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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.

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ARTIFICIAL REEF FOR ARTISANAL FISHERIES ENHANCEMENT - AN ATTEMPT OFF TRIVANDRUM COAST

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INTRODUCTION

Several demersal fishes are found to congregate in the vicinity of submerged objects such as reefs, logs, ship-wrecks and rock out-crops where plants and benthic animals flourish than in areas where the bottom is flat and barren. These communities serve as food for larger predators. Submerged objects may, at times, provide shelter and even spawning locations for many-a-fish. Underwater observations made by divers while retrieving portions of submerged vessels also report that such habitats harbour considerable concentration of fishes .

The use of artificial structures to attract fish and/or enhance fisheries has long been practiced. Increasing impacts on nearshore fisheries from fishing pressure, habitat loss and pollution have caused fisheries authorities in coastal areas of the world to consider the potential for artificial reefs. Artificial reefs and fish aggregating devices are frequently and successfully used to create fishing areas near artisanal villages in several nations . Although utilization of artificial aquatic habitats has occurred for centuries, scientific description of their function and impact has been done only recently. In India, Bergstrom (*BOBP/WP* - **23**, 1983) reveiwed the traditional fish aggregating devices used in the Bay of Bengal. A modified artisanal artificial fish habitat on the Tamil Nadu coast of India has been described by Sanjeevaraj (*Bull. Mar. Sci.*, **44** (2) 1989). A synthetic fish aggregating device-cum-artificial reef has been developed by the Murugappa Chettiar Research Centre (The Hindu, 22 Feb., 1989). An artificial reef structure made of automobile tyre attached to R. C. C. base by M. S. rods is being installed at Minicoy by the Central Marine Fisheries Research Institute to study the aggregating behaviour of tuna live-baits (*CMFRI News Letter No.* **41**, 1988).

The benthic realm of the shelf area stretching between Cape Comorin and Vizhinjam in the south-west coast of India has plenty of rocky out-croppings which harbour rich and varied fauna of fish and the fishermen are immensely benefited by this favourable environment. Similarly, the ship-wreck found off Angengo at a distance of about 10 km from the shore at 40 - 50 m depth also harbours a variety of fish which are being exploited by the fishermen of the neighbouring villages. But, as the adjoining area found in between Panathura and Valia Veli (Fig. 1) being free from any such out-croppings, the fishermen are deprived of the benefits which their counterparts in the neighbouring areas enjoy. This has prompted them to develop artificial reefs, called *paars* in vernacular, in that area to make the fish to congregate there. An attempt is made here to study the impact of such artificial reefs on the local fisheries and the salient findings emerged during a study spread over a period of two years ie., from May. '87 to April, '89 are presented here.

The general information given regarding the first six artificial reefs was collected from the fishermen who were involved in the construction and management of the artificial reefs in the area in the recent past. Details pertaining to the 7th artificial reef were collected by making direct onboard and shore based observations. Out of the seven reefs, fishing was done only in three reefs (Valiyathura, Kochuthoppu-I and Kochuthoppu-II) and hence the data given here relate to these three reefs only. Among these the Kochuthoppu-II reef was in operation only for one year from April, 1988. As the landings were brought to Valiathura landing centre from the reef as well as from the neighbouring fishing areas, the centre was visited weekly once and the landings were recorded separately for the reef as well as for other areas and their total landings were estimated monthwise. On-the -spot observations were also made on the fishing in the reef. Fourteen sampling units, each consisting of a granite stone weighing 2 kg, (square) bits of tyre, plywood, asbestose and roof tile tied to a nylon rope (1cm thickness) at 25 cm interspace, were placed over the reef to study the benthic community. Underwater observations were made on the reef site by scuba diving.

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Artificial reef construction and managment

Reef construction

Reefs were constructed mostly in the sandy region at a depth varying from 5 to 27m. Granite stones of varying sizes were put first on the site selected for the reef construction so as to form a circular or rectangular ridge. Over these, concrete rings (Front cover photo) of 150 cm diameter into 45 cm height locally called 'urai' used for lining the inner side of commmunity wells, were placed. After this, any locally available unwanted/cheap materials like broken concrete slabs, worn-out rubber tyres, empty barrels, up-rooted coconut tree stumps and leaves, screw pine plants etc., were placed in an unorderly manner over this, so as to provide shade and shelter for the fish (Fig. 2). Coconut leaves were also used to tie 2 to 3 granite stones together at the time of loading the stones to the catamarans. Some reefs are even known after the material used such as 'ola paru' and 'kaitha paru' meaning, reef made of coconut leaves or of screw pine plants respcetively. The materials were transported to the reef site by catamarans (non-mechanised). Sometimes 2 or 3 loaded catamarans are towed to the reef site by mechanised boats if the distance to the site from the shore is considerable. After reaching the spot, the material are dumped by turning the catamaran upside-down. As given earlier, seven artificial reefs, as listed in Table 1, have been diveloped in this region. Of these the first six were constructed in 1988 by the Kochuthoppu fishermen by utilising SIFFS funds. Of the first six listed, two got submerged due to silting and 2 were abandoned due to objection from local fishermen; since they were built within the reach of shore seine operation. The first two in the list were renovated subsequently and they along with the 7th one, are of little use as fish congregating device now.

Fishing

Those who were involved in the construction of the reef only are allowed to fish from the artificial reef. There is no float or flag to locate the reef site for fear of poaching by other fishermen. Eventhough fishing was done throughout the year in the neighbouring areas, in the reef environment, it is done only during the calm season between November and April. The fishermen venture into the reef only during day time. Though a variety of gears are employed in the neighbouring areas, only hooks and line (non-mechanised) are operated in the artificial reefs. "Achil", a kind of hooks and line with hooks varying in size from No. 12 to 8, with artificial baits are used. On bright sunny days and in clear weather conditions the fishing operations are found more economical. A single unit goes thrice a day during the peak season. At a time about 15 to 20 such units are operated at a single reef site. Normally single manned catamarans of the size 5 m with 4 logs are used for fishing.

Fisheries

Trend in fisheries

Landings realised during the period 1987-'88 and 1988-'89 from the artificial reef environment and 'other region', ie., from Cheriyathura in the south to Shangumugam in the north are furnished in Table 2. A perusal of the above table indicates that the landing during 1987-'88 from the reef environment was only 59.0 tonnes as against 636.0 tonnes from the 'other region'. A drastic reduction in the landing from the reef environment could be noted during the subsequent year, ie., 1988-'89, with a total of 24.2 tonnes. In otherwords, the percentage contribution of fishes from the artificial reef environment dwindled to 3.6 from 8.5.

The fishing season in the reef environment lasted for about 6 months from November in 1987-'88, while in 1988-'89 it lasted only for 5 months from December. Peak landing was observed during February in 1987-'88 and in March during 1988-'89. The landing from the 'other region', on the contrary, was spread over the year with peak landing during February and March respectively for the above two years (Table 2).

Gear - wise contribution

As mentioned earlier, hooks and line operated from non-mechanised units were in vogue to exploit the fishes from the reef region. But in the 'other region', in additon to the above gear, hooks and line operated from mechanised craft, shore seine, boat seine and gill nets were also operated.

Species composition

Fishes like *Decapterus dayi, Carangoides plagiotaenia, Priacanthus hamrur, Sphyraena* sp. *Rastrelliger kanagurta* and *Nemipterus* spp. dominated the catch of the reef region, while in the 'other region' *Selar crumenophthalmus, D. dayi, Auxis rochei, Trichiurus lepturus, Rastrelliger kanagurta, Euthynnus affinis, Nemipterus* spp. *Sarda orientalis* and *Dussumieria* spp. dominated (Table 3). Among the dominant groups, fishes such as *D. dayi, R. kanagurta* and *Nemipterus* spp. were common in the catches of both the regions. The dominance of species like *Carangoides plagiotaenia, Priacanthus hamrur* and *Sphyraena* sp. in the reef region shows that the reefs attract both reef dwelling and demersal forms of fishes as expected. Fishes like *Carangoides plagiotaenia, Lethrinus harak, Selar*

TABLE 1. *Details of the artificial reefs constructed off Trivandrum coast*

Name of the reef	Location of the reef	Year of construction	Depth (m)	Distance from shore	Materials used for the construction	Remarks
Valiathura reef (*Kaitha Paru*)	On the south-western side of Valiathura pier	1983	20	Beyond the reach of shore seine operation	Coconut tree stumps, concrete rings, granite stones, empty barrels and screw pine trees	A local ex- service man and the village parish priest supported the fishermen. Renovated once. Slight fish aggregation
Kochuthoppu reef I (*Ola Paru*)	On the south-western side of Kochuthoppu	1984	18	Beyond the reach of shore seine operation	Granite stones concrete tub (4x4') used for salting fish, coconut tree stumps and plaited coconut leaves	Fishermen belonging to the Vanakkapura committee. Renovated once. Slight fish aggregation
Beemapally reef	In between of Beemapally and Poonthura	1984	10	With in the reach of shore seine operation	Granite stones and coconut tree stumps	Discontinued as the shore seines got entangled to the reef material
Vettukadu reef	North - west of Kannanthura	1984	5	Within the reach of shore seine operation	Concrete rings, coconut tree stumps and wooden logs	Discontinued as the shore seine fishermen objected to it
Cheriathura reef	In between of Cheriathura and Valiathura	1984	16	Beyond the reach of shore seine operation	Concrete rings and granite stones	Almost burried due to silting
Shanmugam reef	Off Shanmugam	1985	20	Beyond the reach of shore seine operation	Materials used for the construction of stage for the Papal Visit to Trivandrum	Almost buried due to silting
Kochuthoppu reef II	South - west of Kochuthoppu	1988	27	3 km beyond the reach of shore seine	Granite stones, coconut leaves and rubber tyres	Funded by SIFFS and managed by the local fishermen welfare society

kalla, Carangoides malabaricus and *Selaroides leptolepis* were found only in the reef region. It is interesting to note that these forms live normally in reef areas.

Underwater studies

Underwater observations were made on 26 - 10 - '88 and 10 - 1 - '89 by CMFRI scientists using Aqua lung in the Kochuthoppu reef II (Reef No. 7) constructed on 28 - 2 - '88. Due to poor visibility, the divers could not reach the reef bottom on 26 - 10 - '88. But during the second occasion they could reach upto the bottom and study the conditions there. The sea bottom at the reef site was found to be sandy and some of the reef materials were partly buried in sand due to heavy bottom current which was rushing from south to north. Even after one year of its construction the reef materials including the coconut tree trunks were found to be intact except the coconut leaf splinters used for binding the stones and the sampling units: It was found during diving that the layout of the reef was not properly made as to attract bigger fishes. However, the divers could observe large numbers of small fishes such as *Apogon novemfaciatus, Amphiprion* spp., *Chaetodon* sp. and *Dascyllus* spp. hovering over the reef materials. Fishes like *Epinephelus corallicola, Lutianus argentimaculatus, L. lineolatus, Petrois antennata, Spiloticthys pictus* and *Heniochus acuminiatus* were found in small numbers.

TABLE 2. *Monthly fish landings (kg) recorded at Valiathura landing centre during the years 1987 -'88 and 1988 - '89*

Month	From reef region				From 'other region'			
	1987 - '88	1988 - '89	Total	Average	1987 - '88	1988 - '89	Total	Average
May	-	-	-	-	33,384	18,600	51,984	25,992.0
Jun.	-	-	-	-	3,562	1,49,400	1,52,962	76,481.0
Jul.	-	-	-	-	33,534	12,710	46,244	23,122.0
Aug.	-	-	-	-	39,377	No data	39,377	19,688.5
Sep.	-	-	-	-	68,640	79,065	1,47,705	73,852.5
Oct.	-	-	-	-	18,792	56,460	75,252	37,626.0
Nov.	8,060	-	8,060	4,030.0	94,628	41,730	1,36,358	68,179.0
Dec.	465	372	837	418.5	81,237	45,203	1,26,672	63,336.0
Jan.	10,401	3,226	13,627	6,813.5	81,637	72,480	1,53,717	76,858.5
Feb.	28,304	7,392	35,696	17,848.0	61,637	67,620	1,29,257	64,628.5
Mar.	11,036	9,145	20,181	10,090.5	54,067	49,228	1,03,295	51,647.5
Apr.	687	4,050	4,737	2,368.5	65,646	51,690	1,17,336	58,668.0
Total	58,953	24,185	83,138	41,569.0	6,35,973	6,44,186	12,80,159	6,40,079.5

The general fish catch around that area on that day consisted of *Saurida* spp., *Priacanthus* sp., *Nemipterus* spp. *Decapterus dayi* and smaller carangids. The reef building poychaete, *Sabellaria spinulosa* was found plenty in the reef site.

Food preference

The gut contents of fish such as *Saurida undosquamis, S. tumbil, S. gracillis, Apogon novemfaciatus* and *Lutianus lineolatus* caught from the reef were dominated by the polychaete, *Sabellaria spinulosa.* However, the above species caught from the 'other region' and *Decapterus dayi* caught from the reef did not contain polychaete in their stomach.

General remarks

Recent studies (Artificial reefs and fish aggregating device, National Academic Press, Washington, 1988) on artificial reefs suggest that the reef site is more important than the design of the reef. The general guidelines for the placement of artificial reefs suggested are: (1) The site should be nearer to fishing villages to simplify the logistics of installation and to minimise travel time and fuel consumption before the fish can be processsed on land. (2) An artificial reef should not be placed in commercial fishing areas unless it is specially intended to close an area to these operations. (3) The artificial reef should be located 1 km from natural reefs, otherwise, the fish will tend to swim from one to the other. (4) Sites with strong tidal currents should also be avoided because these currents will cause erosion around the reef, unless the bottom is hard. (5) Mouths of rivers where siltation may bury the reef should also be avoided. (6) The long axis of the reef should be perpendicular to the prevailing current and along fish migratory patterns. A constant current is quite acceptable and is favourable to benthic filter feeders inhabiting the structures. (7) The depth of the reef must be approporiate for the target species. (8) A firm sand or shell bottom is most suitable for an artificial reef to prevent subsidence. (9) The bottom profile should be flat or gently sloping. (10) Soft clay,

TABLE 3. *Species constituting the catch (%) at Valiathura landing centre during the years 1987 - '88 and 1988 - '89 combined*

Species	Reef region	'Other region'
Rastrliger kanagurta	7.46	8.96
Euthynnus affinis	0.22	7.70
Sarda orientalis	-	4.27
Auxis rochei	-	10.24
Auxis thazard	-	0.99
Istiophorus sp.	-	0.82
Cybium sp.	-	0.30
Nemipterus spp.	5.71	4.68
Epinephelus spp.	2.05	0.36
Lutjanus malabaricus	0.76	0.36
Lethrinus nebulosus	0.90	0.17
Lethrinus harak	0.75	-
Pristipomoides typus	-	0.30
Priacanthus hamrur	17.15	0.93
Therapon sp.	-	0.34
Leiognathus spp.	-	0.82
Decapterus dayi	30.60	14.36
Selar crumenophthalmus	1.34	16.38
S. mate -	0.34	
S. kalla 0.17	-	
Carangoides malabaricus	0.01	-
Selaroides leptolepis	0.01	-
Carangoides plagiotaenia	17.28	-
Other carangids	3.30	5.76
Coryphaena sp.	-	1.06
Trichiurus lepturus	-	5.94
Lesser sardines	-	1.11
Stolephorus spp.	-	0.53
Dussumieria sp.	-	5.11
Sphyraena spp.	11.58	1.15
Saurida spp.	0.70	1.04
Balistids	-	0.26
Tylosurus sp.	-	0.45
Triacanthus sp.	0.01	0.04
Chorinemus sp.	-	0.32
Rays	-	0.02
Sepia spp.	-	2.47
Crab	-	0.04
Miscellaneous	-	2.38

silt sediments and areas that are already productive should be avoided. (11) High wave energy locations and areas with seasonally shifting sands should not be considered. The Japanese National Programme suggests that artificial reefs should have a hierarchial arrangement where modules form 'sets', 10-20 sets form a 'group' and several groups form a 'complex'. They advocate minimum effective sizes of 400m^3 for a set and 50,000 m^3 for a group, with at least a 1 km seperation between each group.

Though the reef sites selected at the Trivandrum coast have many of the favourable aspects mentioned in the guidelines, they lack certain important aspects such as a suitable depth to attract many of the reef fishes, a suitable bottom to increase the durability of the reefs and an area free from wave action to avoid silting. The bottom of the area in which the present reefs are built is sandy with high rate of silting due to high wave action. Because of high wave action and silting, the water becomes turbid especially during the monsoon months thereby making the fishing in the reef regions impossible for a major period. So it is suggested that the reefs should be constructed at a deeper area having sandy or some hard substrtatum so as to avoid turbidity of the water as well as sinking of the reefs. Already two out of six reefs are buried due to wave action and silting within a period of 2 - 3 years. Other two artificial reefs (Nos. 3 and 4 of the list given in Table 3) had to be abandoned subsequently since they were located within the zone of shore seine operation. This point requires special consideration in the present context since there is a marked delimitation in the operation of various gears along the coastal water. However, it seems that this point has not been considered while constructing the above said two artificial reefs. If the reefs are constructed at a deeper area, there is possibility of getting more varieties of fish especially perches and other economically important reef fishes. This needs careful monitoring of the area scientifically before fixing up the site. However, this has not been done in any of the present cases.

The material used for the construction of reef in the different parts of the world also vary considerably. The actual choice of the material shall be based on what is readily available and economically feasible. Bundles of brush wood are tied to lines to capture crabs, shrimps and small fishes in Japn, Philippines, Indonesia and Vietnam. In Central Africa, boxes full of leaves are placed at the bottom of lakes and estuaries. Ivory Coast fishermen place coconut palm fronds in shallow waters to attract shrimps. In the protected areas inside the bays on the south coast of Cuba, fishermen are still using "mangrove fisheries". Lobster shelters are also

made by constructing reef with mangrove branches. In the Philippines, "brush parks" have been developed to provide shelter and spawning grounds for fish. The traditional Japanses artificial reef involved simply placing shore or quarry rocks at shallow depths as a way to enhance fishing grounds. In North Japan, rocks are placed to enhance kelp production. In Virginia and New York (USA), slit tyres have been imbeded in a 10 cm concrete base for use as a reef module. A steel rod or cable is passed through the tyres for additional reinforcement. Automobile tyres are also used in Thailand for reef construction. An experimental artificial reef constructed of old tyres has been placed near Haifa, Israel. The Japanese have developed hundreds of types of concrete modules to increase fishing grounds. Damaged concrete pipes have been used for artificial reef construction in Hawaii. In Taiwan, concrete blocks have been used on sandy bottoms for over 10 years. In Thailand, artificial reefs have been made with concrete modules to enhance fishing grounds for artisanal fishermen. The trawler exclusion modules are also being combined with groups of artificial reefs to make the area free from trawling. In the United States, ribbons of fiberglass reinforced plastic (FRP) have been bonded into openmesh cylindrical shapes and then joined in arrays of 2 - 10. Cement ballast is used to anchor the units. In the United States obsolate oil and gas drilling rigs and its steel towers have been used to serve as artificial reefs. Here in Trivandrum, granite stones, empty barrels, cocrete rings, coconut tree stumps and leaves and worn-out automobile tyres are used in the construction of reefs.

For a country like India, two approaches are suggested for an artificial reef programme, depending on the available resources. According to the first, commonly available materials withstanding extreme weather conditions such as granite stones can be used for reef construction where funding is limited. The second approach is to fabricate specially designed permanent structure. This requires well-funded programmes, steel and concrete for construction, and larger vessels for their installation.

Acknowledgements

The facilities provided for taking the photographs of the artificial reef construction work by the authorities of South Indian Federation of Fishermen Societies, Trivandrum are greatly acknowledged.

COST AND EARNING OF TWO DIFFERENT SIZED 'DOL NET' BOATS AT VERSOVA (BOMBAY) *

The cost and earning of 7.5 and 12 m boats engaged in 'dol net' fishing are presented in this account. Though non-penaeid prawns accounted for bulk of the catch in both the categories of boats, the quantum of revenue realised depends largely on the magnitude of penaeid prawn landings. Considering the overall expenditure incurred for these boats, the small boat (7.5 m) is found to yield better economic returns. This is mainly due to the exhorbitant wages paid for the crew in bigger boats.

In the coastal sector of Maharashtra, the use of 'Dol net' (Bag net) has been in vogue, over the years. The 'dol net' fishing is one of the oldest method of catching Bombay duck and other fishes. This bag net mainly sustains the economy of a large segment of the fishing community of Maharashtra. Versova in Greater Bombay is a leading fish landing centre where almost 95% of the families depends directly or indirectly on 'dol net' fishery for their livelihood.

At this centre, 178 mechanised boats are exclusively engaged in 'dol net' fishing of which 60 are small (7.5 - 9.0 m) 47 medium (9.3 - 12.0 m) and 71 large (over 12 m). Though the size of boats and the depth of operation vary, the species composition remains more or less similar. Hence two types of boats viz. 7.5 and 12 m long classified as small and medium respectively were selected. Data on daily expenditure, catch, species composition and value realised were collected for three years continuously from 1983 - '84 to 1985 - '86. The cost and earnings of these two types of boats are dealt within this account.

Fishing pattern, season and effort

Usually the boats are owned by a single individual and he has to hire the crew for fishing activities. The fishing activities are being conducted as per direction or guidance given by the boat owner. The owners form into groups; each group consisting of three or more boats at the time of 'sus' making (driving spikes in the sea bed) in the fishing grounds. Further, they remain in groups for the entire season or perma-

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nently for all seasons. The duration of absence of these boats from the shore depends on the quantity of catch. During lean period, maximum number of boats i.e. 6 to 8 join together and each boat by turn returns from the fishing ground to landing centre, with the catch of the group fishing boats. The same boat carries water, food and other necessary items back to the fishing ground.

The operation of the 'dol net' depends on tidal current. Practically the dol nets remain in water for $4^1/_2$ to 5 hours at time of full or new moon. The rest of the time is required for hauling and shooting the nets and to unload the catch manually from net; whereas during neap tide period the net is operated for $2^1/_2$ to $3^1/_2$ hours due to slow tidal current which lasts for only few hours. The number of hauls made depends on the number of low and high tides, number of nets and distance to the fishing ground. The small boats having two nets are operated by three persons. The medium sized boats carry 2 or 3 nets and are operated by five members.

The fishing season commences from mid September or beginning of October and lasts upto the first week of June. The beginning of the season depends on the duration of monsoon and arrival of crew members from their home towns. The small boats are mostly operated by the owners and their family members with only a few hired crew. But the medium sized boats require more man power. Therefore, these boat owners have to wait until they get sufficient number of crew members.

Catch and disposal

The 'Dol' net is a multi-species gear like trawl. The mesh size varies from mouth to cod end of the net. Three types of cod end are used with mesh sizes of 1.3 - 1.5 mm for *Acetes* spp., 2.0 - 2.5 mm for *Palaemon tenuipes* and 3.5 to 4.0 mm for bigger forms like Bombay duck and others depending on their availability.

The catch of penaeid and non-penaeid prawns and all fish by the two types of boats during the different years is given in Table 1.

During 1983 - '86 the overall catch composition of small sized boat was: *Acetes* spp. 60%, *P. tenuipes* 12%, penaeid prawns 10%, Bombay duck 6%, *Cynoglossus dussumieri* 5% and others 7%. Similarly in medium sized boats, species composition was *Acetes* spp. 56%, *P.tenuipes* 12%, Bombay duck 8%, *Myctophids* 6%, *C. dussumieri* 5%, ribbon fish 4%, penaeid prawns 2% and others 7%.

About 85 - 90% of the 'dol net' catch is constituted by low priced fishes which are sun dried. The remaining quality varieties like prawns, pomfret and other fishes are sold in fresh condition in market. Dry fish is sold through three outlets - about 70% dry fish is sold to petty merchants locally, 25% at Marol wholesale dry fish market and 5% at retail market. The price of dry fish also varies according to place, quality and demand for particular fish.

Fishing expenditure

As seen from Table 2, the major component of the operational cost of small sized boat is the expenditure on food provided to the crew member, closely followed by oil and repairing charges; whereas in the case of medium sized boats, wages formed the major expenditure in the operational cost. This is because more number of hired labourers are engaged in medium sized boats. Regarding fixed cost, depreciation is calculated on the basis of the life of each capital asset and interest for capital investment calculated at the rate of 12%. The profit is calculated by deducting operational cost interest on capital investment and insurance of crew members, from revenue received for the three years separately. The quantum of revenue realised appears to depend largely on the magnitude of prawn landings, particularly the penaeid variety. The profit for small sized boats varied from Rs. 16, 988/- in 1984-'85 to Rs. 23, 411/- in 1985-'86; whereas in the case of medium sized boats there was a loss of Rs. 15, 887/- in 1983 - '84. This type of boat realized a maximum profit of Rs. 32, 897/- but considering the expenditure involved, the small sized boats were found to yield better return than the medium ones.

TABLE 1. *Catch details (in tonnes) of dol net boats at Versova*

Year	Small boat			Medium boat		
	Penaeid	Non-penaeid	All fish	Penaeid	Non-penaeid	All fish
1983 - '84	2.5	20.1	30.3	0.7	56.2	87.8
1984 - '85	1.2	26.4	32.1	0.9	131.6	163.4
1985 - '86	4.3	17.7	25.2	5.8	73.3	119.1

TABLE 2. *Annual costs and earnings for two different size dol net boats at Versova during 1983 - '86*

Particulars	Small size boat (25')			Medium size boat (40')		
	1983 - '84	1984 - '85	1985 - '86	1983 - '84	1984 - '85	1985 - '86
A. Initial investment	24,150			1,14,700		
B. Operational expenses :						
1. Oil	5,047	4,871	5,266	16,696	18,378	18,611
2. Preservation	1,100	1,262	1,710	2,772	3,817	7,230
3. Fish storage equipments	950	625	975	3,160	4,470	3,375
4. Crew's wages	1,567	1,477	1,650	50,061	43,618	49,880
5. Food and refreshment	5,755	5,860	5,845	11,400	13,650	15,275
6. Marketing expenses	2,180	1,798	1,754	3,367	3,591	3,545
7. Repair and maintenance	4,829	5,070	3,653	6,296	7,182	12,362
8. Miscellaneous	775	800	950	1,100	1,250	1,400
Total	22,203	21,763	21,803	94,852	95,956	1,11,678
C. Fixed expenses :						
a. Depreciation						
1. Hull	600	600	600	2,250	2,250	2,250
2. Engine	800	800	800	4,333	4,333	4,333
3. Nets	2,083	2,083	2,083	3,083	3,083	3,083
4. Ropes and accessories	775	775	775	1,450	1,450	1,450
5. Insulated fish hold	-	-	-	1,100	1,100	1,100
6. Cenoe -	-	-	275	275	275	
b. Insurance of crew member (Rs. 12 per annum)	-	-	-	60	60	60
c. Interest on capital investment (@ 12%)	2,898	2,898	2,898	17,364	17,364	17,364
Total	7,156	7,156	7,156	29,915	29,915	29,915
D. B+C	29,359	28,919	28,959	1,24,767	1,25,871	1,41,593
E. Gross revenue	50,304	45,907	52,370	1,08,880	1,35,945	1,74,490
Profit = E - D	20,945	16,988	23,411	-15,887	10,094	32,897

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Unusually heavy catches of oil sardine *(Sardinella longiceps)* by shore seines have been made in the coastal waters at Pamban, Kundukal point and Rameswaram during the first week of January, 1990. On 2nd January, an estimated catch of about 10 tonnes was caught in a single unit of shore seine *(Marukku valai)* operated at Kundukal point. Two to three tonnes of oil sardine were landed by each of the 15 units of shore seine operated in the area between Kundukal point and Pungamapad. Besides, small quantities (10 - 25 Kg) were landed by the trawlers operating at Rameswaram.

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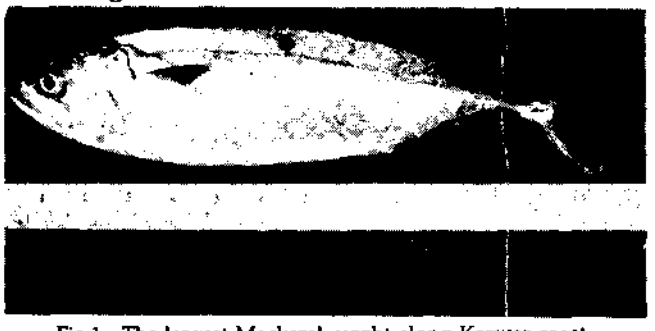

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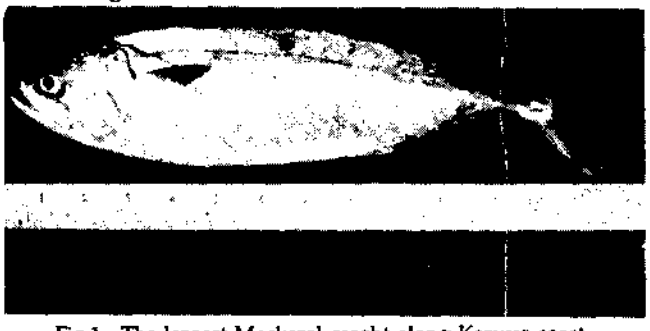

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ON A SPERM WHALE LANDED AT KALPENI ISLAND WITH NOTES ON AMBERGRIS *

Introduction

The sperm whale *Physeter macrocephalus* Linnaeus is widely distributed in the oceans though it prefers warm waters of tropical and sub-tropical regions. In the Indian Ocean it is found concentrated more in the Arabian Sea upto 20° N and between 50° and 80° E especially in the Gulf of Aden and approaches a little east of Minicoy Island and off Sri Lanka. In recent years it has been reported from the mainland of India particularly from the Gulf of Mannar and from the coast of Sri Lanka.

Although this species occurs upto a little east of Minicoy, it has not so far been reported from the Lakshadweep due to the isolation and remoteness of the islands.

The following are the details of the sperm whales landed at various islands in the Lakshadweep.

On 25 - 2 - '71, the fishermen in the pablo boats sent by the Fisheries Department for fishing from Kalpeni Island, saw a sperm whale in sluggish motion near the main entrance of Kalpeni lagoon. The caudal flukes of the whale got entangled in the drift net and the animal could not move. The fishermen harpooned the whale and tied it to the boat with a rope and brought it to the shore (Fig. 1 B). Some of the measurements taken in cm are given below:

Total length	530
Height of the body	98
Girth of the body	62
Length of lower jaw	60
Length of flipper	60
Distance from eye to snoutl	115

After removing the blubber, the flesh was cut into small slices for human consumption.

During November, '82 a large dead sperm whale (Fig. 2) was stranded at Cheriyan shore lying close to Kalpeni Island. Due to putrification the intestine burst and about 150 kg of ambergris was collected.

The anterior portion of a decomposed sperm whale was washed ashore at Chetlat Island on 22 - 12 '83. The total length of the half protion measured 500 cm and maximum diameter was 2 m.

Another small dead sperm whale was stranded again at Chetlat Island on 7 - 8 - '84. Total length of the whale was 550 cm and the height of the body was 220 cm.

The last record was the one from the northern extremity of Chetlat Island on 19 - 11 - 1986 Fig. 1 A. It had two wounds one on the head and the other on the right side just below the lower jaw. May be it was

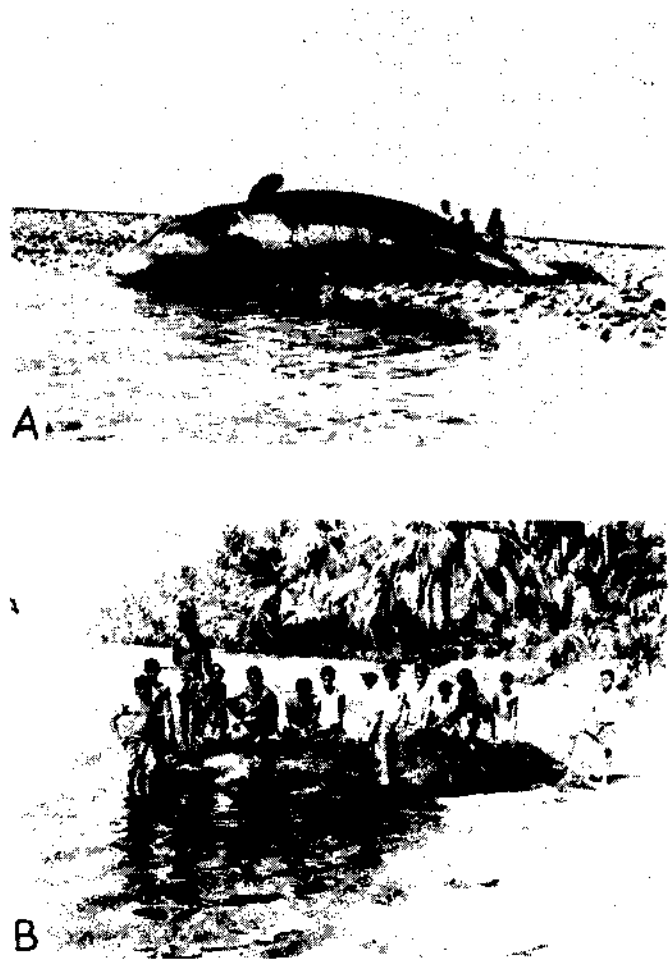

Fig. 1. A. Sperm whale stranded at Chetlat Island on 19-11-86.
B. Sperm whale brought to the shore at Kalpeni Island.

* Prepared by : D. B. James, Tuticorin Research Centre of CMFRI, Tuticorin.

and K. C. S. Panicker, Dept. of Fish., U. T. of Lakshadweep.

hit by the propellor of a sailing vessel since Chetlat Island lies along the navigation channel for larger vessels. Twenty four teeth were seen arranged in two rows on the lower jaw.

Ambergris

In Lakshadweep, three qualities of ambergris *viz., Ponnamber, Puvamber* and *Minamber* meaning gold, flower and fish having yellow, light green and black colour respectively are known. Ambergris is a valuble substance obtained from the sperm whale. It is either found floating in the sea or obtained by cutting open the animal. It is produced in the intestine and retained mostly in the colon. Ambergris is a solid inflamable waxy substance. When fresh, it has an offensive odour but gives off sweet earthy odour on drying. It has the property to absorb, intensify and stabilise the volatile and delicate fragrance. Therefore, it is extensively used in the perfume industry as a fixative. It also finds use in Ayurvedic and Homeopathy systems of medicine. The rich people in the Gulf use it as an aphrodisiac.

In this article some information on the ambergris collected from the Lakshadweep are given. As noted earlier, the Islanders are well aware of the product. In fact every year pieces of ambergris are washed ashore especially during the post-monsoon period. Ambergris is found as small pieces weighing 50 g to 30 kg from the lagoon or shores of various islands. In 1973, the boat crew of the Fisheries Department sighted a huge block of ambergis drifting in the open sea. It looked like a burnt and charred lower portion of a coconut tree trunk. The market rate at that time was Rs.2,000/- per kg. Another huge block weighing about 150 kg was recovered by a private Pablo boat belonging to Agatti Island during the same period while conducting Tuna fishing. From the stomach of a dead sperm whale stranded at Cheriyan shore very near to Kalpeni Island, about 50 kg. of ambergris was recovered. Several people got ambergris in lesser quantities from the same whale afterwards. A small lump weighing below 20 kg was recovered near Kavaratti Island by fishermen in 1980. In 1974 ambergris weighing 90 kg was found floating in the sea and it was auctioned at the rate of Rs. 1,160 per kg. Of this amount, 55% was paid to the fisherman who recovered it and 45% was credited to the Fisheries Department.

Remarks

When James and Manivasagam (1980) reported about the stranding of a sperm whale from Mahabalipuram there were only two earlier records from India. During the course of one decade, 13 more instances of stranding have been recorded. In four instances, the whales were found struggling in shallow waters to get back into the sea. It is unfortunate that instead of towing them back into the sea the fishemen brought them to the shore for ambergris and also to exhibit and get whatever little money that was possible as they have done at Mahabalipuram. Sperm whales being endangered animals should not be brought to the shore and killed. In one case it has been harpooned and dragged to the shore. They are stranded in all the months of the year except in May, July, September and October. Out of the 17 strandings, seven took place during November and December which shows the effect of northeast monsoon when the sea is rough and strong winds prevail. In Lakshadweep also, out of the five strandings, three took place during November and December. In the Gulf of Mannar, out of the three strandings, one took place in November. On the east coast it was stranded on eleven occasions and on the west coast only once at Karwar. Of the eleven stranding four were again during Novermber and December.This clearly shows that November and December are vulnerable months for the strandings of the sperm whales. Another interesting feature about the stranding is that they get into creeks and backwaters as in the case of specimens stranded in Astamudi lake, Kodibag and Peddaganjapallipalem for shelter. James and Soundararajan (1979) have stated that the meat of sperm whale is not edible because it contains adipocure but in Lakshadweep, the meat of the sperm whales is cut into small slices and dried for human consumption.

Fig. 2. Anterior portion of a sperm whale stranded at Kalpeni during Nov. '82.

TABLE 1. *Information on the strandings of sperm whales from the Indian region*

Date	Place	Length (cm)	Sex	Reference	Remarks
January, 1890	Madras	731	-	Balanford (1891)	No details except that it was killed by Enprates.
25-2-1971	Kalpeni lagoon (Lakshadweep)	530	-	Present report	The flesh of the whale after the removal of blubber was cut into small slices for human consumption.
23-6-1973	Karwar	837	Female	Antony Raja and Pai (1973)	Dead. Bleeding profusely from a wound at the base of jaw. A small chunk of flesh cut on the back immediately behind the dorsal fin.
July, 1979	Manauli Island	1,735*	Male	James and Soundararajan (1979)	reported that some quantity of ambergris was recovered from the intestine.
12-4-1980	Mahabalipuram (Near Madras)	670	Male	James and Manivasagam (1980)	Live specimen struggling in the water was brought to the shore.
30-4-1980	Krusadai Island (Gulf of Mannar)	610	Male	James and Soundararajan (1979)	Dead and washed ashore but the specimen was intact.
25-11-1980	Puthenthuruth Island (Ashtamudi lake, near Quilon)	555	-	Bande *et al.* (1980)	It was live and making distress sounds in two metres depth water. It was tied to a rope and dragged to the shore by fishermen.
8-6-1982	Pudupatinam (Near Tranquebar)	906	Male	Nammalwar and Thanapathi (1982)	Found struggling in the surf region and making distress calls. Towed to the shore by fishermen.
November, 1982	Cheriyan shore (Close to Kalpeni Island, Lakshadweep)	Not recorded		Present report	Due to disintegration the intestine burst and 150 kg of ambergris came out of it.
22-12-1982	Chetlat Island (Lakshadweep)	500	-	Present report	Only anterior half of the decomposed whale was stranded. Maximum diameter was 2 m).
15-12-1983	Peddaganjapallipalem , Chirala Taluk, Prakasam District, Andhra Pradesh)	1100	-	Anonymous (1983)	Width of the whale was 1.5 m and height was 1.2 m (Personal communication : T. Chandrasekhara Rao).
7-8-1984	Chetlat Island (Lakshadweep)	550	-	Present report	Height of the whale was 2.2 m.
5-11-1986	Hare Island (Gulf of Mannar)	950	-	Sivadas *et al.* (1987)	Only skull and lower jaw could be examined. Length given is estimated.
19-11-1986	Chetlat Island (Lakshadweep)	1,035	-	Present report	The dead sperm whale had two wounds, one on its head and the other on the right side just below the lower jaw. Twenty four teeth were arranged in two rows on the lower jaw.
3-12-1986	Pondicherry	550	Female	Nammalwar *et al.* (1989) (In press)	— — —
8-3-1988	Kasimedu (Near Madras)	390	Female	Nammalwar *et al.* (1989)	Struggling in the fishing area and later stranded near the shore.
1-2-1989	Neelankarai (Near Madras)	1,060	Female	Nammalwar *et al.* (1989)	-

* Estimated length.

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TAGGED TIGER SHARK (*GALEOCERDA CUVIERI*) LANDED AT TUTICORIN*

On 24 - 8 - 1989, during one of our regular observations at Tuticorin north landing centre, we were informed by some fishermen that a shark had landed with a belt around its neck. It was a female tiger shark *Galeocerda cuvieri* (Le Sueur). This shark was landed with a tag in the form of a girdle round about the nape just behind the 5th gill opening. The tag was pierced through the muscle at the base of right pectoral fin. Except at the place where the tag had passed through, the muscles of the shark had out grown the tag causing a gaping wound 20 mm deep and 25 mm wide around the nape of the shark. The tag measured 1045 mm in circumference and 10 mm in width . It was of plastic material and the joint was securedly pasted by a synthetic gum. Coded markings were imprinted to a length of 33 mm of the tag from one end.

The shark had an ash grey colour dorsally and pale white at the ventral surface. There were 33 vertical stripes on the body. Mouth rounded with four rows of strongly serrated teeth in each jaw. Each row with 23 powerful teeth.

The shark was caught by a mechanised Tuticorin type boat using hooks and line . The fish was caught at a distance of 40 km from shore southeast of Tuticorin in the 26 fathom depth area. Only this shark was caught by them on that day. The fish weighed 130 kg and was sold by auction for Rupees 916.

Morphometric measurements (in mm) of tagged tiger shark *Galeocerda cuvieri* caught off Tuticorin on 24 - 8 - 1989 are given overleaf.

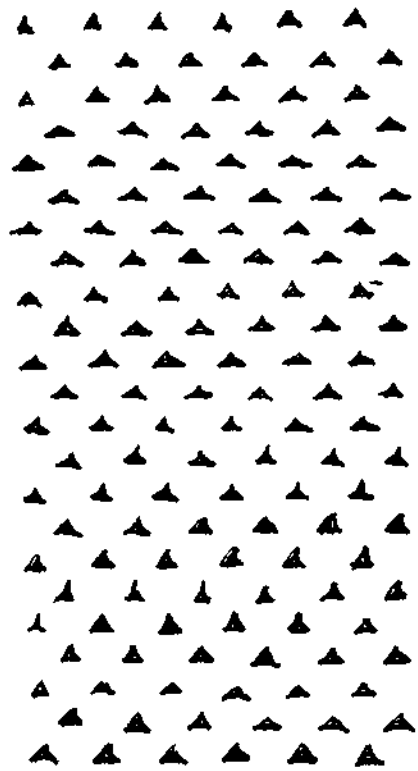

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Fig. 1 A. Coded markings on the tag.

* Reported by P. Sam Bennet, G. Arumugam and T. S. Balasubramanian, Tuticorin Research Centre of CMFRI, Tuticorin.

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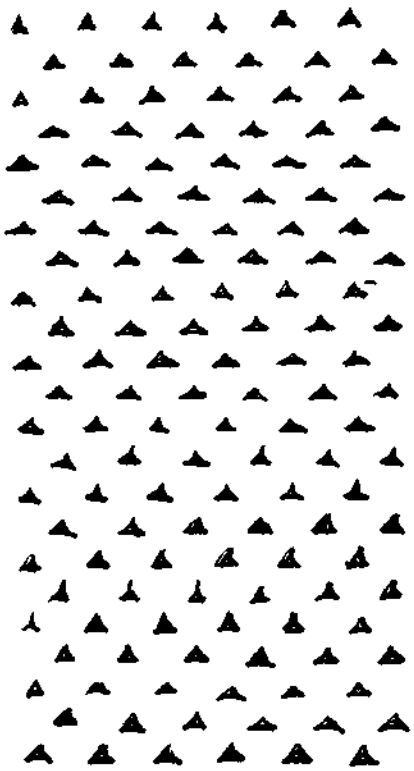

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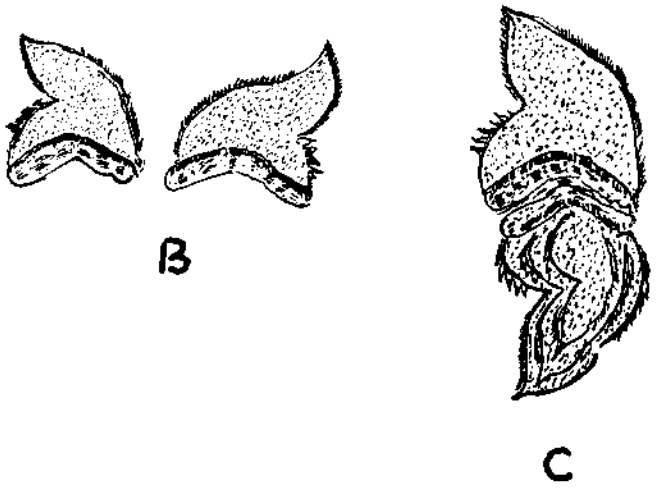

Fig. 1 B. Teeth details, C. Teeth arrangement.

Fig. 2 The tagged shark - a lateral view.

Fig. 3 The ventro - lateral view of the tagged shark.

Total length	2,050
Fork length	1,680
Sex	Female
snout to origin of pectroal	540
Snout to origin of pelvic	1,140
Snout to first gill slit (head length)	430
Snout to anterior margin of eye	380
Snout to inner ends of nostrils	210
Nostril width	15
Distance in between inner ends of nostrils	250
Distance from eye to 5th gill slit	390
Head width through 1st gill slit	1,010
Horizontal diameter of eye	30
Vertical diameter of eye	25
Inter orbital distance	400
Mouth width	360
Mouth height	110
Inter dorsal distance	910
Second dorsal to origin of caudal	320
Distance from pectroal to pelvic	600
Distance from anal to origin of caudal	480
First dorsal base	230
First dorsal height	305
Second dorsal base	90
Second dorsal height	105
Anal base	80
Anal height	100
Pectroal length	375
Pectoral base	180
Caudal upper lobe from origin to tip	700
Caudal lower lobe	340
Depth of body through pectoral	1.030
Depth of body through anal	670
Length of 1st gill slit	262
Length of third gill slit	270
Length of posterior extension of 1st dorsal	130
Length of posterior extension of 2nd dorsal	105
Length of posterior extension of anal	80

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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 ।

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Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.* No. **104** : April, May, June - 1990

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Front cover photo :

Conerete rings kept ready for transporting to reef building site (Ref : Article 1).

मुख आवरण चित्र : कृत्रिम भित्ति के निर्माण केलिए तैयार किए कंक्रीट के वलय ।

Back cover photo :

Reef building in progress at Valiyathura, Vizhinjam (Ref : Article 1).

पृष्ठ आवरण चित्र : विषिंजम के वलियतुरा में कृत्रिम भित्ति का निर्माण-कार्य ।

ON THE DRIFT NET-ENTANGLED DOLPHINS LANDED AT SAKTHIKULANGARA *

The common dolphin, *Delphinus delphis* is the species frequently entangled in the gill nets along the Indian coast. According to a recent report, about 30 - 40 dolphins are caught annually along the Calicut coast though definite statistics is not available.

The present report details the landings of the common dolphins entangled during the drift gill net operations off Quilon. The landing data on the dolphins were collected during the routine observations on fish landings at Sakthikulangara during the period 1982 - '87. Table 1 gives the monthwise particulars on the dolphin landings. The study reveals that maximum entanglements were recorded during the June - October period. Maximum incidence of dolphins was noted during 1982 - '85 period in terms of observed weight. During the entire period, the observed wieght of the dolphins recorded exceeded 2 tonnes and an approximate number of 145 dolphins were encountered.

The dolphin landings at Sakthikulangara deserves special attention due to the fact that they are utilised for human consumption. Generallay, the dolphins entangled in the nets are brought along with fishes and are auctioned separately in the landing centre. It is observed that smaller dolphins which weigh approximately below 15 - 20 kg are preferred for consumption due to its tender meat, whereas the meat of bigger and older specimens is mainly used as baits in the hooks and line fishery for sharks.

It appears that Sakthikulangara is the only centre along the Kerala coast where dolphins are used for human consumption and are sold in fish markets. The above observations are considered important when the marine mammals of the Indian seas including dolphins are attracting special attention in recent years.

* Reported by P. K. Mahadevan Pillai, Madras Research Centre of CMFRI, Madras and S. B. Chandrangathan, Field Centre of CMFRI, Quilon.

TABLE 1. *Particulars of dolphin landings at Sakthikulangara during 1982 - '87*

Months		Years					
		1982	1983	1984	1985	1986	1987
1	2	3	4	5	6	7	8
January	1	-	-	8	-	-	-
	2	-	-	2	-	-	-
	3	-	-	60	-	-	-
February	1	-	-	-	-	-	-
	2	-	-	-	-	-	-
	3	-	-	-	-	-	-
March	1	-	-	8	-	-	-
	2	-	-	1	-	-	-
	3	-	-	27	-	-	-
April	1	10	9	7	8	-	-
	2	4	4	3	2	-	-
	3	110	87	61	61	-	-

1	2	3	4	5	6	7	8
May	1	10	10	-	-	9	9
	2	2	1	-	-	1	1
	3	41	13	-	-	47	39
June	1	14	-	10	7	10	10
	2	1	-	3	1	1	1
	3	28	-	70	21	46	48
July	1	22	9	-	20	-	20
	2	1	3	-	3	-	1
	3	24	68	-	169	-	33
August	1	10	20	10	14	18	19
	2	1	3	1	1	1	1
	3	33	124	26	37	20	22
September	1	17	19	1	12	-	18
	2	4	2	2	5	-	1
	3	168	31	71	173	-	25
October	1	10	8	8	8	9	7
	2	2	2	2	1	1	2
	3	72	59	38	17	24	45
November	1	-	9	7	8	-	-
	2	-	1	1	1	-	-
	3	-	56	26	38	-	-
December	1	-	-	-	-	9	-
	2	-	-	-	-	1	-
	3	-	-	-	-	26	-

1. Number of observation days.
2. Number of days in which dolphins were landed.
3. Observed weight of dlophin in kg.

आर्टिसानल मात्स्यिकी वर्धन केलिए तिरुवनंतपुरम में कृत्रिम भित्ति का निर्माण

पी. एस. बी. आर. जेम्स और एस. लासरस, केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचिन-682 031.

प्रस्तावना

निमज्जित वस्तुओं के पास कई प्रकार के तलमज्जी मछलियों का संचय दिखाई पडता है । ये समुदाय बडे बडे परभक्षियों का आहार हैं । निमज्जित वस्तुएं अधिकांश मछलियों केलिए अंडजनन का स्थान प्रदान करती हैं ।

मछलियों को आकर्षित कराने और मात्स्यिकी के वर्द्धन के लिए कृत्रिम गठन का प्रयोग बडे पैमान में हुआ है । अतिमत्स्यन, आवास की हानि और प्रदूषण से निकट तट की मात्स्यिकी में आए हुए संघर्षों के कारण संसार के तटीय क्षेत्रों के मात्स्यिकी प्राधिकारी कृत्रिम भित्तियों की आवश्यकता पर ज़ोर देते हैं । कई राष्ट्रों के आर्टिसानल गाँवों में प्रायः मत्स्यन क्षेत्रों के सृजन के लिए कृत्रिम भित्तियों और मत्स्य संचयन विधा का प्रयोग सफल रूप से किया है । कृत्रिम जलीय आवासों की उपयोगिता सदियों से होने पर भी उसकी प्रक्रिया और दोषों का वैज्ञानिक विवरण हाल ही में हुआ है । भारत में, बेरगास्ट्रम ने बंगाल के उपसागर में प्रयुक्त परंपरागत मत्स्य संचयन विधा का पुनरवलोकन किया था । भारत के तमिलनाडु तट में संजीवराज द्वारा एक परिवर्तित आर्टिसानल कृत्रिम मछली आवास का विवरण हुआ था । (बुल्लेटिन, मार्च वै; 44(2) 1989) । एक कृत्रिम मछली संचयन विधा और कृत्रिम भित्ति मुरुगप्पा चेट्टियार , अनुसंधान केन्द्र द्वारा विकसित किया है (हिन्दु, 22 फर, 1989) । ट्यूना लाइव बाइट के संचयन स्वभाव के अध्ययन केलिए केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान द्वारा मिनिकोय में, वाहन के टायर आर सी सी बेस में बाँधकर एक कृत्रिम भित्त का ढाँचा बनाया है ।

भारत के दक्षिण पश्चिम तट में कैप कोमरिन और विर्षिंजम के बीच में विस्तृत उपतट के नितलस्थ भाग में चट्टानों का उद्गमन अधिक मात्रा में हुआ है जहाँ मछलियों की अधिकता भी है । मछुओं के लिए यह अनुकूल परिस्थिति अत्यंत लाभदायक है । उसी प्रकार तट से 10 कि. मी की दूरी में 40–50 मी की गहराई में हुए पोतभंग के टुकडों में भी एक प्रकार की मछली की उपजाति दिखाई पडती है जिसका समुपयोजन पडोसी गाँवों के मछुओं द्वारा किया जा रहा है । लेकिन, पाणतुरा और वलियावेली के बीच के समीप क्षेत्र ऐसे चट्टानों से मुक्त है इसलिए यहाँ के मछुओं को पडोसी क्षेत्रों के मछुओं की तरह लाभ नहीं मिलता है । इस स्थिति ने उन्हें वहाँ कृत्रिम भित्ति विकसित करने की प्रेरणा दी । इस भित्ति को स्थानीय भाषा में "पार्स" कहलाते है । स्थानीय मात्स्यिकी में ऐसी कृत्रिम भित्तियों के प्रभाव पर दो वर्ष के अध्ययन से उभर आए प्रमुख निर्णय यहाँ प्रस्तुत हैं ।

प्रथम छः कृत्रिम भित्तियों के बारे में दिया गया विवरण अभी अभी कृत्रिम भित्ति के निर्माण और प्रबन्धन में लगे हुए मछुओं से संग्रहित है । सातवीं भित्ति के विवरण तट पर आधारित आकलन से संग्रहित है । इन सात भित्तियों में सिर्फ तीनों से (वलियातुरा, कोच्चुतोप्पु–। और कोच्चुतोप्पु–।।) मत्स्यन किया जाता है अतः यहाँ दिया गया डाटा इन तीनों से संबन्धित है । इनमें कोच्चुतोप्पु–।। की भित्ति का परिचालन होकर केवल एक वर्ष हुआ है । भित्ति से और पडोसी मत्स्यन क्षेत्रों से स्थलन को वलियातुरा स्थलन केन्द्र में लाते वक्त, हफ्ते में एक बार केन्द्र का निरीक्षण करके भित्ति के एवं अन्य क्षेत्रों के स्थलन का अलग अलग अभिलेख किया गया है और कुल स्थलनों का मासिक अनुमान किया गया है । भित्ति के मत्स्यन का आकलन वहीं से ही किया गया है । नितलस्थ समुदाय के अध्ययन के लिए चौदह नमूना एकक हर एक में, 2. कि. ग्रा. भारवाला ग्रनाइट का पत्थर (समकोण), टायर के टुकडे, प्लाइवुड, आस्बस्टोस और टाइल को नाइलोण की रस्सी से बांधकर, बीच में 25 से. मी जगह लगाकर भित्ति पर रखकर स्कूबा निमज्जन द्वारा अंतरजलीय आकलन किया गया है ।

कृत्रिम भित्ति–निर्माण और प्रबंधन

भित्ति का निर्माण

साधारणतया भित्ति का निर्माण 5 से 27 मी की गहराई में रेत की मात्रा अधिक होने वाले क्षेत्रों में करता है । सबसे

पहले भित्ति के निर्माण के लिए चुने गए स्थान में ग्रानाइट के चट्टान डालते हैं । इनके ऊपर कंक्रीट के वलय जिन्हें आम रूप से "उरय" कहलाते हैं, लगाते हैं और ये कुए बनाने के लिए उपयुक्त करते है । इसके बाद, वहाँ से उपलब्ध अनावश्यक सस्ती सामग्रियों जैसे कंक्रीट के टुकडे, रबड़ के फटे टायर, शून्य बोत्तल, मूल से उखाडे गए नारियल के ठूँठें, पत्ते, केतकी आदि इसके ऊपर अव्यवस्थित रूप से डालते हैं । ये मछलियों को छाया एवं आश्रय देते हैं । नावों में चट्टान भरते वक्त बाँधने के लिए नारियल के पत्ते उपयुक्त करते हैं । बनाने के लिए उपयुक्त पत्तों के आधार पर कुछ भित्तियों को "ओलापारू" और "कैतापारू" कहलाते हैं । भित्तियों के स्थान तक सामग्रियों का परिवहन नावों द्वारा (अयंत्रीकृत) करते हैं । अगर तट से स्थान तक की दूरी अधिक है तो दो तीन नावों को यंत्रीकृत नाव द्वारा खींचता है । स्थान पहूँचने पर नाव से सामग्री का अधोवर्तन करते हैं । पहले दिए गए अनुसार इस क्षेत्र में सात कृत्रिम भित्ति विकसित हुई हैं । इनमें प्रथम छः वर्ष 1983 और 1985 के बीच में निर्मित थी और सातवीं वर्ष 1988 में जो एस आइ एफ एफ एस की धनराशि लेकर वहाँ के मछुओं द्वारा निर्मित है । इन छः में दो गाद के कारण निमज्जित हो गई और दो का परिचालन तट संपाशक परिचालन के निकट निर्मित करने के कारण स्थानीय मछुओं के विरोध से छोड दिया ।अब प्रथम दो और सातवीं का मरम्मत करके मछलियों के संचय के लिए उपयुक्त करते हैं ।

मत्स्यन

भित्ति के निर्माण में लगे हुए आदमियों को कृत्रिम भित्ति से मत्स्यन की अनुमति दिया जाता है । अन्य मछुओं के अतिक्रमण करने के भय से भित्ति के स्थान में प्लव या निशान नहीं लगाते है, फिर भी पडोसी क्षेत्रों में, वातावरण अच्छे होने पर पूरे वर्ष में मत्स्यन होता है, यह नवंबर और दिसंबर के शांत वातावरण में होता है । केवल दिन में मछुए भित्ति के अंदर प्रवेश करते हैं । कृत्रिम भित्तियों में अंकुश और रज्जू, का परिचालन भी किया जाता है । 'अच्चिल' नामक एक प्रकार का अंकुश और रज्जु जिसके भिन्न आकार वाले अंकुश होते हैं और जिसके लिए कृत्रिम चारा का उपयोग भी करते है, का परिचालन करते हैं । दीप्त प्रकाश होने वाले दिनों में और अनुकूल मौसम में मत्स्यन परिचालन लाभदायक होता है । त्रृंगकाल में एक एकक तीन बार दिन में मत्स्यन करता है । एक भित्ति के पास एक ही समय में लगभग 15 से 20 ऐसे एककों का परिचालन होता है । साधारणतया मत्स्यन केलिए 5 मी आकार वाले नावों का उपयोग करता है ।

मात्स्यिकी

मात्स्यिकी उपनतिः वर्ष 1987–88 और 1988–89 के दौरान कृत्रिम भित्ति और अन्य प्रदेश मात्स्यिकी स्थलन में गहरा अंतर दीख पडा । भित्ति के आस पास से वर्ष 1987–88 में 59 मेट्रिक टन और अन्य प्रदेश से 636 मे टन प्राप्त हुई । वर्ष 1988–89 की स्थिति इस से खराब थी । इस साल में यहाँ से प्राप्त मछली सिर्फ 24.2 मे टन थी । भित्ति के मत्स्यन काल 1987–88 में नवंबर से लेकर छः महीने और वर्ष 1988–89 में यह दिसंबर से लेकर पाँच महीने थे । फरवरी 1987–88और मार्च 1988–89 में उच्चतम स्थलन अंकित किया । उपर्युक्त दो वर्षों में अन्य क्षेत्रों का स्थलन पूरे वर्ष तक व्यापक था ।

गिअर का योगदान

पहले बताए गए अनुसार अयंत्रीकृत एककों से अंकुश और रज्जू के सहारे मत्स्यन किया जाता है । लेकिन अन्य क्षेत्रों में उपर्युक्त गिअर के अतिरिक्त यंत्रीकृत यान से परिचालित अंकुश और रज्जु, तट संपाश, पोत संपाश और गिल जाल का भी परिचालन हो रहा है ।

जाति संयोजन

भित्ति क्षेत्र की पकड में **डेकाप्टीरस डेयी, करंजोइड्स प्लाजियोटीनिया, प्रियाकातंस हमरर, स्फिरीना जाति, बांगडा** और नेमिप्टेरस जाति आदि प्रमुख हैं । बल्कि अन्य क्षेत्र में **सेलार कुमेनोफतालमस, डी. डायी, ऑक्सिस रोचेई, ट्राइक्यूरस लेप्टरस, रास्ट्रेल्लिगर कनागुरता,** यूथिनस एफिनिस, नेमिटेरस जाति, सारडा ओरियंटालिस और डस्सुमेरिया जाति आदि प्रमुख हैं । इन प्रमुख जातियों में **डी. डायी, आर. कानागुरता** और नोमिप्टेरस जाति दोनों क्षेत्रों की पकड में साधारण थी । भित्ति के क्षेत्र में करंजोइड्स प्लाजियोटीनिया, प्रियाकांतस हामरर और स्फिरीना जाति की प्रमुखता यह दिखाती है कि भित्तियाँ वहाँ रहनेवाली तथा तलमज्जी मछलियों को आकर्षित करती हैं । मछलियों जैसी, करंजोइडस प्लाजियोटीनिया, लेथ्रिनस हाराक,

सेलार कल्ला, करंजोइड्स मलबारिका और सेलारोइड्स लेटोलेपिस सिर्फ भित्ति क्षेत्र में रहती हैं । यह ध्यान देने योग्य हैं कि ये साधारण रूप में भित्ति क्षेत्रों में रहती हैं ।

अंतर्जलीय अध्ययन

दिनांक 28–2–88 को निर्मित कोच्चुतोप्पु की भित्ति–।। में अक्वा लंग का प्रयोग करके दिनांक 26–10–88 और 10–1–89 में सी एम एफ आर आइ के वैज्ञानिकों द्वारा अंतर्जलीय अवलोकन किया गया । दिनांक 26–10–88 को दृश्यमानता कम होने के कारण पनडुब्बे भित्ति के नीचे पहूँच न सके । दूसरे अवसर पर वे नीचे पहूँचकर वहाँ की स्थितियों का अध्ययन कर सके । भित्ति के क्षेत्र के समुद्र के निम्न भाग में रेत की बहुलता है और अंतर्जल में दक्षिण से उत्तर की ओर धारा तेज़ी से बहने के कारण भित्ति की सामग्रियाँ आंशिक रूप से रेत में निमज्जित हो गई । निर्माण के बाद एक वर्ष होने के बाद भी नारियल पेड के ठूँठ जैसे भित्ति की सामग्रियाँ, चट्टानों को बाँधने के लिए उपयुक्त नारियल के पत्तों को छोडकर अविकल ही रह गई । निमज्जन के वक्त यह देखा गया कि भित्ति की योजना उचित रूप में, मछलियों को आकर्षित कराने युक्त नहीं की है । फिर भी पनडुब्बे छोटी छोटी मछलियाँ जैसी **एपोगन नोवमफेशियाटस, एंफीप्रोण जाति, कीटोडोन जाति और डासिलस जाति** अधिक मात्रा में भित्ति पर मडंराती देख सके । मछलियाँ जैसी **ऐपिनेफेलस कोरालिकोला, लुटियानस अर्जेन्टिमाकुलाटस, एल. लिनिओलाटस, टेरोइस एन्टेन्नाटा, स्पिलोटिक्टिस पिक्टस और हेनियोक्स एक्युमिनियाटस** को छोटी संख्या में दिखाई पडा । उस क्षेत्र के सामान्य मत्स्यन में साउरिडा जाति, **प्रियाकांतस जाति, नेमिटेरस जाति डेकाटेरस डाई** तथा छोटे करंजिड उपलब्ध थी । भित्ति बनानेवाले पॉलीकीट सामेल्लारिया स्पिनुलोसा को भित्ति क्षेत्र में अधिक रूप में दिखाई पडा ।

पसन्द के खाद

भित्ति से पकडी गई मछलियों जैसी **सॉरिडा अंडोस्क्वामिस, एस. तुम्बिल, एस. ग्रासिलिस, एपोगोण नोवम्फाशियटस और लुटियानस लिनियोलाटस** की आहार नली में पॉलीकीट **सबेल्लेरिया स्पिनुलोसा** को दिखाई पडा । लेकिन अन्य क्षेत्र से पकडी गई उपर्युक्त जाति और भित्ति से पकडी गई **डेकाटेरस डाई** के जठर में पॉलीकीट नहीं थे ।

सामान्य टिप्पणियाँ

कृत्रिम भित्तियों पर आधुनिक अध्ययन (कृत्रिम भित्तियाँ तथा मछली समुच्चयन विधाएं, राष्ट्रीय अकादमी प्रेस, वाशिंगटन, 1988) यह सुझाव देते हैं कि भित्ति के नमूने की अपेक्षा स्थान प्रमुख है । भित्ति के निर्माण के लिए प्रस्तावित सामान्य मार्गनिर्देश ये हैं । (1) व्यवस्थापन के संबंध में होनेवाले विवादों को दूर करने केलिए और यात्रा का समय और इंधन का उपयोग कम करने के लिए भित्ति का स्थान गाँव के निकट होना चाहिए । (2) कुछ विशेष संदर्भों को छोडकर वाणिज्यक मत्स्यन क्षेत्रों में कृत्रिम भित्ति का निर्माण नहीं किया जाना है । (3) कृत्रिम भित्तियाँ प्राकृतिक भित्तियों से एक कि. मी. दूरी में स्थापित किया जाना है (4) प्रबल ज्वारीय धारा होने वाले स्थान नहीं चुन लेना है (5) नदियों का मूँहभाग, जहाँ गाद में भित्ति निमग्न होने की संभावना है, छोड देना है । (6) भित्ति का लंबा अक्ष प्रबल धारा और मछलियों के प्रवास की लंबाई में होना चाहिए । एक निश्चित धारा वहाँ रहने वाली नितलस्थ मछलियों के लिए अनुकूल एवं स्वीकार्य है । (7) लक्षित जाति के लिए भित्ति की गहराई पर्याप्त होनी चाहिए । (8) कृत्रिम भित्ति के नीचे का भाग दृढ़ रेत या शेल से युक्त होना धँसाव रोकने केलिए उचित है । (9) नीचे पार्श्व भाग समतल या थोडा ढाल होना चाहिए । (10) मृदु मृत्तिका व गाद होने वाले क्षेत्र छोडना है । (11) प्रबल धारा होने वाले स्थान और मौसमों में रेत बदलने वाले क्षेत्र भी नहीं चुन लिया जाना । जापानी राष्ट्रीय योजना यह सुझाव देती है कि कृत्रिम भित्तियाँ एक प्रकार की श्रेणीबद्ध व्यवस्था में रखना है जहाँ छोटी वस्तुएं मिलकर "सेट" बन जाता है, 10–20 सेट मिलकर "ग्रूप" बन जाता है और कई ग्रूप मिलकर "कॉम्प्लेक्स" बन जाता है । वे प्रस्तावित करते हैं कि सेट के लिए न्यूनतम प्रभावी आकार 400 एम^3 और ग्रूप के लिए 50,000 एम^3 हर एक ग्रूप के बीच में एक कि. मी. दूरी होनी चाहिए ।

त्रिवांद्रम तट में चुने गए भित्ति के स्थानों में ऊपर के मार्गदर्शनों के अधिक पक्ष होने पर भी उनमें कुछ प्रमुख पहलुओं

की कमी है जैसे भित्ति की मछलियों को आकर्षित कराने योग्य गहराई, भित्ति का स्थायित्व बढानेयोग्य धरातल और गाद से निमज्जित होने से बचाने केलिए प्रबल धारा से मुक्त क्षेत्र । वर्तमान भित्तियाँ बनाए गए क्षेत्र में रेत की मात्रा और उच्च धारा के कारण गाद भी अधिक है । उच्च धारा और गाद के कारण जल आविल बन जाता है । विशेषतः मानसून काल में इस के कारण भित्ति के क्षेत्रों में दीर्घ काल के लिए मत्स्यन संभाव्य नहीं हो जाता है । इसलिए यह सुझाव दिया गया है कि भित्ति का निर्माण अधिक गहराई होने वाले क्षेत्र जहाँ रेत या दृढ़ आधार है, में होना चाहिए जिससे पानी की आविलता और भित्ति का निमज्जन से बच सकते हैं । 2–3 वर्षों की अवधि में 6 में से दो भित्तियाँ उच्च धारा और गाद से निमग्न हो गई । तट संपाश परिचालन क्षेत्र के निकट होने के कारण अन्य दो भित्तियों को अभी छोड दिया जाना है । इस संदर्भ में इस मुद्दे पर विशेष विचार किया जाना है क्योंकि तट जल में अन्य गिअर परिचालन में स्पष्ट सीमानिर्धारण है । तथापि, ऐसा लगता है कि उपर्युक्त दो कृत्रिम भित्तियों के निर्माण के समय में इस मुद्दे का विचार नहीं किया गया है । अगर भित्ति अधिक गहराई में निर्मित है तो मछलियों की अधिक उपजातियों जैसे पर्च और अन्य वाणिज्य प्रधान भित्ति मछलियों को मिलने की संभावना है । स्थान निर्धारण के पहले क्षेत्र का वैज्ञानिक रूप से परिवीक्षण किया जाना है तथापि, वर्तमान की किसी भी स्थितियों में ऐसा नहीं किया गया है ।

संसार के भिन्न भागों में भित्ति के निर्माण के लिए उपयुक्त सामग्री में पर्याप्त भिन्नता है । बडी मात्रा में उपलब्ध और आर्थिक रूप में व्यवहार्यता के आधार पर सामग्रियों को चुन लेना है । झाड जंगल के पुंज को श्रेणी में बंधकर जापान, फिलीप्पीन्स, इंदोनेशिया और वियतनाम में कर्कट, चिंगट और छोटी मछलियों को पकडते हैं । मध्य आफ्रिक्का में पेटी पत्ते भरकर झींलों और ज्वारंदमुखियों के नीचे रखते हैं । आइवरी कॉस्ट मछुए चिंगटों को आकर्षित कराने के लिए उथले जल में नारियल के पत्ते लगाते हैं । क्यूबा के दक्षिण तट के उपसागर के संरक्षित क्षेत्रों में मछुए अब भी "मैंग्रोव मात्स्यिकी" का उपयोग कर रहे हैं । मैंग्रोव की शाखाओं से भित्ति का निर्माण करके महाचिंगटों के लिए आश्रय बनाते हैं । फिलीप्पीन्स में " ब्रश पार्कस" को विकसित करके मछलियों को आश्रय और अंडजनन स्थल प्रदान करते हैं ।

उत्तर जापान में उत्पादन बढाने के लिए चटट्टान लगाते है । विर्जीनिया और न्यूयोर्क (यू. एस. ए) में टायर के पट्टे 10 से. मी. कंक्रीट के आधार पर लगाकर भित्ति के रूप में उपयुक्त किया जाता है । तायलान्ट में भित्ति निर्माण के लिए वाहनों के टायरों का उपयोग करते हैं । इस्रायेल के हाइफा के निकट पुराने टायरों द्वारा निर्मित परीक्षणात्मक कृत्रिम भित्ति है । जापान के लोगों ने मत्स्यन क्षेत्र बढाने के लिए सैकडों कंक्रीट नमूने विकसित किए गए है । हावाय में कंक्रीट के टूट–फूट पाइप कृत्रिम भित्ति के निर्मिण केलिए उपयुक्त करते है । तायवान में 10 वर्षों से लेकर रेत के धरातल में कंक्रीट के ब्लॉक उपयुक्त करते हैं । तायलान्ड में मत्स्यन क्षेत्र तथा आर्टिसनल मछुओं को विकसित कराने केलिए कंक्रीट के नमूनों से कृत्रिम भित्ति बनायी जा रही है । यूनाइटड स्टेट्स में लुप्त तेल और गैस ड्रिल्लिंग का यंत्र और इसके टावर कृत्रिम भित्ति के रूप में प्रयुक्त करते है । यहाँ, त्रिवाद्रंम में, ग्रनाइट के पत्थर, खाली बोत्तल, कंक्रीट के वलय, नारियल के पेड के ठूँठ और पत्ते, और वाहनों के पुराने टायर भित्तियों के निर्माण केलिए उपयुक्त करते हैं ।

भारत जैसे देश में, उपलब्ध संपदाओं के आधार पर कृत्रिम भित्ति निर्माण के लिए दो विधाओं का सुझाव दिया जाता है । प्रथम के अनुसार मौसम की चरम अवस्थाओं का सहन करने योग्य साधारण रूप से उपलब्ध सामग्रियाँ जैसे ग्रनाइट के पत्थर भित्ति निर्माण के लिए उपयुक्त करते है और इसके लिए आवश्यक धनराशि बहुत कम है । दूसरी विधा, विशेष रूपरेखा के आधार पर स्थायी ढाँचा बनाना है । इसके लिए बडी धनराशि की जरूरत है और निर्माण केलिए स्टील, कंक्रीट और संस्थापन के लिए बडे पोतों की आवश्यकता है ।

वेरसोवा (बंबई) में दो विभिन्न आकार के "डोल जाल" का लागत और कमाई*

"डोल जाल" मत्स्यन में लगे जानेवाले 7.5 मी और 12 मी. के दो पोतों के खर्च और कमाई का विवरण यहाँ प्रस्तुत है । दोनों पोतों में नॉन पेनीअइड झींगे की बहुमात्रा में पकड होती है फिर भी आय मुख्यतः पेनीअइड झींगे के स्थलन पर आश्रित है । दोनों पोतों के कुल खर्च के विश्लेषण करने पर छोटा पोत (7.5 मी) खूब कमाऊ महसूस हुआ । बडे पोतों के कर्मियों की भारी मज़दूरी इसका मुख्य कारण है ।

महाराष्ट्र के तटीय सेक्टर में कई सालों से "डोल जाल" (बैग नेट) प्रयोग में है । "डोल जाल" मत्स्यन, बम्बिल और अन्य मत्स्यों को पकडने की पुरानी तरीका है । वेरसोवा ग्रेटर बंबई का मुख्य स्थलन केन्द्र है और यहाँ के 95% कुटुम्ब किसी न किसी प्रकार "डोल जाल" मात्स्यिकी पर आश्रित रहते हैं ।

इस केन्द्र में 178 यंत्रीकृत पोत "डोल जाल" मात्स्यिकी में लगे हैं जिसमें 60 छोटे (7.5–9.0 मी) 47 मध्यम (9.3–12.0 मी) और 71 बडे (12 मी के ऊपर) होते हैं । यद्यपि पोतों के आकार और प्रचालन की गहराई में विविधता है तथापि पकड मिश्रण लगभग समान हैं । इसलिए अध्ययन केलिये 7.5 (छोटा) और 12 मी (मध्यम) के पोतों को चुन लिया है । इसकेलिए 1983 से लेकर तीन वर्षों बोट के दैनिक खर्च, पकड, स्पाशीज़ मिश्रण और दाम की डाटा का संग्रहण किया है ।

मत्स्यन रीति, मौसम और प्रयास

साधारणतः पोत एक व्यक्ति का होता है और मत्स्यन केलिए उन्हें कर्मियों को किराये पर लेना पडता है । पोत के मालिक के निर्देशानुसार मत्स्यन कार्याकलाप होता है । मत्स्यन के मौसम आने पर मालिक कर्मियों को दलों में बाँट देते है । एक दल में तीन या अधिक पोत होंगे । वे पूरे मौसम केलिए या सारे मौसम केलिए दलों में रहते हैं । मौसम अनुयोज्य न होने पर 6 से 8 बोट मिलकर एक के बाद एक जाकर मत्स्यन करते हैं ।

डोल जाल का परिचालन ज्वारीय धारा पर आश्रित है । पूर्ण चन्द्र या दूज चन्द्र के दिन डोल जाल पानी में $4^1/_2$ से 5 घण्टे तक डालता है । निम्न ज्वार के अवसर पर $2^1/_2$ और $3^1/_2$ घंटे तक डालता है । क्योंकि ज्वार का प्रवाह इस समय कुछ घंटों तक होता है । दो जाल वाले छोटे पोतों का परिचालन तीन व्यक्तियों द्वारा होता है और दो या तीन जाल वाले मध्यम आकार के पोतों का परिचालन पाँच व्यक्तियों द्वारा होता है । मत्स्यन काल सितंबर मध्य से या अक्तूबर से होकर जून के पहले सप्ताह तक होता है ।

पकड और निपटान

" डोल जाल" ट्राल जाल के समान है जिस से कई प्रकार के स्पीशीज़ पकडे जाते है । जाल के मुख से कोड के अग्र तक जालाक्षियों के आकार बदलते है । इसमें 1.3–1.5 मिमी, 2.00–2.5 मिमी और 3.5–4.0 मिमी के तीन कोड होते है जो यथाक्रम **ऐसीटीज** की जातियाँ, पैलीमॉन **टेनीपस** और बम्बिल एवं अन्य मछलियों की पकड कलिऐ उपयोग करते है ।

1983–86 के दौरान छोटे पोतों का पकड मिश्रण इस प्रकार था **ऐसीटीज** की जातियाँ 60% **पी. टेन्यूपेस** 12% पेनीअइड झींगे 10%, बम्बिल 6%, **सैनोग्लोसस डसमेरी** 5% और अन्य 7% । उसी प्रकार मध्यम आकार के पोतों का पकड मिश्रण ऐसीटीज़ की जातियाँ 56%, पी. टेन्यूपेस 12% बम्बिल 8% **मैक्टोफिड्स** 6% **सी. डसमेरी** 5% फीता मीन 4% पेनीअइड झींगे 2% और अन्य 7% था ।

डोल जाल पकड के 85–90% निम्न दाम की मछली है जिन्हें सूर्यताप में सुखाती हैं । झींगे, पाम्फ्रेट, और अन्य मछली ताज़ा रूप में मार्केट में बिकती है । शुष्क मत्स्य की बिक्री के तीन मार्ग है । 70% छोटी मछली स्थानीय व्यापारियों को 25% थोक व्यापार में और 5% खुदरा मार्केट में बिकती है । स्थान, गुण और माँग के अनुसार शुष्क मत्स्य का दाम भी बदलता है ।

मत्स्यन खर्च

छोटे पोतों का मुख्य खर्च कर्मियों के आहार, तेल और मरम्मत केलिए होता है । लेकिन बडे पोतों का मुख्य खर्च मज़दूरी

है । आय मुख्यतः पेनीअइड जाति के झींगों पर आश्रित है । छोटे पोतों का लाभ 1984–85 में 16,988/– रुपये थे वह 1985–86 में 23, 411 तक बढा मध्यम आकार के पोतों में 1983–84 की अवधि में 15, 887 रुपये का नष्ट महसूस हुआ । मध्यम आकार के पोतों से अधिकतम 32,897 रुपये तक का लाभ मिलते हुये देखा । लेकिन इसके परिचालन खर्च पर विचार करने पर छोटे पोत मध्यम आकार के पोतों से लाभकर दीख पडा ।

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* एस.जी.राजे और एस.राममूर्ति, सी एम एफ आर आइ के बंबई अनुसंधान केन्द्र द्वारा तैयरित

केरल के ट्रिशूर जिला के ब्लागॉड में यूथिनस जातियों से "मास" का उत्पादन*

अभी अभी केरल के ट्रिशूर जिला के ब्लॉगाड नामक स्थान में यूथिनस जातियों से मास (तपित ट्यूना मात्स्यिकी) का उत्पादन करते हुये देखा ।

'मास' उत्पादन केलिए साधारणतया "कुडुता" या "सूता" (यूथिनस जाति) नाम से जाननेवाली मछलियों का उपयोग करता है । इस केलिए पहले मछली के विसीरा और शिरो भाग अलग करके शुद्ध जल में साफ करती है फिर लवण जल में करीब अठारह घण्टे तक उबालती है । इसके बाद मछलियों को पात्र से निकालकर दो टुकडों में लंबाइवार काटती है । कोमल मांस से स्पाइन अलग करके मॉस विशेष रूप में तैयारित लोह निर्मित दंड में एक तह में रखकर इन दंडों के नीचे आग लगाते है । इंधन के रूप में लकडी का उपयोग करते है । इससे साँस तपित एवं धूमित हो जाता है । आधे घण्टे केलिए यह प्रवृत्ति जारी रखती है और इसके बाद तुरंत तपित एवं धूमित पदार्थ को विशेष रीति में तैयारित लकडी के प्लाटफार्म में सूर्यतपन केलिए रखता है । आठ दिनों तक सूर्यतपन कार्य जारी करता है । इससे मॉस कडा, जलरहित और ब्रऊनिश काला बन जाता है । इतने में "मास" बिक्री केलिए तैयार हो जाता है ।

इस प्रवृत्ति में ताजा मछली के भार के 70% नष्ट हो जाता है । अब ब्लॉगाड में एक ही समय पर 400 कि. ग्रा. मछली का संसाधन किया जाता है । यह मुख्यता मछली की उपलब्धि एवं दाम पर आश्रित रहता है । इस प्रकार तैयारित "मास" कोषिकोड जिले (बेपूर) को भेज देते है ।

इस नये उद्यम में लगे हुए व्यक्ति लक्षद्वीप से प्रशिक्षित है । उन्होंने परीक्षण के रूप में यह प्रक्रिया शरू की थी ।

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* सी एम एफ आर आइ, घावक्काड क्षेत्र केन्द्र के सी. के. कृष्णन द्वारा तैयारित ।

मण्डपम के आस पास तारली (नल्लामत्ती) की प्रलाभी मात्स्यिकी*

पम्बान, कुन्डकल और रामेश्वरम के समुद्र तटों से तट संपाशों के ज़रिए तारली (सारडिनेला लौंगिसेप्स) की असाधारण पकड जनवरी 1990 के पहले हफ्ते मिली । जनवरी 2 को कुन्डुकल में प्रचालित तट संपाश (मारुक्कुवले) के एक ही एकक की प्राक्कलित पकड लगभग 10 मीटरी टन थी । कुन्डुकल और पुनगमापाड के बीच 15 तट संपाश एककों का प्रचालन किया था । हर एक एकक दो से तीन मीटरी टन तारली लायी थी । इसके अलावा रामेश्वरम में प्रचालित आनायकों के ज़रिए छोटी मात्रा में पकड प्राप्त हुई थी ।

तट संपाशों से पकडी गयी तारली 12 से 18 से. मी तक रेंच की थी । लेकिन अधिकांश 14–16 से. मी के बीच की थी । आनायकों से पकडी गयी मछली सापेक्षिक रूप से बडी

थी, याने उनकी रेंच 17–20 से. मी. थी । यह भी देखा गया कि आनायकों के ज़रिए पकडे गये नमूने मे कुछ कृश थे ।

इस मौसम के दौरान साधारणतया तारली की पकड स्वाभाविक है, फिर भी चालू मौसम में इस मात्स्यिकी का परिमाण काफी ऊँचा था । इस प्रसंग में उल्लेखनीय बात यह है कि जनवरी 1990 के पहले हफ्ते में यहाँ असाधारण बारिश हुआ था ।

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* सी एम एफ आर आइ के क्षेत्रीय केन्द्र, मण्डपम कैम्प से प्राप्त रिपोर्ट

पानजिम घाट में बाँगडे की बंपर पकड*

पिछले कुछ मौसम को छोडकर पानजिम की बाँगडे मात्स्यिकी इस मौसम में बहुत अच्छी थी । जुलाइ महीने के दूसरे पक्ष से तट संपाशों के ज़रिए यहाँ बाँगडे का स्थलन शुरू होने लगा । जुलाई, आगस्त और सितंबर महीनों के आद्य भाग में पकड उतनी अधिक नहीं थी लेकिन अठारहवीं और उन्नीसवीं सितंबर को पानजिम घाट में 14 से 19 से. मी आकार रेंच के बाँगडे प्राप्त हुए थे । हर एक तट संपाशों से लगभग 3 मेट्रिक टन बाँगडे पकडे गये । पानजिम के उत्तरी और पश्चिमी घाट में बाँगडे की प्रचुरता देखकर वास्को डी गामा, कोल्वा और बेटुल आदि स्थलन केन्द्रों से तट संपाश पानजिम घाट में आ पहुँचे। इस वक्त 40 कि.ग्रा. भार के प्रति बास्केट का दाम दस रुपये तक गिर गया । बर्फ और शीत संग्रहण सुविधाओं के अभाव के कारण 18 और 19 सितंबर बिक्री लाभ रहित ठहरा । तट संपाशों के ज़रिए बाँगडे पकड का ब्योरा नीचे प्रस्तुत है ।

तारीख 18–9–89 को 67 तट संपाश बैंगडों के साथ स्थलित हुये प्रत्येक बोट का पकड रेंच 2 से 4 मेट्रिक टन था । तारीख 19–9–89 को 39 तट संपाश बाँगडे मछली के साथ किनारे पर आये । प्रत्येक बोट का पकड रेंच 1.5 से 5 मेट्रिक टन था ।

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* सी एम एफ आर आइ के गोआ क्षेत्र केन्द्र के प्रकाश सी. शेट्टी द्वारा तैयारित

कारवार से पकडे गये बडे आकार वाला बाँगडा, रैस्ट्रेलिगर कानागुर्टा पर एक टिप्पणी*

यहाँ से प्राप्त इस बडे बाँगडे की कुल लंबाई 366 मिमी थी और भार 592 ग्रा । इसे कोष संपाशों के ज़रिए 11–9–1984 को बिनागा–चेन्डिया से 30 मी गइराई से पकडा गया था । इस मत्स्य का आकृतिमान मापन (मि. मी में) नीचे के प्रकार है ।

कुल लंबाई 366, मानक लंबाई 311, शीर्ष की लंबाई 84, अंतरानेत्रकोटर दूर 29, नेत्रकोटरपूर्वी दूर 27, पूर्व अधरीय दूर–103, पूर्व अधरीय पृष्ठ दूर 186, गुदपूर्वी दूर 195, अग्र पृष्ठ पंख बेस की लंबाई 48, गुद पंख बेस की लंबाई 34, शरीर की अधिकतम ऊँचाई 85, प्रोथ लंबाई 27, आँख का व्यास 15.5 अंस पंख लंबाई 39, अग्र पृष्ठ की ऊँचाई 42, पश्चपृष्ठ की ऊँचाई 29, अधर पंख लंबाई–35, अंस पंख बेस की गहराई 78, गुद पंख बेस की गहराई 75, नेत्रकोटर की गहराई 49, पुच्छ वृन्त की न्यूनतम गहराई 13.

इसके पहले दुलकद और अन्निगिरी ने कारवार से पकडे गये 360 मि मी अधिकतम लंबाई के बाँगडे के बारे में रिपोर्ट की थी ।

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* कारवार अनुसंधान केन्द्र के एन. चेन्नप्पा गौढा और जी. जी. अन्निगिरी द्वारा दी गयी रिपोर्ट ।

पाक खाडी से जेवानीस काउनाज़ शंकुश का एक झुंड*

भारत के दक्षिण पूर्वी तट से अतिक्रमणकारी जेवानीस काउनाज़ शंकुश (राउनोट्टेरा जवानिका) के समूह के बारे में पिछले कुछ सन्दर्भों में रिपोर्ट की गयी है । इस प्रकार का एक झुंड पाक खाडी में 16–12–89 को दिखायी पडी । 10 मी. की गहराई में प्रचालित चिंगट अनायकों के ज़रिए प्रति बोट 350 कि. ग्रा के औसम दर में ये पकडे गये । इसके डिस्क चौडाई 100–165 से. मी के बीच में और भार 16–57 कि.ग्र के रेंच में थे । इसका अस्सी प्रतिशत स्त्री जाति थी ।

आहार नलियों के पदार्थों के विश्लेषण पर जठरपाद (गैस्ट्रोपॉड) सीपियों के कुचली हुई टुकडे, भागिक रूप में पचित सीनेइड्स गोबिइस आदि मछली और कर्कट, स्क्विला, पेनिअस सेनिसुलकाटिस आदि क्रस्टेशियनों की उपस्थिति देखी ।

स्थलित शंकुशों को गर्त संसाधन रीति द्वारा संसधित किया गया और केरल के बाज़ारों में भेज दिया जहाँ इसका अच्छा माँग है ।

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* सी एम एफ आर आइ के मद्रास केन्द्र के हमीद बाचा की रिपोर्ट

कालपेनी द्वीप में एक वसा तिमि का स्थलन–साथ ही साथ इस से प्राप्त सुगन्ध वस्तु ऐम्बग्रिस पर एक टिप्पणी*

प्रस्तावना

वसा तिमी फाइसेटर मॉक्रोसेफालस लिन्नेपस यद्यपि उष्णकटिबंधीय और उपोष्ण क्षेत्र के गरम पानी की पक्षपाती है तथापि सागर में ये बडी संख्या में उपस्थित हैं । ये हिन्द महासागर में, अरेबियन समुद्र में 20°N और 50° और 80° E के बीच विशेषतः एदन खाडी और आस पास में, मिनिकोय द्वीप के कुछ पूर्वी दिशा में और श्रीलंका में उपस्थित हैं । हाल में मान्नार खाडी एवं श्रीलंका तट में इसकी उपस्थिति के बारे में रिपोर्ट की गयी है ।

मिनिकोय के कुछ पूर्वी दिशा तक वसा तिमी दिखाया पडता है । लेकिन लक्षद्वीप में द्वीपों के पृथक्करण और दूरी के कारण अभी तक इसकी उपस्थिति के बारे में रिपोर्ट प्राप्त नहीं हुई है ।

लक्षद्वीप के विविध द्वीपों मे धँसे गये वसा तिमियों के ब्यौरा नीचे प्रस्तुत है । मात्स्यिकी विभाग द्वारा 25–2–71 को पाब्लो पोतों में काल्पेनी द्वीप में मत्स्यन केलिए भेजे गये धीवरों ने काल्पेनी लैगून के मुख्य प्रवेश द्वार में एक निष्क्रिय वसा तिमी को देखा । तिमी के पुछ भाग ड्रिफ्ट जाल में फँसा गया था । इसलिए वह निष्क्रिय था धीवरों ने इसे तट पर ले आया । इसके कुछ मापन से. मी. में यहाँ प्रस्तुत है ।

कुल लंबाई	–	530
शरीर की ऊँचाई	–	98
शरीर का घेरा	–	62
अधो हनु की लंबाई	–	60
अरित्र की लंबाई	–	60
आँखों से प्रोथ तक की लंबाई	–	115

नवंबर 1982 के दौरान काल्पेनी द्वीप के निकटवर्ती चियान तट में एक निर्जीव वसा तिमी धँस गया था ।

चेटलाट द्वीप में 22–12–83 को एक सडा हुआ वसा तिमी के आंतरिक भाग पानी में बहकर तट पर आ गया था । इस आधे भाग की लंबाई 500 से. मी थी और व्यास दो मीटर । इसके अलावा 7–8–84 को चेटलाट द्वीप में और एक निर्जीव वसा तिमी धँस गया । इसकी कुल लंबाई 550 से.मी थी और शरीर की ऊँचाई 220 से. मी ।

वसा तिमी के धँसने के बारे में अंतिम रिकोर्ड 19–11–86 को चेटलाट द्वीप के उत्तरी भाग से प्राप्त हुई थी । इसके सिर पर और अधोहनु के नीचे दायें भाग दो चोट लगी हुई थी ।

ऐम्बरग्रिस

एम्बरग्रिस वसा तिमी से प्राप्त एक बहुमूल्य वस्तु है । लक्षद्वीप में तीन प्रकार के ऐम्बरग्रिस होते है पोन्नाम्बर, पूवाम्बर और मीनम्बर । इसका अर्थ है यथाक्रम सोना, पुष्प और मत्स्य और इसका रंग पीत, टीला हरा और काला है । कभी इसे पानी में बहते हुए और कभी तिमी को काटने पर मिलता है । यह आंत्र में उत्पादित वस्तु है और अधिकतः इसे कोलन में संभाल कर रखता है । ऐम्बरग्रिस एक ठोस एवं ज्वलनशील पदार्थ है । कच्ची अवस्था में इसका गंध अच्छा नहीं होता । लेकिन सुखाने पर इससे खुशबु निकलती है । वायुपरिणामशील सुगन्ध वस्तुओं को प्रबल एवं स्थिर करने का गुण होने के कारण सुगन्ध वस्तुओं के उद्योग में स्थायीकर के रूप में इसका इस्तेमाल किया जाता है । आयुरवेद और हामियोपति दवाइयों में इसका स्थान है । गल्फ, के अमीर लोग इसे वाजिकर के रूप में उपयोग करते है ।

लक्षद्वीप से प्राप्त ऐम्बरग्रिस के बारे में एक सूचना

मानसूनोत्तर काल में ऐम्बरग्रिस के छोटे छोटे टुकडे लैगूनों से या विविध द्वीपों के तटों से प्राप्त होते है । वर्ष 1973 में मात्स्यिकी विभाग के एक दल ने खुले सागर में ऐम्बरग्रिस का एक बडा टुकडा देखा । यह जला हुआ नारियल स्कंध के अधो भाग के समान दिखाया पडा । उस समय इसकी बाज़ार दर प्रति कि. ग्रा. 2000 रु थी । उसी समय ही ट्यूना मात्स्यिकी में लगे हुए अगति द्वीप के एक निजी बोट को 150 कि. ग्रा. भार का एक बडा टुकडा मिला । काल्पेनी द्वीप की निकटवर्ती चेरियन तट में धंस गये एक निर्जीव वसा तिमी के पेट से 50 कि. ग्रा. ऐम्बरग्रिस मिला । इसके बाद कई लोगों को इस तिमी से छोटी छोटी मात्राओं में ऐम्बरग्रिस प्राप्त हुआ । वर्ष 1980 में कवरत्ति के धीवरों को लगभग 20 कि. ग्रा. ऐम्बरग्रिस प्राप्त हुआ था । वर्ष 1974 में प्राप्त 90 कि. ग्रा. एम्बरग्रिस को प्रति कि. ग्रा. में 1160.00 रुपये की दर में नीलाम किया था ।

अभ्युक्तियाँ

जब जेम्स और मनिवासगम ने महाबलिपुरम से वसा तिमी के बारे में रिपोर्ट की थी तब भारत में इस विषय पर सिर्फ दो रिपोर्टें थी । पर बाद के एक दशाब्द में वसा तिमी के धँसने का 13 से अधिक घटना अभिलेखित की गयी है । मई, जुलाई, सितंबर और अक्तूबर को छोडकर बाकी सभी महीने खासकर नवंबर और दिसंबर महीनों में स्ट्रान्डिंग देखा गया । जेम्स और सौन्दरराज ने 1979 में प्रस्तावित किया था कि एडिपोसिपर की उपस्थिति के कारण इसका माँस खाने योग्य नहीं है । लेकिन लक्षद्वीप में वसा तिमी को छोटे टुकडों में काट करके सुखाकर उपयोग करते है ।

* तैयारीः डी. बी. जेम्स; सी एम एफ आर आर के टूटिकोरिन अनुसंधान केन्द्र ।

टूटिकोरिन में स्थलित अंकित पुली सुरा (वागवीर)*

टूटिकोरिन के उत्तर स्थलन केन्द्र में 24-8-89 को स्त्रीजाति के एक पुली सुरा का स्थलन हुआ । इसके गर्दन में एक बेल्ट था जो कटि सूत्र के समान इसके पाँचवे गिल के सामने देखा गया । यह टैग दाई अंस पंख के नीचे की पेशियों में धँसकर प्रवेश किये थे । टैग के दोनों तरफ पेशी बढने के कारण 20 मिमी गहराई और 25 मि मी चौडाई की चोट देखी गयी । टैग का वृत्त परिधि 1045 मिमी व विस्तार 10 मिमी था । टैग का निर्माण प्लास्टिक से किया था । इसका पृष्ठ भाग भस्मवर्णी और अधर तल पीला रंग का था । मुँह में मज़बूत दाँतों की चार पंक्तियाँ थी । हर एक पंक्ति में 23 मज़बूत दाँतें थे ।

इस सुरा को यंत्रीकृत पोतों से काँटा डोर के ज़रिए पाँच धीवरों का एक दल ने टूटिकोरिन के दक्षिण पूर्वी तट से पकडा था । उस दिन केवल इस सुरा को ही पकडा था । इसका भार 130 कि. ग्रा था और नीलाम में 916 रुपये मिले ।

* तैयारीः पी. साम बेनेट, जी. अरमुखम और टी. एस. बालसुब्रहमण्यन, सी एम एफ आर आइ के टूटिकोरिन अनुसंधान केन्द्र, टूटिकोरिन ।

शक्तिकुलंगरा में गिल जाल में फँसकर स्थलित डॉलफिन*

साधारण डॉलफिन डेलफाइनस डेलफिस गिलजाल में जल्दी फँस जाने वाली भारतीय तट की जाति है । हाल की रिपोर्ट के अनुसार कालिकट के तटों से प्रतिवर्ष 30–40 डॉलफिनों को पकडा जाता है लेकिन इसका निश्चित आंकडा उपलब्ध नहीं ।

वर्तमान रिपोर्ट कोइलोन के ड्रिफ्ट गिल जाल परिचालन के दौरान हुए साधारण डॉलफिन के स्थलन का विवरण करती है । डॉलफिनों के स्थलन के डाटा वर्ष 1982–87 की अवधि के दौरान शक्तिकुलंगरा के मछली स्थलन के नेमी आकलनों से एकत्रित किया । अध्ययन के अनुसार जून–अक्तूबर अवधि के दौरान अधिकतम उलझन आकलित किया । डॉलफिनों के अधिकतम अपतन वर्ष 1982–85 की अवधि के दौरान आकलित भार से स्पष्ट रूप से व्यक्त किया । पूरी अवधि में डॉलफिनों के आकलित भार में 2 टन का वर्द्धन अंकित किया और लगभग 145 डॉलफिनों का स्थलन हुआ ।

शक्तिकुलंगरा के डॉलफिन स्थलन इसी तथ्य के कारण विशेष ध्यान देने योग्य है कि मानवीय उपभोग के लिए उनका उपयोग करते है । साधारणतया जाल में फँसे गए डालफिनों को मछलियों के साथ लाते है और स्थलन केन्द्र में ही अलग रूप से नीलाम करते है । यह आकलित किया कि छोटे डॉलफिन जिसका भार लगभग 15–20 कि ग्रा से कम है इसके नरम सांस के कारण उपभोग के लिए ज्यादा पसंद करते है जबकि बडे और अधिक आयु के डॉलफिनों का मांस अंकुश में चारा के रूप में और सुरा को पकडने के लिए रज्जू मत्स्यन में उपयुक्त करते हैं ।

ऐसा प्रकट होता है कि केरल तटों में केवल शक्तिकुलंगरा में मानव के उपभोग के लिए डॉलफिन का उपयोग करता है और फिश मार्केट में इसे बिकते हैं । भारतीय समुद्रों के समुद्री स्तनी डॉलफिनों को भी मिलाकर हाल में विशेष ध्यान आकर्षित कर रही हैं । इस अवसर पर उपयुक्त आकलन महत्वपूर्ण माना जाता हैं ।

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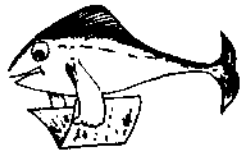
* पी. के. महादेवन पिल्लै और एस. बी. चन्द्रांगदन द्वारा रिपोर्ट की गई ब्योरा ।



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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