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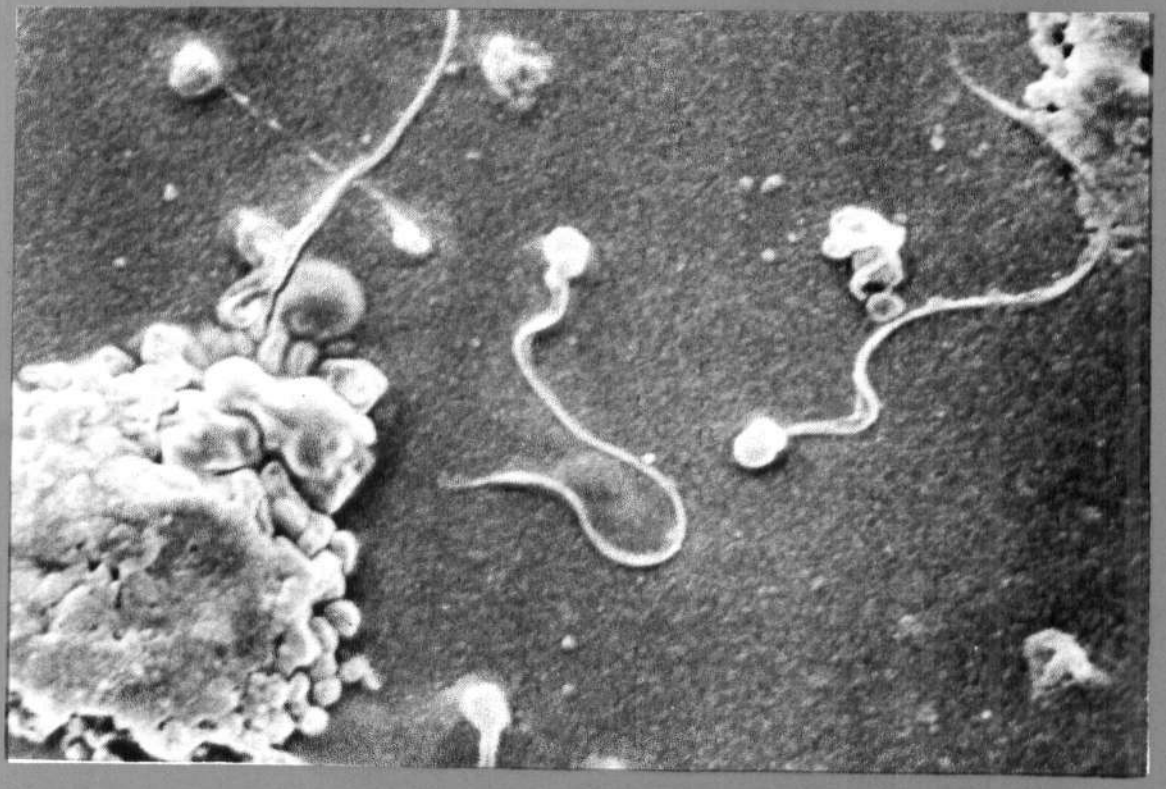

तकनीकी एवं विस्तार अंकावली
TECHNICAL AND EXTENSION SERIES

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान कोचिन, भारत
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INDIAN COUNCIL OF AGRICULTURAL RESEARCH

समुद्री मात्स्यिकी सूचना सेवा : समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

THE MARINE FISHERIES INFORMATION SERVICE : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers and transfer of technology from laboratory to field.

Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.*, No. **118** : October, November, December - 1992

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Front cover photo : Scanning Electron Micrography image of the sperms of fish *Sillago sihama* x 2500. (Scanning Electron Microscopy work was done at All India Institute of Medical Science, New Delhi with help of Prof. G. F. X. David).

मुख आवरण फोटो : सिल्लागो सिहामा मछली के बीजों का स्कानिंग करने पर मिला इलेक्ट्रोन माइक्रोस्कोपी प्रतिबिम्ब। (ऑल इंडिया इन्स्टिट्यूट ऑफ मेडिकल सयन्स, नई दिल्ली के प्रोफसर जी. एफ. एक्स. डेविड की सहायता से किया इलक्ट्रोन माइक्रोस्कोपी स्कानिंग)

Back cover photo : Scanning Electron Micrography image of congregation of sperms of fish *Liza parsia* x 2500. (Scanning Electron Microscopy work was done at All India Institute of Medical Science, New Delhi with help of Prof. G. F. X. David).

पृष्ठ आवरण फोटो : लिज़ा पार्सिया मछली के बीजों के जमाव का स्कानिंग करने पर मिला इलेक्ट्रोन माइक्रोस्कोपी प्रतिबिम्ब। (ऑल इंडिया इन्स्टिट्यूट ऑफ मेडिकल सयन्स, नई दिल्ली के प्रोफसर जी. एफ. एक्स. डेविड की सहायता से किया इलक्ट्रोन माइक्रोस्कोपी स्कानिंग)

A STEPPING-STONE IN DEVELOPING MARINE FISH GENE BANK

A. D. Diwan and A. Nandakumar

Central Marine Fisheries Research Institute, Cochin - 682 031

The use of cryopreserved sperms in the improvement of R and D programmes of aquaculture/mariculture was emphasized earlier by many workers. Later many attempts have been made on cryopreservation studies in teleost fishes particularly on salmonids and freshwater carps. In India such studies have not gained momentum particularly in fisheries sector. However, cryopreservation techniques if properly planned could be useful in the frontier lines of biotechnology to promote growth and production of animals.

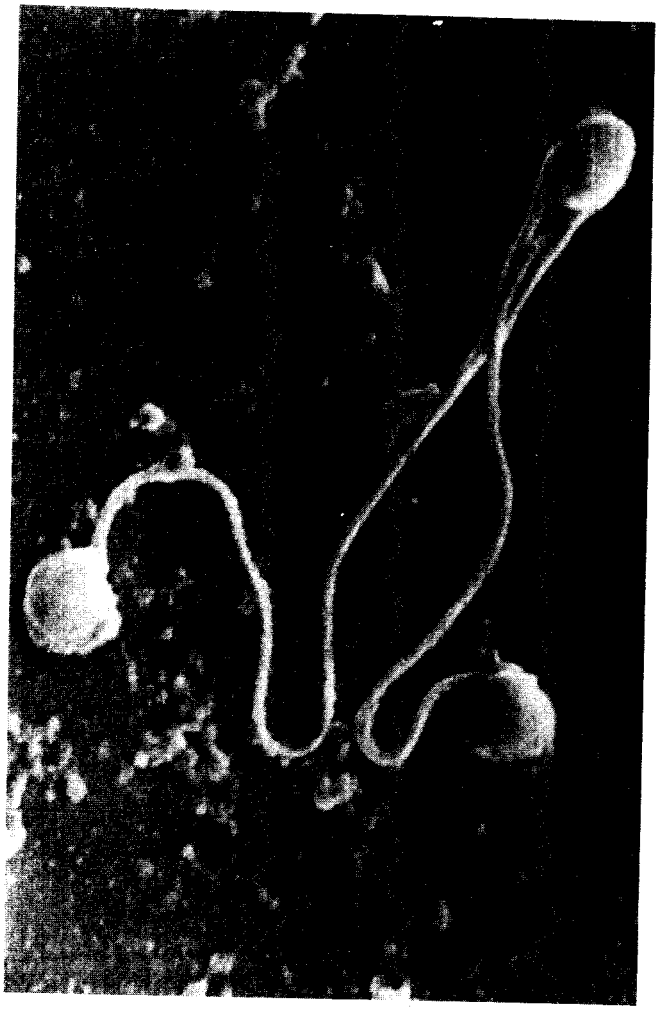

Fig. 1. Scanning electron micrography (SEM) image of the sperms of fish *L. parsia* x 5000.

(Scanning, Electron Microscopy work was done at All India Institute of Medical Science New Delhi with help of Prof: G. F. X. DAVID).

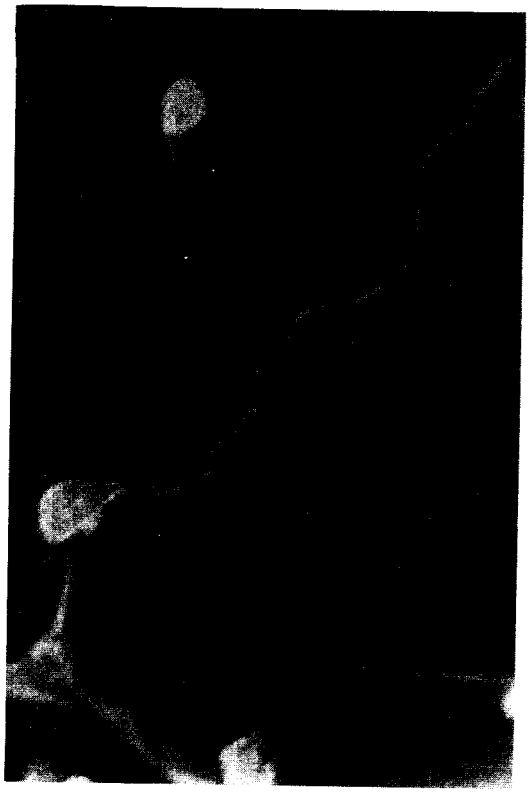

Fig. 2. SEM image of the sperms of fish *M. cephalus* x 2500.

(Scanning, Electron Microscopy work was done at All India Institute of Medical Science New Delhi with help of Prof: G. F. X. DAVID).

The history of the science of cryogenic preservation of fertile semen is not only meant for understanding the basic life secret, but also propagating living resources in long run. The developed techniques for the preservation of life and genetic properties at subfreezing temperatures have been successfully attempted in fish spermatozoa. Many remarkable advantages of such applications to animal husbandary, cattle breeding industry and in medical sciences (particularly infertility treatment) have long been demonstrated. It is a fact that the biological response to the freezing process of each indvidual type of sperms varies widely.

In our aquaculture system, for continuous fish seed production one of the major constraints is the non-availability of sufficient spawners at

TABLE 1. *Media used for cryopreservation of sperms*

* Alsever's solution (Hodgins and Ridgeway 1964)		Mixture[B]		Marine Teleost Ringer (Burton 1975)		Mixture[C]	
Sodium citrate	0.08%	NaCl	750 mg	NaCl	231 mM	NaCl	600 mg
($C_6H_5Na_3O7$)		$NaHCO_3$	200 mg	KCl	9 mM	KCl	38 mg
Dextrose	2.05%	Na_2HPO_4	53 mg	CaCl	2.2 mM	$CaCl_2H_2O$	23 mg
NaCl	0.4%	$MgSO_4.7H_2O$	23 mg	$MgCl_2$	3.7 mM	$NaHCO_3$	100 mg
Cryoprotectant	10% DMSO	KCl	38 mg	Cryoprotectants	10% DMSO 15% Glycerine	$NaHPO_4.H_2O$	41 mg
Ratio	1:1	$CaCl_2.2H_2O$	46 mg	Ratio	1:1	$MgSO_4.7H_2O$	23 mg
		Glucose	200 mg			Cryoprotectants	10% 15% Glycerine
		Glycine	500 mg			Ratio	1:1
		H_2O	100 mg				
		Cryoprotectants	10% DMSO				
		Ratio	1:1				

the desired time. In order to solve this problem, efforts are being continuously made world over to evolve suitable methods of obtaining sperms through creation of gamete banks so that through artificial fertilization one will be able to produce the seeds at any time of the year. Success in the development of technology in this area may definitely help in propagation of animals and boosting aquaculture industry in near future.

Preserving viable gametes of cultured fish is desirable as a means of making good any deficiencies of supply, as a means of enabling breeding to occur whether or not maturation of males and females coincides and as a means of establishing a reserve genetic material of known quality for selective breeding programmes. These objectives are in general realized through the storage of sperms and this problem has received most attention in recent past. The storage of ova of cultured species may assume great importance except in instances where gametes of desirable genetic makeup are to be conserved as a means of extending the breeding base. Work in this area is still in the experimental stage only.

For more than a century, scientists have investigated methods to preserve viable gametes of fish. The early studies were directed at prolonging the life of gametes in non-frozen state. Research in recent years has focused on developing cryoprotective techniques for frozen storage of viable spermatozoa. Most of the works in literature relate to fishes of salmonid group or freshwater carps and two or three reports mention about cryopreservation of mullet sperms.

Developments in the cryopreservation of fish sperms depended upon the identification and testing of suitable cryophylactic agents. Reports

TABLE 2. *Changes in some biochemical constituents of fresh and preserved milt of a marine fish* Liza parsia

Bio-chemical constituents		Fresh milt	Preserved milt at —10°C during different time duration		
			6 hrs	24 hrs	48 hrs
*	Glucose (mg %)	31.66 ± 0.904	29.83 ± 1.700	23.46 ± 1.255	18.53 ± 0.776
**	Protein (mg %)	33.80 ±10.136	-	46.25 ± 7.505	37.40± 2.044
***	Lipid (mg %)	38.83 ± 4.790	38.67± 9.404	103.44 ± 5.080	-

* Significant at 1% level between cryo-preserved and fresh.

** Significant at 10% level between 48 hrs cryo-preserved and fresh.

*** Significant at 10% level between 6 hrs cryo-preserved & fresh and 24 hrs cryo-preserved.

(Each value is the average of 4 determinations).

mentioned earlier have stated the use of glycerol as an effective medium in protecting sperm from freeze-thaw damage. Later dimethylsulfoxide (DMSO) has been found to be the most effective protective agent for cryopreserved salmonid sperms. Though extensive studies have been carried out in preserving motility of sperms, the fertilizing ability of the cryopreserved sperms was not tested for many years. The first successful fertilization of freshwater salmonid ova with cryopreserved sperm was reported by Horton and his associates in the year 1967. Later many workers have attempted and succeeded to certain extent in freshwater carps and to a less extent in marine fishes. However, lot need to be explored in this research sector.

The Central Marine Fisheries Research Institute is engaged actively for the past 3 years in cryopreservation studies. Through the extensive research efforts a breakthrough was made in evolving a viable technique for short term and long term preservation of sperm motility of fish *Liza parsia* at —10°C and —196°C temperature respectively. In both the methods, technique involved was the preservation of fresh milt collected from oozing spawner males or by stripping riped males in different diluents alongwith 10% DMSO as a cryoprotectant in different proportions (Table 1). In this methodology while preserving the sperms particularly at — 196°C in liquid nitrogen, standardisation of equilibration time was found to be a very important factor to avoid the effect of temperature shock while effecting sudden cooling on, sperm motility. By using this method, sperm motility could be preserved with greater success and now the motile sperms are available in cryopreserved state in the Institute's laboratory. Among the various diluents tested 15% glycerine alongwith 10% DMSO was found to be the best medium as it could preserve more than 80% motility of the sperms. However, some loss in motility which is likely to occur during equilibration time while preservation could not be prevented.

In short term preservation at —10°C temperature, motility of the sperms could be maintained successfully upto 3 days. To find out the causative factors for some loss of motility of sperms during this 3 days preservation time, investigation was probed to look into some of the biochemical and mineral content of milt. In doing so, some of important energy constitutents like glucose, protein and lipid were analysed in freshly stripped milt and milt preserved for 6, 24 and 48 hrs at —10°C temperature. It was noticed that the glucose and protein content reduced drastically in preserved milt of 24 and 48 hrs whereas lipid content increased significantly (Table 2). Analysis of micro-environment of milt where certain essential ions like Na^+ and K^+ required for motility has been also done. Significant loss in the levels of Na^+ and K^+ ions was noticed in the preserved milt of 24 hrs and beyond (Table 3). The loss of organic constitutents and ions when restored in the preservation media has been found useful in extending the motility of the sperms for longer time at —10°C temperature. The study shows that the motility of the sperms gets affected by some of these factors.

TABLE 3. *Changes in Na^+ and K^+ content in fresh and cryopreserved milt of* Liza parsia

	Fresh milt	Cryopreserved milt of 24 hrs at -10°C
Na^+ (mEq/l)	124.3± 5.4	54.37 ± 4.05
K^+ (mEq/l)	164.4± 7.6	41.56 ± 3.15

Each value is the average of 3 determinations.

The sperms count in *L. parsia* showed an average 9 billion sperms/fish.

Similar studies on preservation of sperms of other marine fishes like *Sillago sihama, Mugil cephalus* and *Gerrus* sp. are being continued. Several samples of fishes were examined to assess the sperm motility. Successful sperm preservation tests were carried out in *Sillago* and *Mugil.*

The sperm morphology of the three different fishes was also investigated through scanning electron microscopy. The studies revealed that morphological features of the sperms of all the three fishes namely *L. parsia,* (Fig. 1) *M. cephalus* (Fig. 2) and *S. sihama* (Front Cover Photo) look similar. The sperms show distinct knob-like head with a long undulated tail. Acrosome formation (cap like structure) is found to be absent here unlike in mammalian sperms. Efforts are also being made to study the viability of the preserved sperms by fertilizing them with the riped ova of spawner female. Further studies are in progress.

COSTS AND EARNINGS OF TRAWL OPERATIONS ALONG NAGAPATTINAM COAST OF TAMIL NADU

R. Sathiadhas, K. K. P. Panikkar and A. Kanakkan

Central Marine Fisheries Research Institute, Cochin - 682 031

Introduction

Marine fisheries sector of India has undergone a rapid change during the last three decades. The introduction of synthetic nets coupled with high export demand for shrimps has intensified mechanised fishing along our coastal waters. The lucrative external market for shrimp and constant rise in the mechanised trawl fishing fleets not only enhanced the marine fish production of our country but also showed the way for the growth of an organised sea food export industry and increase in employment opportunities in the subsidiary sector. There are at present about 2500 trawlers operating along Tamil Nadu coast and 50 per cent of the total marine fish catch of the state is accounted by them. The coastline of the State runs to about 1000 km with 352 landing centres having facilities to land mechanised boats at 23 centres. Pudumanikuppam, Cuddalore, Nagapattinam, Mandapam, Rameswaram and Tuticorin are the major trawl landing centres of the State. With declining catch rates in recent years in bottom trawling, the diversification of fishing by introducing high opening trawl and fish trawl was observed along this region. A detailed evaluation of the changing pattern of craft-gear combinations, their catch composition and comparative economics of operations are considered highly useful for formulating management policies for marine fisheries. In this context, a study was undertaken at Nagapattinam centre of Tamil Nadu coast where the operation of ordinary trawlers and pair trawlers is common.

Both primary and secondary data have been collected and used for the study. The available data on mechanised and non-mechanised fish landings, crafts and gears and other basic information relating to major mechanised centres of Tamil Nadu have been collected from the NMLRDC of CMFRI. An overall review of production trend of marine fisheries over the years along Tamil Nadu coast has been attempted. The review revealed that Nagapattinam in Tanjavoor District is one of the major centres in Tamil Nadu coast practising both ordinary and pair trawling and hence purposely selected for detailed study.

Two types of schedules were prepared to collect data. Information pertaining to initial capital investment on hull, engine, nets and other accessories, year of purchase, resale value of the unit, source of finance, sharing pattern of crew wages, annual repairing expenses and other details of boat characteristics were collected in schedule I. Data on the daily operational cost, specieswise catch and revenue were collected from the selected 10 sample units each of trawlers and pair trawlers for ten days in each month during October 1987 to September 1988.

Most of the boats under operation at the time of investigation were old and had undergone lot of repairs and replacements over the years which sometimes increased the resale value of the boat. Hence for computation of capital investment, resale value of the boat at the time of observation has been considered for the present study. However, an attempt has been made to work out the projected cost and earnings of a new trawler and pair trawler during 1990-'91.

With regard to fishing wages, the usual sharing practice is followed in Nagapattinam in which 40 per cent of net income (gross income-operational expenses excluding repair charges) is divided equally among crew members. Depreciation of hull, engine and gears worked out on the basis of the life expectancy of 10 years for crafts and 2 years for gears and one year for accessories. The interest for initial investment was worked out at 15 per cent per annum.

Review of production trend

The mechanised fish landings of Tamil Nadu showed a steady upward trend over the last few years. The landings from mechanised and non-mechanised boats and their percentage of the total marine fish landings of the State during the 15 year period 1976 to 1990 are given in Table 1.

TABLE 1. *Marine fish landings by mechanised and non-mechanised boats in Tamil Nadu (1976-1990)*

Year	Fish landings (tonnes)		Total
	Mechanised units	Non-mechanised units	
1976	63,621 (28)	162,457 (72)	226,078
1977	50,359 (24)	155,687 (76)	206,046
1978	81,495 (38)	131,404 (62)	212,899
1979	101,758 (43)	133,250 (57)	235,008
1980	94,131 (43)	123,263 (57)	217,394
1981	106,664 (48)	114,632 (52)	221,296
1982	127,542 (52)	118,419 (48)	245,961
1983	146,225 (52)	134,514 (48)	280,739
1984	116,190 (46)	135,930 (54)	252,120
1985	95,549 (48)	105,002 (52)	200,551
1986	117,898 (49)	124,143 (51)	242,041
1987	173,747 (57)	129,886 (43)	303,633
1988	168,564 (57)	127,100 (43)	295,664
1989	164,481 (58)	116,819 (42)	281,300
1990	187,765 (62)	115,510 (38)	303,275

Figures in paranthesis denote percentages.

Marine fish landings of Tamil Nadu increased from 2.26 lakh tonnes in 1976 to 3.03 lakh tonnes in 1990. The mechanised landings with about 28 per cent of the total landings during 1976 increased to 62 per cent during 1990. The landings by trawlers alone accounted for about 90 per cent of the mechanised catch. The remaining was mostly contributed by motorised country craft. The intensive introduction of mechanised trawlers during the seventies and increased tempo of the same during the early eighties were highly responsible for the rise in production contributing about 50 per cent of the total marine fish landings of the state.

The catch rates of the traditional fishing units declined drastically during the last 15 years. Many traditional fishermen felt that their returns were affected by the intensive fishing operations of mechanised units in the inshore waters. The damaging of the nets of traditional fishermen in the sea by mechanised fishing fleets was also a general complaint. In some of the fishing centres conflict between mechanised and non- mechanised fishermen was also noticed demanding some sort of regulation over the area of fishing operation.

Trawlers versus pair trawlers

Four types of trawlnets are operated by mechanised boats along Nagapattinam coast. They are known as shrimp trawl, fish trawl, single boat high opening trawl and two boat high opening trawl or pair trawl. The size of an ordinary trawlnet is usually 22 metre in length and 7 metre in breadth with mesh size ranging from 10 to 40 mm. The fish trawl which is known as *mixturemadi* or *ropemadi* in some other regions of Tamil Nadu is 25 metre in length and 8 metre in breadth with mesh size ranging from 10 to 80 mm. The single boat high opening trawl with 36 metre length and 12 metre breadth and pair trawl with 40 metre length and 15 metre breadth and mesh size ranging from 40 to 200 mm are also under operation in this region.

The continuous escalation of capital investment on fishing equipments, coupled with rising operational costs and decline in catch rates for trawlers created a dire need to diversify existing fishing methods and to redeploy some of the inshore trawlers to catch under-exploited fin fishes. This led to the introduction of single and two boat high opening trawlnets along Tamil Nadu coast for the operation of mechanised fishing boats. The two boat high-opening trawls or pair trawling enabled substantial catch of commercially important high priced varieties of pomfrets, perches, caranx and cat fish, apart from silverbellies and sciaenids. The extensive migration of boats in search of shrimps to other centres has been drastically reduced due to the introduction of pair trawling. The basic differences between traditional trawls and pair trawls are explained by various authors. The vertical mouth opening of high-opening trawl is about 3 metres and above, compared to the opening of less than a metre in traditional trawls. Because of the larger mesh size of these nets, the friction caused by the nets is much less than the conventional trawls enabling an increase in trawling speed and catch rate. The success of

pair trawling is also due to the higher distance between the boats and the gear. The boats do not pass directly over the path of the nets and thus do not disturb the fishes in shallow waters with the noise generated from engine and propulsion.

Capital investment

The average capital investment per unit works out at Rs. 1.35 lakhs for trawlers and Rs. 3.15 lakhs for pair trawlers operating from Nagapattinam centre during 1987-'88 (Table 2). Most of the boats are 32 footers and the average investment of hull alone works out at Rs. 65,000 for the unit engaged in bottom trawling and Rs. 1.5 lakhs for the two boats unit engaged in pair trawling. The average cost for engine varies from Rs. 55,000 for trawlers to 1.3 lakhs for pair trawlers. However, the investment required for the purchase of new units increased more than two fold during the current year.

TABLE 2. *Average initial investment (Rs.)of trawlers and pair trawlers (1987-'88)*

	Item	Trawlers	Pair trawlers
1.	**Craft**		
	i) Hull	65,000	1,50,000
	ii) Engine	55,000	1,30,000
2.	**Gear**		
	i) Shrimp trawl	5,000	—
	ii) Fish trawl	5,000	5,000
	iii) Pair trawl	—	20,000
3.	**Other accessories**	5,000	10,000
	Total	1,35,000	3,15,000

Fishing trips

Boats doing bottom trawling leave the shore in early morning engaging themsevles in day-fishing and arrive in the afternoon whereas the pair-trawlers leave either early morning or late evening and engage in day and night fishing before their arrival to the shore. Hence, fishing trip of a trawler consists of a day alone while that of pair trawlers about two days. The average annual fishing trip of a trawler came about 240 and that of a pair trawler 101 at Nagapattinam during 1987-'88 (Table 3). The conversion of trawlers into pair trawlers and vice versa is very often noticed here depending upon the seasonal availability of prawns and quality fishes.

For trawlers, the maximum number of 67 fishing trips each were observed during January-March and April-June quarters and minimum of 43 trips during July-September. The pair trawlers operated 35 trips during July-September and only 12 trips during April-June. Since the catch rates of prawns and gross returns per trip were higher for trawlers during January-June period, many boats engaged in pair trawling also shifted to usual trawling in these six months. But it was noticed that the returns per trip of pair trawlers were very high during July-September period and many trawlers shifted to this type of fishing.

TABLE 3. *Average fishing trips for trawlers and pair trawlers (1987 October-September 1988)*

Quarter	Average annual fishing trips per unit	
	Trawlers	Pair trawlers
Oct.-Dec.	63	30
Jan.-March	67	24
April-June	67	12
July-Sept.	43	35
Annual	240	101

The employment generated in active fishing alone by trawlers and pair trawlers works out at 1440 and 2424 man days per annum respectively.

Fixed cost

The fixed cost consists of the depreciation of fishing equipments which depends on its life expectancy, the interest for initial investment, insurance and any other costs which are incurred even if there is no operation. Interest for the invested capital is worked out at the rate of 15 per cent per annum. The computed average fixed cost for trawlers and pair trawlers during October 1987 to September '88 is given in Table 4.

The average annual depreciation is worked out at Rs. 22,000 for trawlers and Rs. 50,500 for pair trawlers. The annual interest for initial investment comes about Rs. 20,250 for trawlers and Rs. 47,250 for pair trawlers. Thus, the annual average fixed cost of trawler worked out at Rs. 42,250 and pair trawlers Rs. 97,750.

Variable cost

Variable cost is defined as all those costs which are incurred only when the units are under operation and liable to vary with every fishing operation of units. Fuel expenditure, wages for

TABLE 4. *Average annual fixed cost for trawlers and pair trawlers (1987-'88)*

Item	Average fixed cost			
	Trawlers (Rs.)		Pair trawlers (Rs.)	
	Annual	Per trip	Annual	Per trip
1. **Depreciation**				
Hull @ 10%	6,500	27	15,000	148
Engine @ 10%	5,500	23	13,000	129
Net @ 50%	5,000	21	21,500	124
Other accessories @ 100%	5,000	21	10,000	99
Sub total	22,000	92	50,500	500
2. **Interest on initial investment @ 15%**	20,250	84	47,250	468
Total	42,250	176	97,750	968

fishing labour, repair and maintenance and auction charges are some of the important items of operating expenditure or variable costs of fishing units. The average variable cost (AVC) for a trawler and pair trawler for the period October 1987 to September1988 is worked out and given in Table 5.

TABLE 5. *Average variable cost of a trawler and pair trawler (1987-'88)*

Item	Variable cost			
	Trawlers (Rs.)		Pair trawlers (Rs.)	
	Annual	Per trip	Annual	Per trip
1. Wages to crew	81,260	339	169,583	1,679
2. Food and bata	34,800	145	64,000	634
3. Fuel	91,050	379	168,044	1,664
4. Repair & maintenance	10,000	42	20,134	199
5. Auction charges	5,700	24	6,200	61
6. Ice	1,750	7	9,772	97
7. Other expenses	10,800	45	7,050	70
Total	235,360	981	444,783	4,404

The AVC per unit per annum comes to about Rs. 2,35,360 for trawlers and Rs. 4,44,783 for pair trawlers. Fuel expenditure and wages for fishing labour are the major items constituting about 73 per cent of the AVC of trawlers and 75 per cent of pair trawlers. Along the Nagapattinam coast of Tamil Nadu, sharing of the catch is the prevailing system of payment of wages for fishing labour. Both for trawlers and pair trawlers, 40 per cent of the value of catch after deducting all operating costs except repair and maintenance is paid as wages to the crew. Wages constitute about 34.5% of the operating cost of trawler and 38% that of the pair trawler. The daily bata contributes 4 to 15% of the operating cost of trawler and 14% that of pair trawler.

Season-wise catch and revenue

The catch and revenue of fishing units in capture fisheries are highly influenced by the seasonal availability of different species of fish and the prevailing price structure at the landing centre. Hence the season-wise average catch and revenue of trawlers and pair trawlers are worked out and given in Table 6 and 7.

Maximum prawn catches for trawlers are observed during January-March and for pair trawlers during October-December. The availability of lobster, ribbon fish and carangids are restricted to specific seasons both for trawlers and pair trawlers. The shrimps contribute maximum revenue for all seasons to trawlers whereas pomfret are the prime contributing to pair trawlers. Silver-bellies catch is comparatively more during October-December both for trawlers and pair trawlers. The average price realised for prawns vary from Rs. 10.73 per kg during October-December to 26.6 per kg during July-September for trawl catches and from Rs. 19.40 per kg during January-March to 23.2 per kg during April-June for pair trawl catches. Such variations are mainly due to variations in size and catch composition.

For trawlers, in terms of quantity, silverbellies dominate both the quarters of July-September and October-December, clupedis during April-June and prawns during January-March and in terms of revenue prawns earn maximum in all the quarters. But for pair trawlers in terms of quantity, silverbellies dominate during October-December croakers in January-March, April-June and rays during July-September with maximum revenue from pomfrets in all seasons.

The average annual catch of a trawler works out at 94.7 tonnes valued at Rs. 3.46 lakhs and for a pair trawler 157.8 tonnes realising Rs. 6.79 lakhs.

The catch and revenue per trip of pair trawlers are much higher than the ordinary trawlers (Table 8). The average catch per trip of trawlers works out at 394 kg as against 1562 kg for pair trawlers. The revenue earned per trip is found to be Rs. 1,443/- for trawlers and Rs. 6,724/- for pair trawlers. The silverbellies, prawns, clupeids and croakers form the major

TABLE 6. *Seasonwise average catch and revenue of a trawler at Nagapattinam*

	Oct.-Dec.		Jan.-March		April-June		July-Sept.		Annual	
	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)
Prawns	4,032	43,281	6,298	83,683	1,474	28,542	602	16,039	12,406	171,545
Lobster	63	1,512	67	938	—	—	—	—	130	2,450
Cuttle fish	63	1,323	67	1,407	201	3,082	86	1,376	417	7,188
Rays	3,654	7,875	1,005	3,015	2,345	5,226	1,806	3,870	8,810	19,986
Croakers	2,142	2,961	3,618	5,561	4,020	7,437	1,892	3,268	11,672	19,227
Ribbon fish	—	—	2,680	2,680	—	—	—	—	2,680	2,680
Carangid	693	1,638	—	—	1,139	2,278	2,795	4,773	4,627	8,689
Clupeids	2,457	3,024	1,474	2,010	7,236	20,234	1,548	2,666	12,715	27,934
Silverbellies	7,056	8,064	4,489	4,556	5,829	10,720	4,300	6,579	21,674	29,919
Pomfret	126	2,142	268	4,690	268	5,226	215	3,612	877	15,670
Other perches	1,008	2,583	335	737	1,139	2,814	301	731	2,783	6,865
Threadfin breams	2,898	9,198	938	2,278	2,680	7,303	1,075	2,666	7,591	21,445
Others	1,323	2,709	402	134	4,556	5,293	2,021	4,515	8,302	12,651
Total	25,515	86,310	21,641	111,689	30,887	98,155	16,641	50,095	94,684	346,249

TABLE 7. *Seasonwise average catch and revenue of a pair-trawler at Nagapattinam*

Name of fish	Oct.-Dec.		Jan.-March		April-June		July-Sept.		Annual	
	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)	Catch (kg)	Revenue (Rs.)
Prawns	1,800	41,040	480	9,312	360	8,376	910	18,970	3,550	77,698
Lobster	60	1,800	96	2,256	—	—	—	—	156	4,056
Cuttle fish	120	2,340	96	1,344	72	816	140	1,890	428	6,390
Rays	10,260	21,120	1,872	5,904	984	2,160	20,790	42,000	33,906	71,184
Croakers	9,840	10,620	14,448	23,328	1,608	2,568	5,110	8,050	31,006	44,566
Ribbon fish	—	—	1,824	1,824	96	96	—	—	1,920	1,920
Carangid	3,420	7,140	—	—	744	1,200	2,450	5,250	6,614	13,590
Clupeids	6,300	6,540	4,176	5,328	1,248	1,752	1,820	3,010	13,544	16,630
Silverbellies	13,560	12,000	9,072	9,024	1,992	2,016	7,500	8,050	32,184	31,090
Pomfret	3,240	45,180	11,088	229,968	1,416	30,624	4,410	74,900	20,154	380,672
Other perches	540	1,800	720	1,968	960	1,344	140	420	2,360	5,532
Threadfin breams	2,040	5,760	960	2,208	1,008	2,112	2,730	5,390	6,738	15,470
Others	2,400	5,640	768	768	552	528	1,470	3,290	5,190	10,226
Total	53,590	160,980	45,600	293,232	11,040	5,3592	47,530	171,220	157,750	679,024

catch of trawlers as against rays, silverbellies, croakers and pomfrets in pair trawlers. About 50% of gross revenue is earned by prawns in trawlers and by pomfrets in pair trawlers. Substantial revenue is earned by silverbellies, clupeids and threadfin breams in trawlers and by prawns, rays, croakers and silverbellies in pair trawlers.

Contribution of shrimps

Several studies over the last few years have indicated that there is a gradual decrease in the average size of prawns in the commercial landing along the Indian coast coupled with reduced catch rates. There are reports that the littoral prawn stock all along the Indian coast are being

TABLE 8. *Average catch (Kg) and revenue (Rs.) per trip of a trawler and pair trawler at Nagapattinam (Oct. 1987 to Sept. 1988)*

Name of fish	Trawler		Pair trawler	
	Catch	Revenue	Catch	Revenue
Prawns	51	715	34	770
Lobster	1	20	2	40
Cuttle fish	2	30	4	64
Rays	37	83	336	704
Croakers	49	80	304	442
Ribbon fish	11	11	20	20
Carangids	19	36	66	134
Clupeids	51	117	136	164
Silverbellies	90	125	318	308
Pomfret	4	65	200	3,768
Other perches	12	29	24	54
Threadfin breams	32	89	66	154
Others	35	43	52	102
Total	394	1,443	1,562	6,724

fished intensively and there is practically no scope for increasing the fishing effort any further. The continuous induction of small mechanised trawlers into the coastal fishery had led to diminishing CPUE and also conflict with the artisanal fisheries sector. The species composition of shrimp catches with revenue realised for trawlers and pair trawlers along Nagapattinam coast is given in Table 9.

M. dobsoni and *M. stridulans* dominate in the shrimp catches of ordinary trawlers whereas *M. stridulans* and *P. semisulcatus* in pair trawlers. About 84% of revenue realised by shrimp was from *P. semisulcatus* in pair trawlers. But in ordinary trawlers 37% was from *M. dobsoni* followed with 33% by *P. semisulcatus*. Seasonal occurance of *P. hardwickii*, *P. indicus*, *M. brevicornis* and *M. affinis* in trawlers and *M. monoceros* in pair trawlers are also observed. The average shrimp catch per trip during the year works out at 51 kg for trawlers and 34 kg for pair trawlers realising Rs. 715 and Rs. 770 respectively. However, the catch of *P. semisulcatus* which fetch comparatively higher price are more in pair trawlers than the ordinary trawlers.

Productivity, profitability and economic efficiency

Various economic efficiency measures have been worked out for trawlers and pair trawlers operating at Nagapattinam on the basis of costs and earnings data and are given in Table 10.

Both trawlers and pair trawlers are found to be highly efficient in terms of productivity and profitability. The average catch per trip of a trawler is 394 kg and a pair trawler 1434 kg. Although the catch per trip of a pair trawler is about 3.5 times higher than that of ordinary trawler, the annual catch of the former is 95 tonnes as against 158 tonnes of the latter. The cost of production per kg of fish by trawlers worked out at Rs. 2.93 and for pair trawlers Rs. 3.44 and the price realised per kg being Rs. 3.66

TABLE 9. *Contribution of shrimps (Kg) in catch and revenue (Rs.)*

Name of species	Trawlers				Pair trawlers			
	Annual		Per trip		Annual		Per trip	
	Catch	Revenue	Catch	Revenue	Catch	Revenue	Catch	Revenue
P. semisulcatus	547	56,604	2	235	654	65,242	6	646
M. stridulans	4,022	15,555	17	65	2,740	9,624	26	96
P. hardwickii	315	4,032	1	17	—	—	—	—
P. indicus	244	18,482	1	77	—	—	—	—
M. dobsoni	6,746	63,797	28	266	—	—	—	—
M. brevicornis	264	9,263	1	39	—	—	—	—
M. affinis	268	3,752	1	16	—	—	—	—
M. monoceros	—	—	—	—	156	2,832	2	28
Total	12,406	171,545	51	715	3,550	77,698	34	770

and Rs. 4.30 respectively. The fuel cost per kg of fish production is 96 paise for trawlers and Rs. 1.07 for pair trawlers. The fish catch per litre of fuel is 3.82 kg for trawlers and 3.56 kg for pair trawlers.

Net operating income is obtained by subtracting operating costs from gross income. This is the major factor in decision making in day to day operations of marine fishing involving heavy risk and uncertainity. Any unit will continue to work even during lean season as long as it could cover the operational expenses. The annual operating income worked out at Rs. 1,10,889 for a trawler and Rs. 2,34, 241 for a pair trawler, the same per day of operation being Rs. 462 for the former and Rs. 1,065 for the latter. The net profit (deducting fixed cost from operating income) for trawlers worked out at Rs. 68,639 and for pair trawlers Rs. 1,36, 491 per annum which is Rs. 286 and Rs. 620 per day of operation.

The annual rate of returns to capital (ratio between the surplus over all costs except opportunity cost of capital and the initial investment) worked out at 66 per cent for trawlers and 58 per cent for pair trawlers. Capital turn over ratio which indicates the rate at which income is generated for each rupee invested, is found to be Rs. 2.56 for trawlers and 2.16 for pair trawlers. The pay back period of the investment is found to be 1.5 years for trawlers and 1.7 years for pair trawlers.

Labour efficiency is often measured by dividing total output by units of labour engaged. It may be seen that the average production per man day is 65.7 kg in trawlers and 65 kg in pair trawlers fetching Rs. 241 and Rs. 280 respectiively. The wages of a crew per man day worked out at Rs. 81 in trawlers and Rs. 96 in pair trawlers. The labour cost per kg of fish catch worked out at Rs. 1.2 in the former and Rs. 1.48 in the latter. Considering all the economic efficiency parameters, both the trawlers and pair trawlers operating along Nagapattinam coast shows encouraging results. However, the optimum production and maximum profit are obtained by shifting the appropriate technique either of bottom trawling or pair trawling depending upon the seasonal availability of prawns and pelagic quality fishes. No doubt the diversification of trawl fishing along this region has helped to increase economic efficiency of mechanised fishing boats.

TABLE 10. *Key indicators of economic efficiency*

Item	Trawlers	Pair trawlers
1. Annual operating income (Rs.) (gross earnings - operating expenses)	110,889	234,241
2. Annual net profit (Rs.) (operating income - fixed cost)	68,639	136,491
3. Rate of returns to capital (%)	66	58
4. Capital turnover ratio (%)	256	216
5. Pay back period (years)	1.5	1.7
6. Average catch per trip (kg)	394	1,562
7. Gross revenue per trip (Rs.)	1442	6,723
8. Break even price (Rs./kg)	2.93	3.44
9. Break even price to cover operating expenses (Rs./kg)	2.49	2.82
10. Price realised per kg of fish (Rs.)	3.66	4.30
11. Net operating income per day (Rs.)	462	1,160
12. Net Profit per day of operation (Rs.)	286	676
13. Number of crew required per operation	6	12
14. Average production per man day (kg)	65.7	65
15. Value of production per man day (Rs.)	240.5	279.5
16. Average wages and bata per man day (Rs.)	80.6	96.4
17. Labour cost per kg of fish (Rs.)	1.2	1.48
18. Fuel cost per kg of fish (Rs.)	0.96	1.07
19. Fish catch per litre of fuel (kg)	3.82	3.56

Economic viability of new units (1990-'91)

The continuous cost escalation of fishing units has pushed up the initial investment of a new trawler to about Rs. 3 lakhs and a pair trawler to Rs. 6.2 lakhs during 1990-'91. The ever spiraling fuel prices further escalated the operational expenses of these units. However, about 25 per cent overall average increase in fish prices at the landing centre had been observed during 1990-'91 over that of 1987-'88. The species composition and catch rate of fishing boats are liable for wide fluctuations. However, a follow up study along Nagapattinam coast during 1990-'91 reveals that there is not much variation in the average catch and species composition of trawlers and pair trawlers. Assuming the new units, with higher investment levels, have the same catch rate the investment turn over ratio has been worked out and given below.

TABLE 11. *Investment - turnover ratio of new fishing units at Nagapattinam, Tamil Nadu*

Sl. No.	Item	Trawlers	Pair trawlers
1	Initial investment (Rs)	3,00,000	6,20,000
2	Annual catch (tonnes)	94.7	157.8
3	Average landing centre price (Rs/kg)	4.6	5.4
4	Gross earnings (Rs)	4,35, 625	8,52,120
5	Capital-turnover ratio (%)	145	137

The capital-turn over ratio of new units indicates that this ratio is less than that of the old boats operating during 1987- '88. These units with higher investment are still economically viable. This is mainly due to the increasing trend of fish prices in the internal markets. Since the trawl catches highly dpend upon the external market for better price, it is expected that the recent devaluation of Indian currency will further boost the price of exportable varieties and gross revenue of these units making the investment on trawlers more viable and profitable.

Conclusion

The contribution of mechanised boats in the total marine fish landings of Tamil Nadu steadily increased over the last fifteen years from about 28 per cent in 1976 to 62 per cent in 1990. The trawl catch forms more than 90 per cent of the mechanised landings and 50% of the total landings of the state. However, the induction of more and more trawlers in search of shrimps led to declining catch rates in the inshore waters. The cost escalation of capital investment for trawlers and continuous increase in its fuel expenditure enhanced the cost of production and reduced the fishing surplus. The introduction of single and two boats high opening trawlnets not only served as diversification of the existing bottom trawling but also directed to redeploy many units to catch commercially important fin fishes depending upon the seasonal abundance. The over dependance of prawn catches for the survival of trawlers has been considerably reduced. The study indicates that pomfrets contributed to more than 50 per cent of the revenue of pair trawlers and prawns about 50 per cent of the revenue of trawlers. The pair trawling further provided a new technique to fishermen of this region to harvest the hitherto underexploited valuable resources like pomfrets, rays, croakers, clupeids, carangids and perches in substantial quantity.

The study indicates that both types of fishing are economically efficient. The average initial investment of a trawler worked out at Rs. 1.3 lakhs. The average annual cost of this unit comes to about Rs. 2,77, 610 comprising fixed cost of Rs. 42,250 and variable cost of Rs. 2,35,610. Gross earning of trawlers worked out at Rs. 3,46,249 per annum yielding a net profit of Rs. 68,639. Average initial-investment of pair-trawling unit comes to about Rs. 3.15 lakhs. With fixed cost of Rs. 97,750 and variable cost of Rs. 4,44,783, the total annual cost worked out at Rs. 5,42,533. The gross earnings of pair trawling unit worked out at Rs. 6,79,024 with a net profit of Rs. 1,36, 491 per annum. The follow up study in 1990-'91 on the economic viability of units also indicated the advisability of diversified trawl fishing.

With the introduction of pair trawling the migration of boats of other centres in search of shrimps during the lean season has been drastically reduced. The convenience of shifting from trawling to pair trawling or vice-versa depending on the availability of various resources within the region has enhanced the overall catch rates of these units offering further scope to increase the trawl landings along Tamil Nadu coast by proper substitution of these two fishing methods appropriately.

The services rendered by S/Shri. V. Thanapathi and V. Sivasamy of Nagapattinam Field Centre of CMFRI in collection of data, Smt. K. P. Salini for tabulation and R. C. Shenoy for secretarial assistance are greatefully acknowledged.

RECORD PRODUCTION OF *GRACILARIA EDULIS* IN CULTURE SYSTEM IN MINICOY LAGOON*

Attempts at culturing the economically important seaweed *Gracilaria edulis* have been going on since two decades in India, in view of its importance as an industrial raw material for extraction of the phycocolloid agar-agar.

The Central Marine Fisheries Research Institute and the Central Salt and Marine Chemicals Research Institute have been continuously striving to evolve an economically feasible method to culture this agarophyte in order to augment the resource of the same to the seaweed based industries as the production from natural beds has been found to be inadequate to cater to the demands of the agar industry in the country. A certain amount of success has been achieved in this direction with production values ranging from 3 fold increase in 60 days to 4.5 fold in 80 days.

With a view to find out the feasibility of culturing *G. edulis* in Minicoy lagoon, experiments have been started since 1989 and encouraging results were obtained, with a maximum production value of 7.1 fold increase over the initial seed material introduced in the coir ropes or nets in 60 days time.

During 1992 also, the experiments have been continued in Minicoy lagoon and the results obtained are very encouraging, surpassing to a great extent the earlier production values for this ecosystem.

In September 1992, one culture rope harvested at Fisheries Jetty site after 50 days of growth recorded a 31 fold increase over the initial seed material of 300 g (Table) and two other ropes harvested near Navodaya School site have shown an 11 fold and 12.6 fold increase. This is the

TABLE 1. *The maximum values obtained during 1990-92*

Name of culture site	Date of introduction of the culture rope/net	Date of harvest	Initial seed material in kg	Harvest obtained in kg	Rate of increase
Fisheries Jetty	20-7-1992 rope	11-9-1992 50 days	0.30	9.30	31 fold
Navodaya School I rope	21-7-1992 rope	10-9-1992 50 days	0.30	3.80	12.6 fold
Navodaya School II rope	21-7-1992 rope	10-9-1992 50 days	0.30	3.30	11 fold
Fisheries Jetty	3-1-1992 (one rope & one net)	25-2-1992	0.30	2.00	6.6 fold
Fisheries Jetty	31-7-1991 (rope)	26-9-1991 56 days	0.25	1.10	4.4 fold
Navodaya School	15-6-1991 (rope)	30-7-1991 45 days	0.50	1.95	3.9 fold
Fisheries Jetty	13-4-1990 (rope)	11-6-1990 60 days	0.80	6.46	7.1 fold
Navodaya School	26-10-1990 (net)	31-12-1990 66 days	0.60	4.30	7.1 fold

*Prepared by V. S. K. Chennubhotla, V. A. Kunhikoya and A. Anasukoya, Research Centre of CMFRI, Minicoy, Lakshadweep.

maximum production recorded for Indian coastal waters and elsewhere also. Further work is in progress. A table showing the details of the culture operations, when maximum values were obtained during these three years from 1990 to 1992 is given to get a comparative picture.

From these results it can be inferred that the grazing of the crop by fishes as reported previously was mainly responsible for the low production values in the earlier instances. Neverthless grazing has been observed during this year also is some of the ropes, but this particular culture rope which escaped the attack by fish and other organisms has given an idea about the real culture potential of the seaweed *G. edulis* in Minicoy Lagoon. Hence this clearly suggests that attempts at preventing grazing of the crop by fishes and other organisms must be taken up in future in seaweed farming to derive maximum benefits.

HOLDING AND SPAWNING OF THE EDIBLE OYSTER *CRASSOSTREA MADRASENSIS* DURING OFF-SEASON*

In a hatchery for marine organisms, broodstock maintenance and spawning are important aspects. Production of seed from the hatchery throughout the year would help to undertake stocking in the grow out systems at appropriate time which may vary in different areas.

At Tuticorin, in the natural beds, the oyster *Crassostrea madrasensis* (Preston) spawns intensively during April-May and August-September. In the remaining months the spawning is sporadic at a low key. In order to obtain spawning in all the months it is necessary to maintain ripe oysters year round in the hatchery. This can be achieved either by accelerating the maturing process of the oysters outside the normal spawning period or by delaying the spawning of ripe oysters during the spawning season or both. Experiments were conducted at the hatchery in the CMFRI Research Centre in Tuticorin towards delaying the spawning and the results obtained are presented here. Ripe oysters with a size range of 70-120 mm were collected from Korampallam creek near Tuticorin. They were placed in 11 fibreglass tanks of 100 l capacity at the rate of 15 oysters in each tank. The oysters were placed over a PVC grid which was kept inside the FRP tank for facilitating easy removal of faecal matter while changing the seawater. The experiment was conducted in conditioning room where the water temperature was maintained at 20 ± 1°C and the salinity at 32-33 ppt. Filtered seawater was used after storing the oysters for a day in the conditioning room. Water was changed daily and mild aeration was given. After changing the water 35 l of mixed algae (about 0.75 - 1 million cells/ml) consisting of *Chaetoceros* sp., *Skeletonema* sp. and *Nitzschia* sp. were provided as feed for each batch of oysters. The mixed algae were cultured in outdoor tanks.

A sample of 15 oysters were subjected to temperature of 29 ± 1°C in every fortnight for induced spawning. The results of the experiments conducted from August '88 to February '89 are given in Table 1.

The percentage of oysters that spawned was high (73-80%) during August and September '88. In the following five months 20-60% of the oysters spawned. This study indicates that spawning in *C. madrasensis* could be held back upto six months if maintained in lower temperature of 20 ± 1°C.

Thus holding the ripe oysters is a promising line of work for getting spawn in the hatchery outside the spawning period, leading to seed producction throughout the year.

TABLE 1. *Spawning of* C. madrasensis *brood stock by thermal stimulation*

Date of spawning	No. of oysters induced to spawn	No. of oysters spawned	Sex of oysters		Percentage spawned
			male	female	
31.08.88	15	11	6	5	73.3
08.09.88	15	12	10	2	79.9
24.09.88	15	11	8	3	73.3
07.10.88	15	7	3	4	46.6
22.10.88	15	9	5	4	59.9
21.11.88	15	5	3	2	33.3
24.11.88	15	3	2	1	19.9
14.12.88	15	7	3	4	46.6
28.12.88	15	7	4	3	46.6
16.01.89	15	4	2	2	26.6
15.02.89	15	3	2	1	19.9

*Prepared by Rani Palaniswamy and S. M. Sathakkathullah, Tuticorin Research Centre of CMFRI, Tuticorin-628 001.

A RESEARCH NOTE ON ECONOMIC PERFORMANCE OF 'DOL' AT SASOON DOCK*

Stakenet which is popularly known as 'dol' in Maharashtra is an important gear to fish, specially, Bombay duck and *Acetes* spp. A significant catch contribution by 'dol' is noticed in this state almost round the year except for a few months of monsoon at some centres. Though 'dol' is a stakenet, most of the units now-a-days operate mechanised boats. The 'khamba' system of 'dol' fixing is most popular and technically efficient but the cost of 'khamba' has gone up very high and the fishermen are substituting it with 'khunt' system. In the adjoining areas of Bombay 'khunt' system is commonly used for fixing the 'dol'. 'Khunt' is the wooden spike driven into the muddy bottom of the sea and used to tie the net.

Sasoon dock is one of the important fish landing centres in Maharashtra which is blessed with almost all infrastructure and fish marketing facilities since it is part of the Bombay city. It is commonly used for landing mechanised catch of trawl and 'dol' units. Based on the economic study conducted by the Central Marine Fisheries Research Institute, Cochin during 1990-'91 an effort is made to analyse the economic performance of 'dol' operating at Sasoon Dock centre. At this centre the 'dol' operation is noticed round the year. For observation of fish catch and cost of operation, the data have been collected on 10 sample days every month for one year starting from April 1990.

Investment and annual fixed cost

The value of a new craft with inboard engine is reported to be Rs. 2 lakhs and that of nets in a 'dol' unit Rs. 0.3 lakhs (Table 1). Taking 10% depreciation for the craft and 33.33% for gear the annual depreciation comes to be Rs. 30,000. Similarly, taking a mild interest rate of 15% per annum, an amount of Rs. 34,500 is set apart towards annual interest to be paid on capital investment of Rs. 2.3 lakhs. Thus, annual fixed cost is calculated at Rs. 64,500.

Operational cost

Fuel, labour, repair & maintenance and marketing are the main components of operational expenditure. The wage and food expenses of an average crew of 6 persons in a unit came to Rs. 65,520 in a year (Table 2). An amount of Rs. 25,390 was spent on fuel during 1990-'91. The cost of repair & maintenance and marketing was found to be Rs. 11,000 and Rs. 9,500 respectively. Thus, the operational expenses totalled to Rs. 1,11,410 during the study period.

The annual fishing expenditure which is the sum total of fixed and variable cost comes to Rs. 1,75,910 for a 'dol' unit at Sasoon Dock.

TABLE 1. *Investment in a 'dol' unit at Sasoon Dock and components of fixed cost (1990-91)*

I.	Items	Investment (Rs)
	Boat	1,30,000
	Engine	70,000
	Net & other accessories	30,000
	Total = Rs	2,30,000
II.	Annual depreciation (Rs)	
	Boat and Engine	20,000
	Net & other items	10,000
III.	Interest on capital (@ 15% Pa)	34,500
IV.	Total fixed cost (II + III)	64,500

TABLE 2. *Operational expenses of 'dol' unit (1990-'91)*

i)	Fuel	Rs.	25,390
ii)	Labour	Rs.	65,520
iii)	Repairs & maintenance	Rs.	11,000
iv)	Marketing etc.	Rs.	9,500
	Total	Rs.	1,11,410

Production and revenue

On an average fishing was observed on 273 days by 'dol' units during 1990-'91. The catch mainly consists of *Acetes* (Jawla), Bombay duck, prawns, clupeoids and ribbon fish. The Table 3 shows that a maximum catch of 7,775 kg (Rs. 23,350) was observed during September and a

* Prepared by D. B. S. Sehara, A. Y. Mestry and K. P. Salini of CMFRI, Cochin - 682 031.

TABLE 3. *Production and revenue of a 'dol' unit at Sasoon Dock during 1990-'91*

Name of fish		April '90	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. '91	Feb.	March	Annual
1. *Acetes* Sp.	Catch %	57	68	69	44	22	18	21	40	56	58	54	38	44
	Value %	50	50	60	32	19	19	16	26	42	43	33	35	34
2. Bombayduck	C %	5	4	5	23	45	56	41	23	8	8	9	6	22
	V %	9	9	8	33	48	39	34	24	8	10	12	11	23
3. Penaeid prawn	C%	6	4	5	9	5	3	6	6	13	12	11	9	7
	V %	12	13	13	18	14	12	15	17	30	25	30	21	16
4. Clupeoids	C %	17	12	15	12	13	14	11	10	6	7	10	26	13
	V %	9	12	12	9	9	9	7	7	4	7	10	16	9
5. Pomfret	C %	2	1	—	—	—	5	5	3	1	2	2	2	2
	V %	10	6	—	—	—	18	16	14	7	8	8	9	9
6. Ribbonfish	C %	5	3	4	5	5	1	5	4	2	1	1	2	3
	V %	6	6	5	5	5	1	6	5	2	1	1	3	4
7. Misc.	C %	8	8	2	7	10	3	11	14	14	12	13	17	9
(including cat fish)	V %	4	4	2	3	5	2	6	7	7	6	6	5	5
Total catch (kg)		4476	4888	5040	2541	4136	7775	5500	5640	3750	2712	2354	2150	51,262
Value (Rs)		16488	16718	17712	10647	16104	23350	21475	19992	16500	13632	12540	9375	1,94,533
No. of days		20	21	24	21	22	25	25	24	25	24	20	22	273

TABLE 4. *Economic performance of a 'dol' unit*

No. of days fished	...	273
Total production (kg)	...	51,262
Revenue (Rs.)	...	1,94,533
Variable cost (Rs.)	...	1,11,410
Gross profit (Rs.)	...	83,123
Total cost (Rs.)	...	1,75,910
Net profit (Rs.)	...	18,623
Pay back period (yrs.)	...	4.7
Rate of return to capital (%)	...	23.1
Catch per day (kg)	...	188
Revenue per day (Rs.)	...	712.6
Variable cost per day (Rs.)	...	408.1
Gross profit per day (Rs.)	...	304.5
Total cost per day (Rs.)	...	644.4
Net profit per day (Rs.)	...	68.2
Productivity per man day (kg)	...	31.3
Fuel cost per kg of fish (Rs.)	...	0.50
Labour cost per kg of fish production (Rs.)	...	1.28
Total cost per kg of fish production (Rs.)	...	3.43
Revenue per kg of fish (Rs.)	...	3.79
Net earning per kg of fish (Rs.)	...	0.36

minimum of 2,150 kg (Rs. 9,375) during March. The *Acetes* catch was good (more than 40%) during 8 out of 12 months. From July to November, Bombay duck catch was more than 20%. Clupeoids varied from 6 to 26 per cent and ribbon fish from 1 to 5 per cent in the monthly catch. Pomfret catch was good in September and October (5% each). Catfish is included in miscellaneous catch.

In the total revenue of Rs. 1,94,533 a maximum contribution was made in September and the minimum in March. The fishing days ranged from 20 to 25 a month. In all the months, *Acetes* and Bombay duck contributed maximum towards the annual revenue. Penaeid prawn contributed 12-30% towards the monthly revenue.

Profitability level

Annual net profit of a 'dol' unit is calculated at Rs. 18,623 during the study period (Table 4). The pay back period worked out at 4.7 years and the rate of return to the capital at 23.1%. The productivity per man day was 31.3 kg. One kg of fish production requires Rs. 0.5 worth of fuel and adds Rs. 3.79 to the revenue. The net earning per kg of fish is calculated at Rs. 0.36. Thus, 'dol' operation during 1990-'91 was profitable at Sasoon dock.

REVIVAL OF RIBBONFISH FISHERY IN MANDAPAM REGION*

During the 60s, ribbonfish formed a fishery of considerable strength in the Mandapam region and occasionally large quantities were landed in shore seines and drift gill nets. In 1962, enormous quantities of *Trichiurus lepturus* Linnaeus were landed during September-October at Rameswaram island (James, 1967, Memoir-I, *Marine Biological Association of India* : 226 pp.). However, in recent times ribbonfish landings have declined markedly in the region. During 1980-'91 period though there was no ribbon fish landings in several years, a total of 112 of ribbonfish were landed at Rameswaram which formed only 0.05% in total landings (Table 1).

TABLE 1. *Ribbonfish landings at Rameswaram Verkottil landing centre during 1980-'91* (Source : *Fishery Resource Assessment Division, CMFRI, Cochi*)

Year	Total fish landings (t)	Ribbonfish catch (t)	Percentage in total landings
1980	20,578	0	0
1981	20,586	0	0
1982	22,814	4	0.018
1983	22,579	3	0.013
1984	27,093	0	0
1985	21,495	0	0
1986	20,039	0	0
1987	—	—	—
1988	17,965	1	0.006
1989	15,793	0	0
1990	16,448	104	0.63
1991	16,483	0	0
Total	2,21,873	112	0.050

In March, 1992, the paired mechanised boats with high opening trawl (Pillai and Sathiadhas, *Mar. Fish. Infor. Serv., T & E Ser.*, No. 39 : 1982) operating about 15 km N.E off Rameswaram (9°10'-9°20'N & 79°20'-79°35' E) at about 12 m depth, had landed an estimated 45.18 t of ribbonfish at a CPUE of 21.8 kg forming 1.2% in total catch. The resource started appearing in the pair trawl catches from 4.3.'92 onwards, on which date 320 kg were caught. On 10.3.'92, 14.4 t were landed at a CPUE of 172 kg. In a single unit alone 4 t were caught. The fishery disappeared by about 24.3.'92, presumably because the shoal would have moved away from the fishing area.

The catch consisted of a single species, *Trichiurus lepturus* in the size range of 540-850 mm TL, with a dominant size group of 640-659 mm (Fig. 1). Analysis of stomach contents showed food items such as *Sardinella* spp, *Thryssa* sp., *Stolephorus* sp., *Acetes* sp. and penaeid prawns in their stomachs. All the individuals were in spent and spent recovery stages. Female to male ratio was 7:2.

The ribbonfish catches were sold at a rate of Rs. 4/- to 6/- per kg. About 80% of landings were iced and taken to Kerala markets by fish traders arrived from there; the rest being taken to the interior markets of Tamil Nadu, such as Madurai, Coimbatore and Pollachi.

Remarks

Though it is generally observed that large schools of *T. lepturus* which contribute to the commercial fishery during certain months at dif-

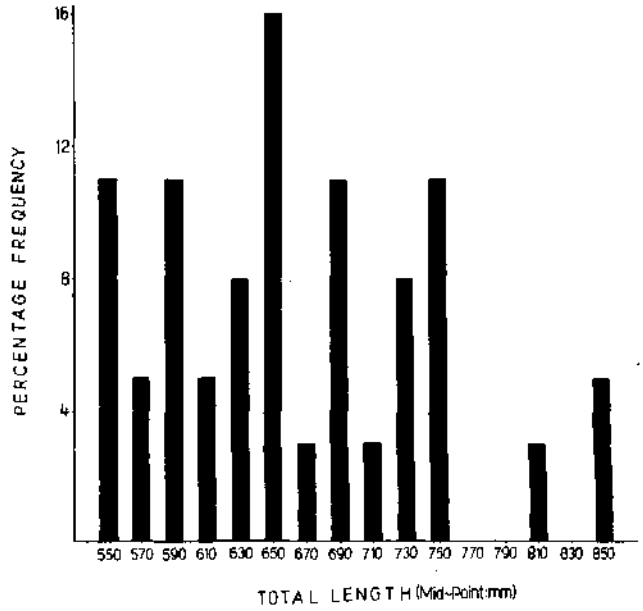

Fig. 1. Length frequency distribution of *T. lepturus* in the pair trawl catches at Rameswaram landing centre in March, 1992.

* Prepared by P. Jayasankar, Mandapam Regional Centre of C. M. F. R. I., Mandapam Camp - 623 520.

ferent landing centres mostly comprise of spent fish measuring above 50 cm length, neither the schooling behaviour nor the migratory pattern are understood to any appreciable extent. Our knowledge about sex ratio in the schools of ribbonfish, too is meagre. Rao *et al.* (*Seafood Export Journal*, 9 (11) : 9-25 : 1977) suggested a general trend in the southward shift of ribbonfish concentrations beginning from April to July-August in the western shelf region. James (Memoir I,*Marine biological Association of India* : 226 pp : 1967) indicated that *T. lepturus* moves in large shoals during August to October from east to west around Cape. The presently reported shoaling is apparently associated with spawning. This aspect apart from the present observation is noteworthy that a virtually extinct ribbonfish fishery in the Mandapam region has shown a brief but significant revival.

OBSERVATIONS ON CATFISH LANDINGS BY PAIR TRAWLERS AT RAMESWARAM*

During 1980-'81, trawling trials by two-boats with high opening trawl nets commenced in the Palk Bay with Mandapam, Pamban and Rameswaram as bases of operation. Pillai and Sathiadas (*Mar. Fish. Infor. Serv., T & E ser.*, No. 39 : 1982) have furnished a detailed account on the history and other particulars of this fishery in 1982. They reported the landings of 109 t of catfishes during February-April at Rameswaram, which formed 9.32% in total landings. Subramani (*Mar. Fish. Infor. Serv., T & E Ser.*, No. 73 : 1987) recorded good landings of catfish from this gear, sometimes even upto 7 t/unit. Kasinathan and Bose (*Mar. Fish. Infor. Serv., T & E Ser.*, No. 95 : 1989) observed occasionally heavy landings of catfishes from pair trawlers in February and March, 1988.

Pair trawl catfish fishery during 1988-'92

Table 1 furnishes data on the catch, effort and species composition of catfishes in pair trawl operations during 1988-'92 at Rameswaram Verkottil landing centre. From 1988 to 1992, the fishing effort and total landings have registered staggering increase by 32.45 and 39.41%, respectively. Catfish catches showed a steady decline from 77.03 t in 1988 to 19.18 t in 1991. But in the year 1992, it registered a phenomenal 18.20% increase over the catch in the previous year. Regarding species composition, from 1988 to 1991, *Tachysurus caelatus* Val. was the dominant, forming an average 69% of all catfishes. In 1992, the soldier catfish, *Osteogeneiosus militaris* (Linnaues) constituted 61.85% of all catfishes. Such heavy landings of this species have never occurred before in any gear along the Palk Bay and the Gulf of Mannar.

Details of catfish fishery in 1992

During mid January-mid April, 1992, the pair trawling boats operated about 10-25 km N.E. off Rameswaram (approx. 9°10'-9°30'N and 79°20'-79°35'E) at 10-16 m depth, where the sea bottom is mostly muddy. Of the estimated 12,874.55 t of fish landed, about 3% was constituted by catfishes at a CPUE of 52.2 kg. Peak catfish catches were recorded in February (254.15 t at a CPUE of 116 kg). In April, the catch plummeted to 3.74 t and the fishery disappeared by about middle of April. The proportion of *O. militaris* in the total catfishes ranged from 59.5% in January to 64.9% in April. From the enquiries with local fishermen, it was learnt that best catches of catfishes came from west of Katchativu.

A perusal of catfish catches from pair trawlers during 1988-'92 (Table 1) and the total rainfall during September to April (Table 2) indicates an inverse relationship between the two. Minimum catch of 19.18 t was recorded in 1991 while the total rainfall during September, 1990 - April, 1991 was maximum (893.4 mm). Though the rainfall decreased to 584.8 mm during September, 1991 to April, 1992, catfish catches registered an enormous increase.

Some biological studies of *O. militaris*, *Tachysurus caelatus* and *T. maculatus* were carried out in the month of March. In *O. militaris*, the total length varied from 220 to 419 mm with 320-339 mm as the modal size group. Female to male ratio was 2:1. Of the females examined, 88% were in stages IV-VII; 25% were in stage VI (fully ripe). In *T. caelatus*, length ranged from 322 to 590 mm with

* Prepared by P. Jayasankar and M. Boss, Mandapam Regional Centre of C. M. F. R. I., Mandapam Camp - 623 520.

TABLE 1. *Catch effort and species composition data of catfishes from pair trawlers at Rameswaram Verkottil landing centre during 1988-1992 (Given in the parenthesis are percentage of catfish in total landings and that of different species in total catfish catch)*

	1988					1989					1990					1991					1992				
	Jan.	Feb.	Mar.	Apr.	Total	Jan.	Feb.	Mar.	Apr.	Total	Jan.	Feb.	Mar.	Apr.	Total	Jan.	Feb.	Mar.	Apr.	Total	Jan.	Feb.	Mar.	Apr.	Total
Units	—	125	86	—	211	36	201	185	59	481	—	376	171	—	547	—	392	813	221	1426	780	2196	2069	2012	7057
Total catch (t)	—	231.57	87.02	—	318.59	33.48	75.04	152.04	46.10	306.66	—	276.20	188.10	—	464.30	—	831.40	1316.66	227.76	2375.82	2035.79	3695.0	3662.36	3281.4	12874.55
Total catfish (t)	—	70.55 (30.47)	6.48 (7.45)	— —	77.03 (24.18)	15.00 (44.8)	6.71 (8.94)	22.25 (14.63)	16.27 (35.29)	60.23 (19.64)	— —	24.00 (8.69)	31.50 (16.75)	— —	55.50 (11.95)	— —	— —	19.18 (1.46)	— —	19.18 (0.81)	63.55 (3.12)	254.15 (6.53)	46.73 (1.28)	3.74 (0.11)	368.17 (2.86)
Tachysurus caelatus (t)	—	47.20 (66.90)	4.57 (70.59)	— —	51.77 (67.21)	8.45 (25.24)	4.50 (67.06)	14.75 (66.29)	13.65 (83.90)	41.35 (68.65)	— —	16.85 (70.21)	25.45 (80.79)	— —	39.25 (70.72)	— —	— —	13.89 (72.42)	— —	13.89 (72.42)	14.30 (22.50)	86.41 (34.00)	9.81 (20.99)	0.73 (19.52)	111.25 (30.22)
Osteogeneiosus militaris (t)	—	4.80 (6.80)	0.06 (0.89)	— —	4.86 (6.31)	2.55 (7.62)	0.95 (14.16)	3.55 (15.96)	1.15 (7.07)	8.20 (13.61)	— —	4.55 (18.96)	1.75 (5.56)	— —	3.75 (6.76)	— —	— —	3.48 (18.14)	— —	3.48 (18.14)	37.81 (59.50)	157.57 (62.00)	29.91 (64.01)	2.43 (64.97)	227.72 (61.86)
Other species (t)	—	16.55 (26.29)	1.85 (28.55)	— —	20.40 (26.48)	4.00 (11.95)	1.26 (18.78)	3.95 (7.75)	1.47 (9.04)	10.68 (17.73)	— —	2.60 (10.83)	4.30 (13.65)	— —	12.50 (22.52)	— —	— —	1.81 (9.44)	— —	1.81 (9.44)	11.44 (18.0)	10.17 (4.00)	7.01 (15.0)	0.58 (15.51)	29.20 (7.93)

TABLE 2. *Data on total rainfall in Rameswaram Island during September, 1987 to April, 1992 (Source : Meteorological Department, Pamban) and pair trawl landings of catfish during January to April in each year*

Period	Total rainfall (in mm)	Total catfish catch during Jan.-Apr. (in t)
September 1987-April 1988	497.20	77.03
September 1988-April 1989	517.10	60.23
September 1989-April 1990	759.30	55.50
September 1990-April 1991	893.40	19.18
September 1991-April 1992	584.80	368.17

520-539 mm as the mode. Female to male ratio was 2.1:1. 65% of females were in stages IV-VII; 30% were in stage VI. Total length range of *T. maculatus*, the third most dominant species, was 204-333 mm with 320-339 mm as the mode. Female to male ratio was 1:1. 90% of females in stages IV-VII; 65% were in stage VI. Specimens carrying eggs in the mouth were rare in all the species.

Marketing

In 1992, the pair trawl fishery catches have attracted a large number of fish traders from Kerala. During peak landing period (February), upto 35 lorries/day, fully loaded with ice blocks arrived at Rameswaram landing centre. About 10% of the catfish catches were purchased by them, while about 70% were taken to the interior markets of Tamil Nadu, like Tiruchi, Coimbatore, Madurai and Pollachi, the rest being sun-dried before selling in the local markets. Price of catfish remained rather steady at Rs. 5 to 7 per kg, during both peak and weak periods of its fishery.

Remarks

During their introductory operations in the Palk Bay, the pair trawlers brought enormous quantities of white pomfrets, hence the gear came to be known locally as 'Vaval madi' (In Tamil 'Vaval' means white pomfret and 'madi' means net). However, in the following years, the composition of the dominant species in the catches varied and in 1992, oil sardines constituted about 71% of total landings. Pair trawl has proved to be the most efficient gear in this region exploiting shoaling fishes moving slightly above the sea bottom.

Though generally a subsidiary catch, catfishes are observed to dominate the catches in some units occasionally. They also fetch a reasonably good price. The marked increase in catfish catches in the year 1992 could be attributed to different reasons, such as increase in fishing effort by about 395%, change in the area of operations, etc. Occurrence of a high percentage of fish in advanced stages of maturation in the catches suggest that catfishes engaged in spawning migration are exploited by this gear.

ON A WHALE SHARK LANDED AT MAKARABAGH NEAR MALVAN, IN MAHARASHTRA*

On 21.2.1992 a specimen of *Rhineodon typus* (whale shark) locally called 'Bhera' of 5 m length and 500 kg weight was landed at the Makarabagh fish landing centre near Malvan. It was caught in a trawlnet at about 15 km away from the coast where the depth measured 48 m. The fish was cut into pieces and sold to local people and a total of Rs. 400 was realised.

Fig. 1. The Whale Shark landed near Malvan, Maharastra.

* Reported by K. R. Mainkar, Field Centre of CMFRI, Malvan - 416 606.

ON A MARINE TURTLE *LEPIDOCHELYS OLIVACEA* LANDED AT BASSEEIN KOLLIWADA IN MAHARASHTRA*

A dead male turtle of the species *Lepidochelys olivacea* measuring a carapace length of 68.58 cm and width of 55.88 cm was landed at the Basseein Kolliwada near Bombay on 3.5.1991. On enquiry it was learned that altogether three turtles were caught in a 'dol' net of which the two live ones were released into the sea. The turtle weighed 34.8 kg.

Fig. 1. Dorsal view of the turtle.

Fig. 2. Ventral view of the turtle.

* Reported by Jayadev S. Hotagi, Research Centre of CMFRI, Bombay - 400 023.

ON THE LANDING OF A LEATHERBACK TURTLE*

A female of the least abundant sea turtle in the Indian seas, the leatherback turtle, *Dermochelys coriacea* Schlegelii (Fig. 1), locally known as 'odavitta amai', was caught incidentally on 3-8-1991 in a boat seine operated 1 km off Colachel (western coast of Kanyakumari district, Tamil Nadu) at 15 m depth. The turtle, weighing about 250 kg had the following morphometric measurements in cm.

Total length	..	213.0
Length of carapace	..	173.2
Width of carapace	..	132.4
Length of plastron	..	154.7
Width of plastron	..	86.0
Width of head	..	32.5
Length of anterior flipper	..	106.7
Length of posterior flipper	..	68.8

Fig. 1. Ventral view of the leatherback turtle caught off Colachel on 3-8-1991.

The turtle was auctioned for Rs. 750/- at the beach and transported to a nearby market for disposal of its flesh in fresh condition for human consumption.

* Reported by I. P. Ebenezer, Kanyakumari Field Centre of CMFRI, Kanyakumari, and Jacob Jerold Joel, Vizhinjam Research Centre of CMFRI, Vizhinjam - 695 521.

समुद्री मछली जीन बैंक-विकास का पहला सोपान

ए. डी. दिवान, और ए. नंदकुमार केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन - 682 031.

समुद्री या जलीय जीवियों के संवर्धन कार्यक्रमों में निम्न ताप में शुक्राणुओं को संरक्षित करने की रीति पर कई लोगों ने पहले ही जोर किया है। इसके अनुसार सालमोनिड्स और शुद्वजल कार्प मछलियों पर इस संबंधी अध्ययन चलाया गया है। लेकिन भारत में इस संबंधी अध्ययन मन्द गति में था विशेषकर मात्स्यिकी के क्षेत्र में। जो भी हो क्रयोप्रिसर्वेशन तकनीकों का उचित आयोजन से जीवियों का उत्पादन और वृद्धि की जा सकती है।

उर्वर शुक्राणुओं का क्रयोप्रिसर्वेशन (निम्नताप में अनुयोज्य मीडियम में संरक्षित करने की रीति) जीवन का रहस्य खोजने का मार्ग ही नहीं बल्कि भविष्य में जीव संपदाओं का संवर्धन करने का एक तरीका भी है। स्पर्मोटाज़ोवा मछली में इस रीति का परिरक्षण सफलता से किया है। क्रयोप्रिसर्वेशन रीति विभिन्न प्रकार के जीवियों के पालन, प्रजनन और वंध्यता चिकित्सा के लिए अनुयोज्य देखी गई है। जलजीवियों की कृषि में देखी जानेवाली मुख्य कठिनाई उचित अवसरों पर शुक्रदाताओं की अनुपलब्धता है। इसके निराकरण केलिए "गमेट बैंकों" की स्थापना करने का यत्न आगोल स्तर पर हो रहा है जिस से कृत्रिम संकलन से किसी भी समय पर बोने का बीज उपलब्ध हो सके।

प्रजनन कार्यक्रमों में जनतिकी वस्तुओं का संरक्षण करके वांछित मछलियों का संवर्धन करने में इसलिए कठिनाई आती है कि स्त्री गमेट और पुरुष गमेट का परिपक्वन अलग अलग समय पर होता है। शुक्राणुओं का परिरक्षण करके उचित समय पर निषेचन केलिए उपयोग करने का तरीका विकसित किया है। पर स्त्री गमेट के परिरक्षण संबंधी कार्य परीक्षणात्मक अवस्था में है। हाल के वर्षों में मछलियों में क्रयोप्रिसर्वेशन संबंधी अध्ययन सालमोनिड और कार्प मछलियों में चलाया है। मल्लटों में किये जानेवाले परीक्षण पर दो तीन रिपोर्ट भी मौजूद है।

मछली शुक्राणुओं में क्रयोप्रिसर्वेशन की बात अनुयोज्य क्रयोफिलटिक एजेंट पर निर्भर होती है। ग्लिसरोल और डैमीथैल सल्फोक्सैड इसकेलिए अनुयोज्य देखा था। यद्यपि शुक्राणुओं के परिरक्षण पर कई अध्ययन चलाये गये है तथापि इसकी निषेचन योग्यता पर विशेष अध्ययन नहीं हुआ है। क्रयोप्रिसर्व किये अंड के साथ शुक्राणु का निषेचन संबंधी पहली रिपोर्ट शुद्व जल सालमोनिड मछलियों की है। यह वर्ष 1967 का *होर्टन* की रिपोर्ट है। बाद में शुद्व जल कार्प मछलियों और समुद्री मछलियों में भी परीक्षण हुआ था।

सी एम एफ आर आइ में पिछले तीन वर्षों से इस पर अध्ययन हो रहे है। इस अध्ययन में *लिजा पार्सिया* के शुक्राणुओं के -10°C में थोडी मात्रा में और -196°C में लंबी मात्रा में सक्रिय रखवाने की रीति पर संस्थान विजय पाया है। दोनों तरीकाओं में विविध तनुकारी (diluents) और 10% डैमीथैल सल्फोक्सैड को क्रयोप्रोटक्टन्ट के रूप में उपयोग करके ताजे शुक्राणुओं का परिरक्षण किया। इस रीति के अनुसार -196°C में लिक्विड नैट्रोजन में शुक्राणुओं का परिरक्षण करने पर सन्तुलनधारण समय का मानकीकरण तापमान शॉक से बचाने केलिए आवश्यक है। इस तरीके से शुक्राणुओं की चलन्दता (motility) जारी रखी जा सकती है और ऐसे शुक्राणु संस्थान के प्रयोगशाला में लभ्य है। परीक्षित किये तनुकारकों में सब से अनुयोज्य 15% ग्लिसरिन और 10% डैमीथैल सल्फोक्सैड का मीडियम है जिस में 80% शुक्राणु ने चलन्दता प्रकट की। -10°C तापमान में परिरक्षित शुक्राणुओं की चलन्दता 3 दिवस थी। इसका कारण ग्लूकोस और प्रोटीन मात्रा में आई कमी और लिपिड मात्रा में आई बढती निरीक्षित की गई। अन्य समुद्री मछलियाँ जैसे *सिल्लागे सिहमा, मुगिल सेफालस* और जेरस जातियों में इस संबंधी अध्ययन कर रहा है। इन तीनों जातियों के शुक्राणुओं का बाह्य आकार संबंधी अध्ययन इलक्ट्रॉन माइक्रोस्कोप के ज़रिए किया। तीनों के बाह्य लक्षण एक समान थे। परिरक्षित शुक्राणुओं को परिपक्व अंड से निषेचन करके शुक्राणुओं की जीवनक्षमता समझाने केलिए भी अध्ययन चल रहे हैं।

तमिलनाडु के नागपट्टणम तट में ट्रॉल परिचालन-लागत और लाभ

आर. सत्यदास, के. के. पी. पनिक्कर और
ए. कनक्कन, केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचीन-31.

भारत की समुद्री मात्स्यिकी सेक्टर में पिछले तीन दशक में द्रुतगामी परिवर्तन आया है। सिंथेटिक जालों की शुरुआत और झींगा मछलियों की निर्यात साध्यताओं ने यंत्रीकृत मत्स्यन को तीव्र कर दिया है। इसके ज़रिए देश में समुद्री खाद्य वस्तुओं का निर्यात उद्योग विकसित हुआ है जिससे रोज़गार का अवसर बढ गया है। तमिलनाडु के तटों में अब करीब 2500 ट्रॉलरों का परिचालन होता है और कुल मछली पकड का 50% मात्स्यिकी इसके ज़रिए प्राप्त होती है। तमिलनाडु के करीब 1000 कि. मी में समुद्री तट है और यंत्रीकृत बोटों के अवतरण केलिए अनुयोज्य 23 केन्द्र हैं। इन में पुदुमनक्कुप्पम, कूडल्लूर, नागपट्टनम, मंडपम, रामेश्वरम और टूटिकोरिन प्रमुख हैं। हाल के दिनों में निम्नतलीय ट्रालिंग में हुई कम पकड दर के कारण यहाँ हाइ ऑनिंग ट्रॉल और फिश ट्राल का प्रयोग बढते हुये देखा। समुद्री मात्स्यिकी में प्रबंध नीतियाँ आयोजित करने को क्राफ्ट और गिअरों का समीचीन उपयोग, पकडी गई मछलियों के प्रकार और परिचालन की रीतियों के विषय में अध्ययन आवश्यक है। तमिलनाडु के नागपट्टणम में, जहाँ साधारण ट्रॉल और

युग्मट्रॉलरों का परिचालन होता है इसके विषय में किया गया अध्ययन इस लेख का प्रतिपाद्य है।

अध्ययन में विवरणों के संकलन केलिए दो अनुसूचियाँ तैयार की गई है। पहली सूची में मत्स्यन सामग्रियों केलिए मूलधन निक्षेप, बोट खरीदने की तिथि, पुनःबिक्री का मूल्य, वित्त का मार्ग, कर्मियों का वेतन, पुनःनिर्माण का व्यय आदि बातों का संग्रहण किया। दूसरी में दैनिक परिचालन, व्यय, जातिवार पकड और राजस्व संबंधी बातों का संग्रहण किया। संग्रहित विवरणों के अनुसार वर्ष 1990-91 के दौरान नई ट्रॉलर और पेअर ट्रॉलर का व्यय और लाभ संबंधी डाटा प्राप्त कर सका।

पकड की प्रवणता

तमिलनाडु के यंत्रीकृत मत्स्यन में पिछले कुछ वर्षों में क्रमपूर्ण बढती दिखाई पडी। कुल पकड में और यंत्रीकृत यानों का बढता प्रयोग मछली की वर्द्धित पकड का कारण है। परंपरागत मत्स्यन एककों की पकड में समर्थ घटती देखी। इसके कारण मछुओं के बीच स्पर्धा भी कुछ केन्द्रों में देखा गया।

ट्रॉलर व पेअर ट्रॉलर

नागपट्टनम तट में श्रिंप ट्रॉल, फिश ट्रॉल, सिंगिल ट्रॉल और पेअर ट्रॉल नामक चार ट्रालों का प्रचालन करता है। पेअर ट्रॉल परिचालन के शुरुआत से पाम्फेट, शिंगटी, मुल्लन और सिएनिड्स की पकड में बढती हुई है।

पूँजी निवेश

सिंगिल ट्रॉल का मूलधन निवेश 1.35 लाख और पेअर ट्रॉल का 3.15 लाख रुपये हैं। बोट के पेट (Hull) का लागत 65,000 रुपये और निम्नतल पेअर ट्रॉल बोट के पेट का लागत 1.5 लाख रुपये हैं। इंजन का लागत 55,000 रु से 1.3 लाख रु के बीच हैं। लेकिन चालू वित्तीय वर्ष में नई एकक का लागत दुगुना हो गया है।

मत्स्यन यात्रा की अवधि

सिंगिल ट्रॉल का मत्स्यन समय एक दिवस है जबकि पेअर ट्रॉलर का दो दिवस है। मछलियों की मौसमिक प्रचुरता के अनुसार यानों के प्रचालन में भी परिवर्तन लाया करता है माने कभी कभी पेअर ट्रॉल सिंगिल ट्रॉल में और सिंगिल ट्रॉल पेअर ट्रॉल में परिवर्तित करता है। सिंगिल जाल ने जनवरी-जून के दौरान यात्रायें माने 67 और पेअर जाल जुलाई-सितंबर के दौरान सब से अधिक मत्स्यन यात्राएं माने 35 यात्रायें आयोजित की। पेअर ट्रॉलर से प्रति ट्रिप में जुलाई-सितंबर के दौरान सब से अधिक मछली प्राप्त की थी।

नियत लागत

ट्रॉल का वार्षिक औसत लागत 42,250 रु और पेअर ट्रॉलर का 97,750 रु आंका गया।

मौसमिक पकड और राजस्व

झींगों की सब से अधिक पकड ट्रालरों से जनवरी-मार्च के दौरान और पेअर ट्रॉलरों से अक्तूबर से दिसंबर के दौरान मिली। महाचिंगट, फीतामीन और करंजिड ट्रालरों और पेअर-ट्रालरों से नियत महीनों में प्राप्त हुई। ट्रालरों से सभी महीनों में चिंगट मिली और पेअर ट्रॉलरों से महाचिंगट। अक्तूबर-दिसंबर के दौरान दोनों ट्रालरों से मुल्लन ज़्यादा मात्रा में प्राप्त हुई। ट्रालरों की वार्षिक औसत पकड 94.7 टन और पेअर ट्रालरों की 157.8 टन थी। इसका मूल्य यथाक्रम 3.46 लाख और 6.79 लाख टन आंका गया। प्रत्येक ट्रिप से प्राप्त राजस्व यथाक्रम 1443 रु और 6724 रु आंका गया।

शिंगटियों का योगदान

शिंगटियों की पकड के संबंध में पिछले कुछ वर्षों में चलाये अध्ययन ने व्यक्त किया है कि इनकी पकड वर्धित करने की ज़रूरत नहीं है क्योंकि पकड दबाव बहुत अधिक है। ट्रालरों में *एम. डोबसोनी* और *एम. स्ट्रिड्युलन्स* और पेअर ट्रालरों में *पी. सेमिसुलकाटस* ज़्यादा मिलती है।

उत्पादकता, लाभ और वित्त क्षमता

उत्पादकता और लाभ की दृष्टि से दोनों ट्रालर अच्छा देखा गया। ट्रॉलर के प्रति ट्रिप की औसत पकड 394 कि ग्राम और पेअर ट्रॉलर की 1434 कि ग्राम मछली थी। ट्रॉलर का वार्षिक लाभ 68,639 रु और पेअर ट्रालर का वार्षिक लाभ 1,36,491 रु आंका गया। सभी प्रकार के वित्तीय प्राचलनों को ध्यान में रखते हुये किये गये अध्ययनों से व्यक्त हो गया है कि अभी नागपट्टनम में किये जानेवाले ट्रालरों का परिचालन सन्तोषजनक है और ट्रॉल मत्स्यन में वैविद्यता लाने की कोई ज़रूरत नहीं है।

मिनिकोय लैगून में *ग्रेसिलेरिया एडुलिस* का अभूतपूर्व संवर्धन

पिछले दो दशक से भारत में वाणिज्य प्रधान समुद्री शैवाल *ग्रेसिलेरिया एडुलिस* के संवर्धन केलिए प्रयत्न हो रहे हैं। फाइकोकोल्लोइड ऐगार-ऐगार नामक औद्योगिक कच्चे माल का उत्पादन इस से होता है।

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान और केन्द्रीय नमक और समुद्री रसायन अनुसंधान संस्थान ने संयुक्त रूप में इस एगारोद्भिद के संवर्धन केलिए एक सुसंगत रीति प्रस्तुत करने केलिए निरन्तर प्रयास कर रहे है ताकि यहाँ दिन-व-दिन बढते जाने वाले ऐगार उद्योग केलिए आवश्यक कच्चे माल प्रदान कर सके। इस दिशा में कुछ न कुछ सफलता भी हुई है जैसे उत्पादन मूल्य में क्रमाधिक वृद्धि दिखाई पडी।

जी. एडुलिस के संवर्धन के लिए सुसंगत रीति ढूँढ निकालने के उद्देश्य से मिनिकोय लैगून में 1989 से निरीक्षण शुरु किया और इसका परिणाम भी प्रोत्साहजनक था। रस्सी या जाल में प्रस्तुत किए गए बीजों का 60 दिनों में 7.1 गुना उत्पादन मूल्य प्राप्त हुआ था।

मिनिकोय लैगून में 1992 के दौरान भी यह परीक्षण जारी किया। फिशरीश जेटी में सितंबर 1992 को लगायी रस्सी में 50 दिनों के बाद 31 गुनी वृद्धि रिकार्ड की गयी। नवोदया स्कूल के निकट किए गए परीक्षणों ने 11 गुनी और 12.6 गुनी वृद्धि दिखाई। इंन्डियन कोस्टल वाटेर्स केलिए यही अधिकतम उत्पादन है। आगे की कार्रवाई हो रही है।

इन परिणामों से अनुमान कर सकता है कि इसके पहले के उत्पादन मूल्य में हुई कमी का कारण मछलियों द्वारा फसल की चराई ही थी। यद्यपि कुछ रस्सियों में इस साल भी चराई देखी गयी, तथापि यह विशेष रस्सी मछली और अन्य जीवियों से बची रही और इसने मिनिकोय लैगून में समुद्री शैवाल *जी. एडुलिस* का अधिकतम उत्पादन की वास्तविक शक्यता के बारे में धारणा भी प्रदान की। अतः समुद्री शैवाल कृषि का पूरा लाभ उठाने केलिए मछलियों और अन्य जीवियों द्वारा फसल की चराई रोकना अनिवार्य है।

वी. एस. के. चेन्नुबोतला, सर्वश्री वी. ए. कुंजिकोया और अनसुकोया, सी एम एफ आर आइ का मिनिकोय अनुसंधान केन्द्र, लक्षद्वीप।

गैर मौसम में खाद्य शुक्ति *क्रासोस्ट्रिया माड्रॉसेन्सिस* का संभाल और (पेस्टन) अंडजनन

आर्थिक दृष्टि से प्रमुख द्विकपाटी मोलस्क के बीजोत्पादन केलिए हैचरी प्रणाली इस सदी के तीसवीं दशक में विकसित की है। शुक्ति बीजों की उपलब्धि केलिए हमेशा प्रकृति पर निर्भर नहीं रह सकती। अब बृहत पैमाने में बीजोत्पादन करने की सुविधा स्पुटनशाला में उपलब्ध है। इसके अलावा हैचरी कृषियोज्य जातियों की तीव्र बढती केलिए आवश्यक अध्ययन की सुविधा भी प्रदान करती है।

टूटिकोरिन में, प्राकृतिक संस्तरों में *शुक्ति क्रासोस्ट्रिया माड्रासेन्सिस* (पेस्टन) का अंडजनन अप्रैल-मई और अगस्त-सितंबर के दौरान होता है। बाकी महीनों में अंडजनन उतना तीव्र नहीं होता। इसलिए सारे महीनों में अंडजनन की प्राप्ति केलिए हैचरी में साल भर परिपक्व शुक्तियों का अनुरक्षण करना अनिवार्य है। यह साधारण अंडजनन अवधि को छोडकर बाकी समय परिपक्व करने की प्रक्रिया को बढाकर या अंडजनन काल में परिपक्व शुक्तियों का अंडजनन विलंबित करके किया जा सकता है। यहाँ दूसरा तरीका ही स्वीकार किया है।

टूटिकोरिन के निकट के कोरमपल्लम खाडी से परिपक्व शुक्तियों का संग्रहण किया था। संगृहीत शुक्तियों की लंबाई 70-120 मि मी तक रही और इन्हें 100/लि धारिता के 11

फाइबर ग्लासों में प्रत्येक में 15 शुक्तियों की दर में डाल दिया। उच्छिष्टें निकालने का प्रबंध भी किया था। निरीक्षण कंडीशनींग कमरे में किया था जहाँ जल का ताप 20 ± 1°C में रखा गया था। लवणता 32 से 33ppt में अनुरक्षित की। इसकेलिए फिल्टर किये समुद्र जल एक कंडीशनिंग कमरे में एक दिन स्टोर करने के बाद उपयोग किया था। रोज़ पानी बदलकर हल्का वातन दिया। पानी बदलने के बाद हर बैच शुक्तियों को 35 लि मिश्रित शैवाल खाद्य के रूप में दे दिया।

15 शुक्तियों का 29 to 1°C ताप में प्रेरित अंडजनन किया गया।

अगस्त और सितंबर 88 के दौरान प्रेरित अंडजनन से प्राप्त शुक्तियों की प्रतिशतता ऊँची थी (73.80%) इसके अनुवर्ती पाँच महीनों में अंडजनन की प्रतिशतता 20-60% दीख पडी। अध्ययन सूचित करता है कि *सी. माड्रासेन्सिस* का अंडजनन 20 ± 1°C के निम्न तापमान में छः महीने तक विलंबित किया जा सकता है।

इस प्रकार परिपक्व शुक्तियों को अंडजनन काल के परे संभालके रखकर साल भर बीजोत्पाद प्रदान करना विज्ञान की एक आशाजनक कार्य प्रणाली है।

तैयारी टूटिकॉरिन अनुसंधान केन्द्र के रानी पलनिस्वामी और एस. एम. सत्ताक्कातुला।

सासून डॉक में "डोल" के आर्थिक काम पर एक शोध टिप्पणी

स्टेकनेट जो "डोल" नाम से महाराष्ट्र में विख्यात है, बम्बिल, एसिटीज़ आदि मछलियों के मत्स्यन केलिए उपयुक्त प्रधान गिअर है। कुछ केन्द्रों में मानसून के कुछ महीनों को छोडकर बाकी सारे के सारे महीनों में "डोल" का योगदान उल्लेखनीय है। "डोल" एक स्टेकनेट होने पर भी आजकल अधिकांश यूनिट यंत्रीकृत पोतों का प्रचालन करते हैं। "डोल" की तैयारी में "खम्बा" प्रणाली अधिक लोकप्रिय और तकनीकी दृष्टि से प्रभावी भी है। लेकिन इसका लागत ज्यादा ऊँचा होने के कारण मछुओं ने "खन्द" प्रणाली स्वीकार किया है। "खन्द" एक लकडी का नुकीला दंड है जो समुद्र के पंकिल तल में चलाकर जाल बाँदने केलिए उपयोग करता है।

सासून डॉक महाराष्ट्र के प्रमुख अवतरण केन्द्रों में एक है जो बंबई नगर के एक हिस्सा होने के कारण सारे अवसंरचना एवं मत्स्य विपणन सुविधाओं से सज्ज है। यहाँ साधारणतया ट्राल और "डोल" का अवतरण होता है। केन्द्रीय मात्स्यिकी अनुसंधान संस्थान, कोचीन द्वारा 1990-91 के दौरान चलाये गये आर्थिक अध्ययन के आधार पर सासून डॉक केन्द्र में "डोल" प्रचालन के आर्थिक निष्पादन का विश्लेषण करने का एक प्रयास किया गया। इस केन्द्र में "डोल" प्रचालन साल भर होता है। मछली पकड और प्रचालन व्यय के निरीक्षण केलिए अप्रैल 1990 से हर एक महीने के 10 सैंपिल दिनों के डाटा का संग्रहण किया गया।

निवेश और वार्षिक नियत लगत

इनबोर्ड इंजन के एक नये क्राफ्ट का मूल्य 2 लाख रुपये है और "डोल" एकक के जालों का मूल्य 0.3 लाख रुपये। क्राफ्ट केलिए 10% और गिअर केलिए 33.33% अवमूल्यन लेने पर वार्षिक अवमूल्यन 30,000 रुपये तक आता है। इसी प्रकार दर, प्रति वर्ष 15% का एक छोटा ब्याज लेने पर 2.3 लाख के मूल निवेश पर 34,500 रु का वार्षिक ब्याज देना पडता है। इस प्रकार वार्षिक नियत लगत 64,500 रु अनुमानित किया गया है।

प्रचालन लागत

प्रचालन व्यय के मुख्य घटकें ईंधन, मज़दूरी, मरम्मत, अनुरक्षण और विपणन है। एक एकक के 6 व्यक्तियों के औसत दल का आहार केलिए वर्ष में 65,520 रुपये का खर्च होता है। 1990-91 के दौरान ईंधन पर 25,390 रुपये खर्च किया था। मरम्मत व अनुरक्षण और विपणन का लागत क्रमशः 11,000 और 9,500 रु दीख पडा। इस प्रकार अध्ययन की अवधि में प्रचालन व्यय 1,11,410 रुपया देखा गया।

सासून डॉक में एक "डोल" जाल केलिए नियत एवं परिवर्तनीय व्यय जोडकर वार्षिक मत्स्यन व्यय 1,75,910 रुपये तक आता है।

उत्पादन और आय

"डोल" जाल एककों द्वारा 1990-91 के दौरान औसत 273 दिनों का मत्स्यन हुआ था। पकड में ऐसीटीज, बम्बिल, झींगे, क्लूपियोइड्स, फीतामीन आदि मुख्य थे। अधिकतम पकड, 7775 कि. ग्रा (23,350 रु) और न्यूनतम पकड, 2150 कि. ग्रा (9,375 रु) सितंबर में थी। 12 महीनों में 8 महीनों के दौरान ऐसीटीज़ की अच्छी पकड प्राप्त हुई थी। जुलाई से नवंबर तक बम्बिल पकड 20% से अधिक थी। मासिक पकड में क्लूपियोइड्स 6-26% और फीतामीन 1 से 5% देखा गया। सितंबर और अक्तूबर में पॉम्फ्रट की पकड काफी अच्छी थी।

कुल आय 1,94,533 रुपये में अधिकांश योगदान सितंबर और न्यूनतम मार्च में मिला था। मत्स्यन दिवस महीने में 20-25 दिनों तक रहा। वार्षिक आय में अधिकांश योगदान ऐसीटीज़ और बम्बिल का था। मासिक आय के 12-30% पेनिआइड झींगों का योगदान था।

लाभ स्तर

अध्ययन की अवधि के दौरान एक "डोल" एकक का वार्षिक लाभ 18,623 रुपये आकलित किया गया है। प्रति व्यक्ति द्वारा प्रतिदिन उत्पादन 31.3 कि. ग्रा. था। एक कि. ग्रा मछली उत्पादन केलिए 0.5 रुपये का ईंधन की आवश्यकता पडती है और आय में 3.79 रुपये जोडते है। प्रति कि. ग्रा मछली का वास्तविक लाभ 0.36 रुपये आकलित किया गया है। इस प्रकार सासून डॉक में 1990-91 के दौरान "डाल" प्रचालन लाभकारी ठहरा।

तैयारीः सी एम एफ आर आइ कोचीन-31 के डी. बी. एस. सेहरा, ए. वाई. मेस्ट्री और के. पी. शालिनी

मंडपम क्षेत्र में फीतामीन मात्स्यिकी का पुनर्जागरण

उन्नीस सौ साठ से शुरु होनेवाले वर्षों में मंडपम क्षेत्र से तट संपाशों एवं ड्रिफ्ट गिल जालों द्वारा फीतामीनों की बडे पैमाने की पकड हुई थी। वर्ष 1962 में रामेश्वरम द्वीप से भी *ट्रैक्यूरस लेप्ट्यूरस* की भारी पकड हुई। लेकिन हाल के वर्षों में फीतामीनों के अवतरण में उल्लेखनीय कमी दिखाई पडी। वर्ष 1980-91 के दौरान रामेश्वरम से सिर्फ 112 टन फीतामीनों का अवतरण हुआ जो कुल अवतरण का 0.05% था और कई वर्षों से लेकर इनका अवतरण नहीं के बराबर था।

मार्च 1992 में रामेश्वरम से यंत्रीकृत युग्म यानों द्वारा 12 मी गहराई से 45.18 टन फीतामीनों की पकड हुई। अवतरण के ऋंग काल में एक दिन में 320 कि ग्रा और एक एकक द्वारा 4 टन फीतामीनों को पकडा गया। दिनांक 4-3-1992 से लेकर शुरू हुआ मत्स्यन दिनांक 24-3-1992 तक पहूँचने पर उसी मत्स्यन क्षेत्र से मछली समूह (Shoal) दूर जाने के कारण खत्म करना पडा।

पकड में *ट्रैक्यूरस लेप्ट्यूरस* जाति प्रमुख थी और मछलियों का आकार 640-659 मि मी था। इनके पेट का विश्लेषण करने पर खाद्य का अंश दिखाया पडा। सभी नमूने अंडरिक्त (Spent) अवस्था और इस अवस्था की समाप्ति पर थे। मादा और नर नमूनों का अनुपात 3.5:1 था।

फीतामीनों की पकड को प्रति कि ग्रा केलिए 4/- से 6/- रु. को बेच दिया। अवतरण का 80% बर्फ में डालकर परिरक्षित किया और केरल के बाज़ारों में बेच दिया और बाकी पकड तमिलनाडु के मदुरै, कोयम्बतूर और पोल्लाच्ची के बाज़ारों में बेच दिया।

टिप्पणी

साधारणतया इस जाति में *टी. लेप्ट्यूरस* प्रमुख है जिनमें अधिकांश नमूने 50 से मी लंबाई और अंडरिक्त अवस्था के होते हैं। अध्ययनों से व्यक्त हो गया है कि फीतामीनों में अप्रैल से जुलाई-अगस्त महीनों के प्रारंभ से लेकर दक्षिण की ओर जाने की प्रवणता है। *टी. लेप्यटूरस* अगस्त से अक्तूबर तक झुंडों में रहती है। हाल में यह रिपोर्ट मिली है कि अंडजनन के समय में इसमें झुंडों में रहने की प्रवणता अधिक है। वर्तमान अध्ययनों से व्यक्त हो जाता है कि मंडपम क्षेत्र में अप्रत्यक्ष फीतामीनों की मात्स्यिकी में महत्वपूर्ण पुनर्जागरण दिखाया पडता है।

मंडमपम क्षेत्रीय केन्द्र के पी. जयशंकर द्वारा तैयार किया लेख।

रामेश्वरम से पेअर ट्रॉलरों द्वारा शिंगटी की पकड

वर्ष 1980-81 के दौरान पाक उपसागर, मंडपम, पाम्बन और रामेश्वरम में बडे जाल लगे हुए युग्म यानों (पेअर ट्रॉलर) द्वारा मत्स्यन करने का श्रम हुआ। पिल्लै और सत्यदास ने इस के बारे में वर्ष 1982 में विस्तृत विवरण दिया और उन्होंने रिपोर्ट की कि रामेश्वरम से फरवरी अप्रैल के दौरान 109 टन शिंगटियों का अवतरण हुआ जो कुल अवतरण का 9.32% था। बाद में भी इस तरह के मत्स्यन के बारे में कई व्यक्तियों ने रिपोर्ट की है।

वर्ष 1988-92 के दौरान युग्म यान द्वारा शिंगटी की मात्स्यिकी

इस अवधि में कुल मछली अवतरण में 3245 और 3941% की वृद्धि दिखाई पडी। शिंगटी की पकड में वर्ष 1988 में 77.03 टन और वर्ष 1991 में 19.18 टन की घटती हुई। लेकिन वर्ष 1992 में पिछले वर्ष की अपेक्षा 1820% वृद्धि अंकित की। वर्ष 1988 और 1991 के जाति मिश्रण में *टैकीस्युरस सिलाटस* प्रमुख (69%) था। वर्ष 1992 में सोलिटयर शिंगटी *ओस्टिओजनीसस मिलिटारिस* का अवतरण सभी शिंगटी जातियों का 61.85% हुआ था। पाक उपसागर और मन्नार खाडी से इस जाति का भारी अवतरण इससे पहले कभी नहीं हुआ है।

वर्ष 1992 की शिंगटी मात्स्यिकी का विवरण

वर्ष 1992 के जनवरी-अप्रैल के मध्यकाल में रामेश्वरम के 10-25 कि मी उत्तर-पूर्वी दिशा में युग्म यानों का परिचालन करके पकडी गई 12,874.55 टन मछलियों का 3 % शिंगटी थे। फरवरी महीना पकड का श्रृंग काल था। कुल शिंगटी पकड में *ओ. मिलिटारिस* के अनुपात का रेंच जनवरी में 59.6% और अप्रैल में 64.9% था।

वर्ष 1988-92 के दौरान की शिंगटी पकड और सितंबर-अप्रैल में हुई कुल बारिश इन दोनों के बीच का विपरीत संबंध व्यक्त करती है। वर्ष 1991 में न्यूनतम पकड 19.18 टन और अधिकतम बारिश भी अंकित की। सितंबर, 1991 से अप्रैल, 1992 तक बारिश में 584.8 मि मी कमी होने पर भी शिंगटियों की पकड में उल्लेखनीय वृद्धि देखी गई है।

मार्च महीने में *ओ. मिलिटारिस, टकिस्युरस सीलाटस* और *टी. माक्युलाटस* का जीव वैज्ञानिक अध्ययन किया गया। *ओ. मिलिटारिस* की लंबाई का रेंच 220 से 419 मि मी तक है और नर-मादाओं का अनुपात 2:1 भी। मादा शिंगटियों का 88% IV-VII अवस्थाओं में और 25% VI यानी पूर्ण परिपक्वन की अवस्था में थीं। *टी. सीलाटस* का लंबाई रेंच 322 से 590 मि मी तक है और नर-मादाओं का अनुपात 2.1:1, जिनमें 65% मादा IV-VII और 3% VI अवस्था में थी। *टी. माक्युलाटस* का लंबाई रेंच 204-333 मि मी है और नर-मादाओं का अनुपात 1:1, जिनमें 90% मादा IV-VII और 65% VI अवस्था में थी।

विपणन

वर्ष 1992 में केरल के व्यापारियों के बीच में युग्म यान मात्स्यिकी की पकड को बडी मौंग थी। अवतरण के श्रृंगकाल (फरवरी) में रामेश्वरम अवतरण केन्द्र में प्रतिदिन 35 लॉरियाँ मछली लेने केलिए आयी और शिंगटियों का 10% खरीदी थी। 70% तमिलनाडु के तिरुच्ची, कोयम्बतूर, मदुरै और पोल्लाच्ची के बाज़ारों में बिके गये और बाकी मछलियों को सुखाया गया। मात्स्यिकी के श्रृंगकाल में भी इस मछली का दाम प्रति किलोग्राम के लिए 5 से 7/- रुपए रहा।

टिप्पणी

युग्म यानों के परिचालन के प्रारंभकाल में मुख्य रूप से पाम्फेट्स का अवतरण किया जाता था लेकिन बाद के वर्षों में तारली जैसे अन्य मुख्य जातियों का अवतरण होने लगा। यह साबित हुआ है कि इस क्षेत्र के नितलस्थ समुद्र की मछलियों को पकडने योग्य गियर है युग्म यान।

पी. जयशंकर और एम. बोस, मंडपम क्षेत्रीय
द्वारा तैयार किया लेख।

महाराष्ट्र के मकराबाग में तिमि सुरा का अवतरण

महाराष्ट्र के मकराबाग के मछली अवतरण केन्द्र में "भेरा" नाम से पुकारे जानेवाला *रिनिओन टाइप्स* जाति का एक तिमि सुरा का अवतरण 21-2-1992 को हुआ। इसे 48 मी गहराई से ट्रॉल नेट के ज़रिए पकडा था। इसे काटकर टुकडों में बेचकर मछुओं ने 400 रुपये कमाये।

सी एम एफ आर आइ का मालवन क्षेत्र केन्द्र के. आर. मयंकर की रिपोर्ट

महाराष्ट्र में समुद्री कच्छप *लेपिडोचेलिस ओलिवेसिया* का अवतरण

बबंई के निकट कोल्लिवाडा में 3-5-1991 को *लेपिडोचेलिस ओलिवेसिया* जाति का एक मृत समुद्री कच्छप का अवतरण हुआ। पूछताछ पर व्यक्त हो गया कि एक डोल नेट में 3 समुद्री कच्छपों को पकडा था जिन में दो जिन्दा थे जिन्हें समुद्र में फिर से छोड दिये। मृत कच्छप को तट पर छोड गया था और इसका 34.8 कि ग्राम था।

सी एम एफ आर आइ के होटागी क्षेत्र केन्द्र के जयदेव. एस की रिपोर्ट

कोलचल में लेथरबाक कच्छप का अवतरण

तमिलनाडु के कोलचल से तारीख 3-8-91 को *डेरमोशेली कोरियेशिया श्लेगेलि* जाति की एक कच्छप का अवतरण हुआ। इसका स्थानीय नाम "ओडविट्टा अमई" है। 15 मी की गहराई में बोट सीन के परिचालन करने पर इसे मिला था। इसको बेचने पर 750 रु दाम मिला।

सी एम एफ आर आइ के कन्याकुमारी फील्ड सेन्टर के आई. पी. इबनेज़र और विषिंजम अनुसंधान केन्द्र के जेकब जेरोल्ड जोइल की रिपोर्ट

GUIDE TO CONTRIBUTORS

The articles intended for publication in the MFIS should be based on actual research findings on long-term or short-term projects of the CMFRI and should be in a language comprehensible to the layman. Elaborate perspectives,material and methods, taxonomy, keys to species and genera, statistical methods and models, elaborate tables, references and such, being only useful to specialists, are to be avoided. Field keys that may be of help to fishermen or industry are acceptable. Self-speaking photographs may be profusely included, but histograms should be carefully selected for easy understanding to the non-technical eye. The write-up should not be in the format of a scientific paper. Unlike in journals, suggestions and advices based on tested research results intended for fishing industry, fishery managers and planners can be given in definitive terms. Whereas only cost benefit ratios and indices worked out based on observed costs and values are acceptable in a journal, the observed costs and values, inspite of their transitionality, are more appropriate for MFIS. Any article intended for MFIS should not exceed 15 pages typed in double space on foolscap paper.

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