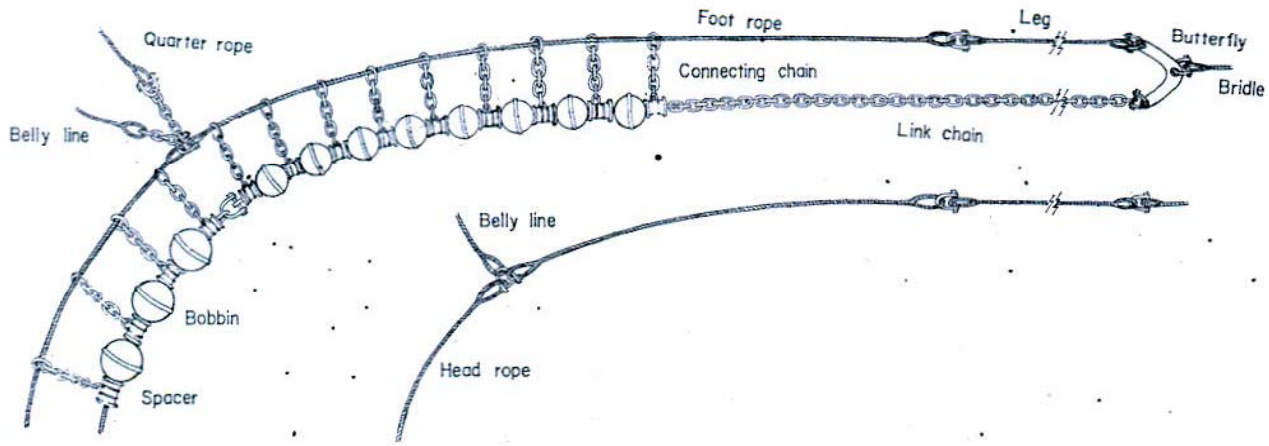

Fig. 12. Details of bobbin assembly.

As in the case of a biological or oceanographic vessel, a fishery technology vessel cannot have all the fishing techniques in one package and such a vessel will end up with overloaded compromise combinations. Hence an ideal fishery technology research vessel can be much less sophisticated than a biological or oceanographic vessel with R&D facilities for two or maximum three main fishing techniques incorporated according to priority on a commercial outfit style. Taking into consideration of our priority sector the FTRV should have facilities for trawling both pelagic and demersal combined with long lining and squid jigging with sufficient laboratory, fish handling and processing facilities and refrigeration and hold capacity.

The most important constraint that could be avoided is the customs bonding of the material. This has created problems in replenishing the fishing gear as the materials cannot be taken out from the vessel for the fabrication of the gear, which is not possible to carry out in the vessel for want of space and time. This constriant can be remedied by exempting the items required for gear fabrication from customs duty payments.

The unutilized aquarium space and sparsely used dry fish lab, if converted into processing facilities can go a long way in making FORV *Sagar Sampada* better suited for fish technology work also. The present dry fish lab could be accommodated in the sparsely-used Carbon 14 lab or in the hydrography lab.

Alternate exclusive fishing technology cruises can speed up the R&D programme on harvest and post harvest technology of fish to cope with the immediate requirement of exploitation and utilization of the deep sea fishery resources of the EEZ.

Absence of properly trained technical personnel to handle and maintain acoustic and other electronic equipments and computers have resulted in malfunctioning and even breakdown of such equipments frequently.