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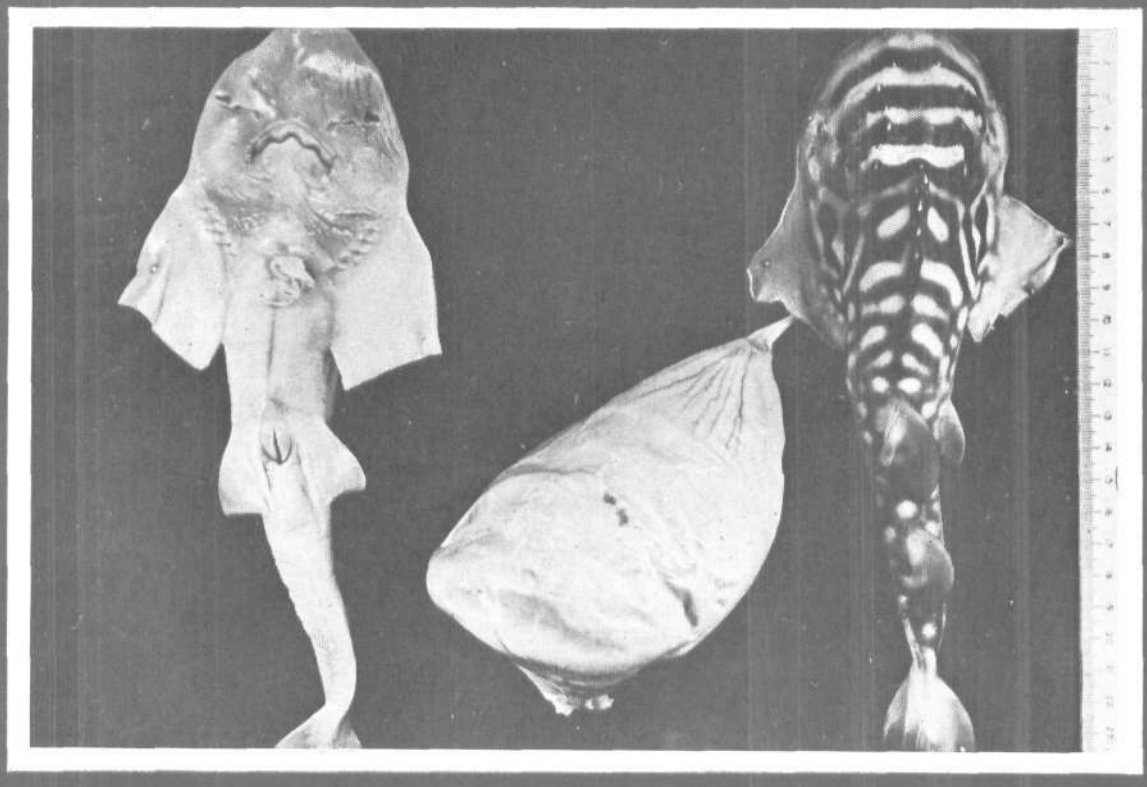

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समुद्री मात्स्यिकी सूचना सेवा: समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनोलजी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना इस तकनीकी और विस्तार अंकावली का लक्ष्य है।

THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages dissemination 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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Front cover photo : Embryos of *Rhina ancylostoma*, a rare elasmobranch distributed in the tropical Indo-Pacific region. On the left is the ventral view of a specimen with the yolk - sac removed and on the right side is the dorsal view of a specimen with the yolk sac intact.

मुख्य आवरण फोटो : रिना अलसैलोस्टोमा के भ्रूण: ट्रॉपिकल इन्डोपसिफिक क्षेत्र में यह उपारिस्थमीन कम पाई जाती है। बाई तरफ मछली का अधरीय दृश्य और दाई तरफ पीतक कोष सहित मछली का पृष्ठीय दृश्य

PRAWN FARMING IN ANDHRA PRADESH — A RETROSPECT

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India with 2 million hectares of brackish-water low lying areas along her coasts offered immense potential for developing prawn farming. This advantage coupled with the technology available in the country and elsewhere in the world attracted the entrepreneurs of every shade and size into this industry and as a result vast areas of the coastal lands have been brought under prawn farming in most of the maritime states.

Andhra Pradesh became the forerunner in this venture due to various technical advantages over the other states. India produced about 82,910 t of prawns by culture from an area of 1,07,700 ha in 1994-'95 which valued at Rs. 1,658 crores. More than 50% of it was produced in Andhra Pradesh. Almost 90% of the semi-intensive and intensive farms of the corporate companies are located in Andhra Pradesh. These figures indicate the magnitude of the prawn culture industry in the state. However, the development in prawn culture has been haphazard, unscientific and without any respect for the ecosystem. As a result of the unscientific expansion of prawn farming there was a crisis in 1994 caused by disease and it still haunts the prawn farming industry. It is high time to take stock of the situation and see where we have failed and how it can be rectified.

Consultants

The major problem of the industry was created by the socalled consultants who infiltrated from freshwater fish culture, agriculture and veterinary fields into prawn culture. These people having very little knowledge about the basic principles of life of prawns and brackishwater aquaculture prescribed unscientific procedures to the farmers.

Soil tests

The first extravagant step suggested to the prospective farmer is the soil tests. Sometimes several chemical parameters are indicated for the soil testing that if one goes for all these tests a lot of money would have to be spent for this purpose. In fact prawns are greatly influenced by chemical properties of the water taken into the pond rather than the chemical properties of the soil. If at all there is any influence of the soil chemicals they get nullified due to the frequent water exchange.

It is true that physical properties of the soil influence the economy of prawn farming systems. Soil should be suitable for bund construction and should not give scope for seepage. Soil with more proportion of sand and gravel should not be used for prawn farming since expenditure on bund laying and maintenance and controlling of seepage is abnormally high leading to lesser returns on the investment. The best soil for pond construction is with a composition of 55-60% sand, 20-25% clay and 10-20% silt.

Pond design

Even the pond design in most of the farms is not suitable for proper drainage. Maximum importance should be given for drainage during designing a farm. The central drainage system where water is taken out from the centre of the pond is the best.

Liming

Another practice prevailing in Andhra Pradesh is the application of lime in the prawn fields. It is certain that almost 90% of the people who advocate liming are ignorant of the basic properties of brackishwaters. Lime should be used only to neutralise the acid soils. Surveys conducted in the past indicated that acid soils are rare along our coasts. Some people claim that the lime acts as a bactericide and fungicide for which there is no scientific evidence. It was observed that the recent crisis of disease may be due to high pH as a result of continuous liming of ponds. It is better that we do away with this liming practice.

Fertilizers

The importance of fertilizers both organic and inorganic is over emphasized in prawn farming. Such ideas are adopted from freshwater fish culture. One should not forget that brackishwater prawn culture is entirely different

from carp culture in freshwater ponds. The fundamental difference in the practices is that in freshwater fish culture the pond water is rarely exchanged but mostly replenished. So whatever fertility derived from fertilizers is retained in the farm and does not go waste. Contrastingly in brackishwater prawn farming water is exchanged whenever there is a chance to do it and so whatever fertility derived from fertilizers goes out of the farm and adds to the pollution of the adjacent brackishwater ecosystem. It is argued that fertilizers are needed to increase phytoplankton production so that prawn can feed on phytoplankton.

There is a basic difference between a penaeid prawn and a carp in feeding. Carp is a plankton feeder and can effectively utilise both phytoplankton and zooplankton as food. A penaeid prawn cannot feed on phytoplankton and its ability to feed on zooplankton is limited since its feeding organs are not designed to catch microscopic prey.

Due to these reasons it is suggested that there should not be any sort of fertilization of the prawn farm. Infact most of the fertilizers such as cowdung, chicken manure etc. contribute to the deterioration of the water quality by increasing the concentration of ammonium compounds which are lethal to prawns.

Feed pellets

In the market many brands of feed pellets either Indian or imported are available and most of these are giving good FCR. However, when they are stored for longer time the results are negative and sometimes disastrous. Farmers should avoid using such outdated stock of feeds in the ponds. Unfortunately most of these companies do not indicate correct packing date on the bags.

Some of the feed companies claim that their feeds can protect the prawns from disease. Till date there is no feed that can prevent diseases in aquaculture system. In fact this is only taking the farmer for a ride.

A survey of the feeding practices in prawn farm indicated that most of the farmers resort to overfeeding. Although farmers use check trays to formulate feeding schedule many a time these check trays give wrong indications leading to overfeeding and consequent feed wastage and deterioration of the water quality. In most of the cases where deep discolouration was observed, it was due to feed wastage and consequent bloom of phytoplankton. There is a simple underwater device to examine the feeding behaviour of prawns in the ponds. This device is called 'snorkel' and consists of a water tight head gear with a glass in front of the eyes and a bent pipe to help in the respiration of the observer when he is below the water surface. The person can observe behaviour of prawns in the ponds for about half an hour. Based on these observations feeding can be regulated so as to maintain optimum dosage of feed and feeding schedule.

Vitamins

Most of the brands of pelleted feeds advertise that their feeds contain all the required vitamins for prawns. There has not been any specific work on the vitamin requirements of *Penaeus monodon*. Whatever knowledge available on vitamin requirements of prawns is the work based on *P. japonicus*. It is widely known that most of the synthetic vitamins are highly soluble in water and hence only a fraction of the vitamin content of the pelleted feed reaches the prawns.

Water management

It was observed that our practices are not very conducive for sound water management. The major factors governing the water quality include depth, transparency, temperature, salinity, dissolved oxygen, pH, plankton, ammonia and hydrogen sulphide.

A prawn pond should have water column of one metre and the level should be adjusted by intake of water. If the depth is too low the temperature of water may raise to harmful levels affecting the growth and survival of prawns. If the depth is too much it would hamper biochemical release of waste products settling at the bottom as a result of prawn metabolism. This will also result in stratification of the water column effecting release of ammonia and hydrogen sulphide from the metabolites resulting in decreasing level of dissolved oxygen.

Transparency

Transparency of water can be measured with the help of a simple device known as Secchi disc. Shrimp ponds should have an optimum

Secchi disc visibility of 30 cm. Phytoplankton should be maintained at this level so that dissolved oxygen and other factors are maintained at optimum levels.

Temperature

The temperature has an effect on the chemical and biological processes taking place in the water. The temperature range of 25-30°C is ideal for prawn farms. Exchange of water may be done late in the evening or in the early morning hours to avoid fluctuation in temperature and stress to prawns.

Salinity

P. monodon can survive in a salinity range of 1-55 ppt. However, the ideal salinity for the culture of this species is 15-20 ppt. At 15 ppt, saline water has maximum capacity to absorb oxygen from the atmosphere. Hence it should be the aim to take advantage of this situation to have good oxygen level.

Dissolved oxygen

The most important factor determining the quality of water is the amount of dissolved oxygen in it. Although *P. monodon* can survive even under anaerobic conditions for shorter duration it is not desirable to allow oxygen concentration to go down below 3.5 ml/l in the prawn culture ponds. It is always better to keep the dissolved oxygen level around 5 ml/l. During day time phytoplankton consume carbondioxide and release oxygen. This process is reversed during night and overcast days. Too much of phytoplankton in the water would lead to oxygen deficiency during night.

pH

In natural brackishwater the pH is around 7-8. Prawns grow better in water of 7.3 to 8 pH. Hence we need not add any chemicals to maintain the pH to any level. If one resorts to fertilizers, liming or any other such practices the pH will increase resulting in bad water quality. Higher pH hampers dissociation of ammonium and would lead to ammonia poisoning. Ammonium compounds are the major excretory products and may reach harmful concentration in water at higher pH levels.

As ammonia concentration increases in the water, ammonia excretion by prawns decreases resulting in higher levels of ammonia in blood and other tissues. This leads to mortality of the stock. The prawns can tolerate ammonia concentration of 0.4 mg/l at a pH of 7.5 but with increasing pH the lethal effect of ammonium increases and at a pH level above 9 even 0.002 mg/l of ammonia can kill the prawn stock.

Aeration

To maintain all these factors at optimum limits water exchange has to be undertaken whenever it is possible to the maximum extent. In the case of high density stocking aeration has to be given. Aeration by any means increase the carrying capacity of an aquatic ecosystem. There are various types of aeration systems which can be broadly divided into 'diffusion' type and 'churning' type. Diffusers are ecofriendly and maintain good water quality. Even the outgoing water from the pond will be sufficiently clean so that it will not pollute the adjacent brackishwater ecosystem. Unfortunately a type of churning aerators–the paddle wheel aerators–have become very popular in India and particularly in the Andhra Pradesh. This paddle wheel aerator has the dubious distinction of creating maximum pollution in the prawn farming areas. These aerators were mainly responsible for the doom of prawn culture in Thailand, Taiwan and other far east countries. So it is high time to do away with the paddle wheel. Infact the crisis in prawn culture industry since 1994 has been due to this aeration system. In this system all the polluted water is released into the drains polluting the entire environment. Since most of these prawn farms have to take water from the same ecosystem they get easily polluted.

Diffusion type aerators allow the faecal matter of the prawn and the feed remains to settle to the bottom where they are allowed to undergo bacterial degradation resulting in purification of the water column apart from supplying much needed oxygen to the prawns. Bacterial colonies so formed will be used by the prawns as feed. In this system it is not necessary to exchange water frequently except for the maintenance of required salinity. Although initial investment will be a little bit higher as compared to paddle wheel aerators it is better for a sustained development of prawn culture.

Disease and antibiotics

Most of the diseases of prawns are due to poor water quality in the farm and the feeder

channels. Some of the pharmaceutical companies came up with medicines to cure diseases. Most of these claims have no scientific basis. In aquatic system if the stock gets infected, it is difficult to save it from disease except from individual treatment of animals. Prawns being small animals it is difficult to give individual treatment. If we have to add medicines to kill the germs in the ponds heavy quantities are to be used which becomes very costly. Inspite of adopting these procedures there is no guarantee that the disease can be completely eradicated from ponds since feeder channels infested with these species can infect the water in the pond. If there is any doubt of the disease the best thing to do is to harvest the stock and dry the ponds.

A variety of antibiotics are being used to save the crop from disease. Most of these antibiotics are incorporated into the feed pellets. These antibiotics are leached out into the pond water before the animal feeds on the pellets. As a result only a negligible portion of the antibiotics reaches the prawns and the rest goes as waste in the water medium. Whatever is lost in the water medium is responsible for the development of resistent varieties of disease creating organisms.

Probiotics

There are certain bacteria, plants and animals which can reduce pollution levels in the prawn farms. In fact some of them are always present in the prawn farms and are helpful in decomposition of the waste material in the ponds. Since waste material load is more than what existing organisms can handle, it may become necessary to supplement with some more organisms so that maximum amount of waste is treated in the ponds to have favourable habitat for prawns.

Now a number of bacterial mixtures are available in the market to serve this purpose. However, the cost of these mixtures is prohibitive and not advised in commercial operations. The best alternative is to introduce animals like mussels and clams which are good filter feeders of phytoplankton and other suspended particles. A judicious application of this system will go a long way in sustaining prawn farming at economic levels.

The 1994 debacle

In 1994 there were heavy rains at the end of October all along the coastal Andhra and most of the estuarine creeks were flooded with freshwater. The prawn farmers were afraid of taking this water and hence there was no water exchange for 10-20 days. Lime was sprayed indiscriminately assuming that it would maintain the water quality. The occurrence of disease was noticed and a variety of chemicals, bleaching powder, iodine, copper sulphate and formalin, to name a few, were sprayed in the farms. There was no use and the farms were affected one after the other and about 60% of the crop to be harvested in November and December was lost.

Various agencies came up with claims that they found out the pathogens responsible for the disease. First it was the turn of the bacteriologists who claimed that bacteria were responsible for the disease as they could find 5-6 species of bacteria in the culture of affected animals tissues. Then came the claim of virologists since a number of viruses were isolated from the infected samples. Finally it was accepted by the majority that it was 'white spot syndrome' (WSS). A world renowned virologist was called to India to examine the samples and give his opinion on the subject. He accepted that it was white spot syndrome but could not pin point the virus responsible for the disease.

Another version, the most plausible one, was that mortality was due to ammonia poisoning as a result of increase in pH due to limited exchange or no exchange of water causing building up of load of waste products in the ponds. The bacteria observed in the cultures of white spot tissue were only saprophytes browsing on the dying prawns.

The future

The foregoing analysis gives an insight into the various procedures followed in Andhra Pradesh for prawn farming and their merits and demerits. It is for the farmers and entrepreneurs to realise the need to take care of the different factors like location, soil characteristics, pond design, water quality, management, appropriate method of aeration, nutritional quality, dosage of feed and farm management which determine the yield from culture practices. Through improved culture practices and regular monitoring of the environmental and biological parameters, there are very good prospects for raising prawn production from coastal aquaculture in Andhra Pradesh from the present level.

THE PORTUNID CRAB, *CHARYBDIS (CHARYBDIS) FERIATUS* – AN EMERGING FISHERY RESOURCE OF MANGALORE COAST

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Introduction

The marine crab fishery by mechanised trawlers along the Mangalore coast is mainly supported by those belonging to the genera *Portunus* and *Charybdis* of the family Portunidae. Among the species, *Portunus (Portunus) sanguinolentus*, *Portunus (Portunus) pelagicus* and *Charybdis (Charybdis) feriatus* (previously known as *Charybdis cruciata*) grow to large size and commercially very important. Of these, until recently *P. (P.) sanguinolentus*, *P. (P.) pelagicus* together contributed to the bulk of the catch, while *C. (C.) feriatus* along with other crabs formed less than 10%. Over the years, there has been a sea change in the pattern of trawl fishing. From single-day, the fishing has been changed to multi-day fishing to facilitate long voyages to exploit the under-exploited/unexploited resources of the deeper waters upto a depth of 100 m. Coupled with this changed scenario in the fisheries sector, there has been sharp increase in the landing of *C. (C.) feriatus* along the Mangalore coast. A brief account of this emerging fishery resource is reported here.

C. (C.) feriatus fishery

The landings of *C. (C.) feriatus* by mechanised trawlers at Mangalore and Malpe combined for the fishing seasons 1992-'93 to 1995-'96 are presented in Tables 1-4. The annual catch increased from a minimum of 64,659 kg (9.3% of total crabs) in 1992-'93 to a maximum of 3,29,479 kg which formed 60.5% of the total crab landings in 1995-'96 at these centres.

Seasonal abundance

Although trawling started by late August and extended upto May end, the catch of this crab occurred only for a short duration i.e., from February to May during 1992-'93 season (Table 1). However, during the following season (1993-'94), the fishery for this species was extended from December to May (Table 2). More recently, (during 1994-'95 and 1995-'96), this crab was caught from October to May, fairly in large quantities resulting in steep increase in its landings (Tables 3-4). The catch was so high that this species dominated the crab landings relegating the traditional species such as, *P. (P.) sanguinolentus*

TABLE 1. *Landings (in kg) of* C. (C.) feriatus *by mechanised trawlers at Mangalore & Malpe centres during the period 1992-'93*

Parameters	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Units	805	5,447	8,181	5,145	7,424	9,714	9,394	8,312	9,362	8,862	72,646
Total crab catch	626	3,167	19,554	9,948	61,027	3,09,435	97,610	59,898	72,084	63,228	6,96,577
C. (C.) feriatus	0	0	0	0	0	0	13,294	7,821	27,232	16,312	64,659
Catch/unit (kg)	0	0	0	0	0	0	1.4	0.9	2.9	1.8	0.9
% in total crabs	0	0	0	0	0	0	13.6	13.1	37.8	25.8	9.3

TABLE 2. *Landings (in kg) of* C. (C.) feriatus *by mechanised trawlers at Mangalore & Malpe centres during the period 1993-'94*

Parameters	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Units	695	2,776	4,616	6,482	10,471	8,974	7,062	8,171	8,597	7,341	65,185
Total crab catch	594	3,320	3,614	10,292	35,229	86,040	43,076	57,600	99,624	74,029	4,13,418
C. (C.) feriatus	0	0	147	0	6,719	30,486	15,785	21,777	29,820	34,551	1,39,285
Catch/unit (kg)	0	0	0.0	0	0.6	3.4	2.2	2.7	3.5	4.7	2.1
% in total crabs	0	0	4.1	0	19.1	35.4	36.6	37.8	29.9	46.7	33.7

TABLE 3. *Landings (in kg)* C. (C.) feriatus *by mechanised trawlers at Mangalore & Malpe centres during the period 1994-'95*

Parameters	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Units	340	1,522	4,438	7,977	9,150	7,878	7,876	9,217	8,882	8,671	65,951
Total crab catch	60	748	3,421	607	22,440	73,650	49,779	49,426	57,114	73,435	3,30,680
C. (C.) feriatus	0	0	3,376	196	14,416	50,006	33,965	30,563	37,042	38,292	2,07,856
Catch/unit (kg)	0	0	0.8	0.0	1.6	6.3	4.3	3.3	4.2	4.4	3.2
% in total crabs	0	0	98.7	32.3	64.2	67.9	68.2	61.8	64.9	52.1	62.9

TABLE 4. *Landings (in kg) of* C. (C.) feriatus *by mechanised trawlers at Mangalore & Malpe centres during the period 1995-'96*

Parameters	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Units	161	3,076	4,252	9,016	7,548	9,514	10,005	9,780	9,810	9,397	72,559
Total crab catch	0	196	0	2,373	29,597	1,16,848	92,674	92,049	89,880	1,21,019	5,44,636
C. (C.) feriatus	0	0	3,376	1,450	24,398	78,595	47,541	54,397	46,249	76,849	3,29,479
Catch/unit (kg)	0.0	0.0	0.8	0.2	3.2	8.3	4.8	5.6	4.7	8.2	4.5
% in total crabs		0.0		61.1	82.4	67.3	51.3	59.1	51.5	63.5	60.5

and *P. (P.) pelagicus* to second and third positions respectively.

The monthly catch ranged from a minimum of 147 kg (4.1%) in October 1993 to a maximum of 78,595 kg (67.3%) in January 1996 (Table 4). The highest catch rate of 8.3 kg/unit was also realised in this month. It is interesting to note that the percentage contribution of *C. (C.) feriatus* was so high that it formed 98.7% of the crab landings in October 1994 (Table 3).

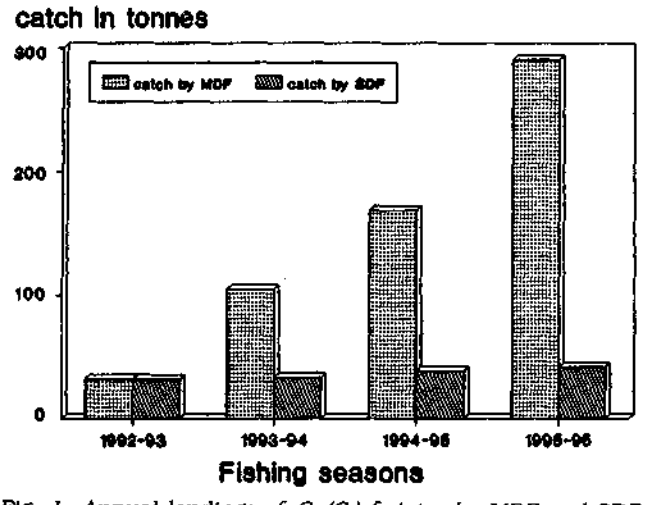

Fig. 1. Annual landings of *C. (C.) feriatus* by MDF and SDF at Mangalore and Malpe for the period from 1992-'93 to 1995-'96.

C. (C.) feriatus is mostly caught by multi-day trawlers operating beyond 25 m depth. Present study has revealed that the annual catch of this species obtained by multi-day fleets increased from 50.3% in 1992-'93 to 87.2% in 1995-'96 (Fig. 1). It is also noteworthy that the landings of this crab showed an upward trend over the recent years, although there was a fall in annual crab landings (Fig. 2).

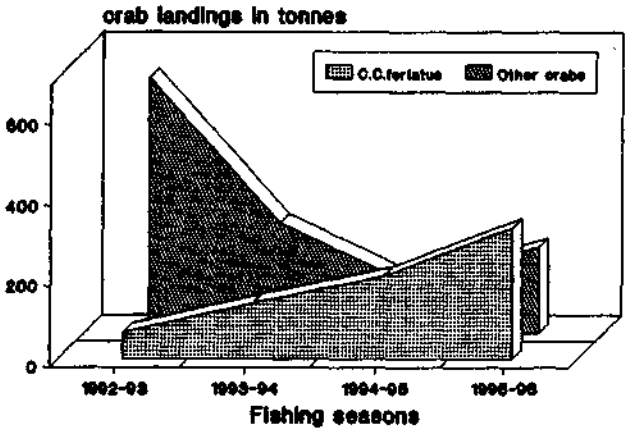

Fig. 2. Annual landings of *C. (C.) feriatus* and total crabs at Mangalore and Malpe for the period from 1992-'93 to 1995-'96.

Biology of *C. (C.) feriatus*

Unlike *P. (P.) sanguinolentus* and *P. (P.) pelagicus*, *C. (C.) feriatus* is exclusively a marine species. The size ranged from 41 to 145 mm carapace width (C.W.) for males and from 36

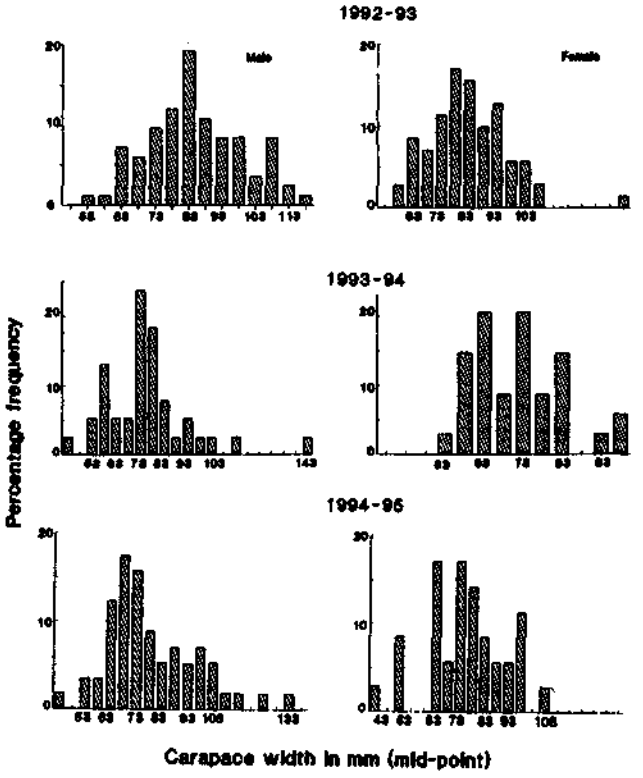

Fig. 3. Annual size frequency distribution of *C. (C.) feriatus* from 1992-'93 to 1994-'95.

to 140 mm (C.W.) for females (Fig. 3). Sex ratio studies indicated that males outnumbered females. It was observed that most of the females were with immature or maturing ovary. Crabs with fully matured ovary were seldom found. However, berried crabs were available from January to May (in fewer numbers) indicating spawning during this period. Smallest ovigerous female measured was 65 mm C.W.

Remarks

With the unprecedented heavy landings of this species, the recent years have witnessed the emergence of *C. (C.) feriatus* as a predominant constituent of the crab resources exploited by mechanised trawlers off Mangalore coast. With the expansion of mechanised trawl fishery coupled with the introduction of more sophisticated fish finding equipments as fishing aids in a large number of units, it is possible that the landings of this species may further increase in the years to come.

On the fishery of the spiny lobster off Tharuvaikulam, Gulf of Mannar*

Tharuvaikulam is a fishing village near Tuticorin on the southeast coast of Tamil Nadu. Fishing by bottom-set gill nets is carried out off Tharuvaikulam almost round the year. Normally, the swimming crab *Portunus pelagicus* dominates the catches. But at times lobsters are also encountered in the catches in good numbers. Two species of lobsters namely, *Panulirus ornatus* and *P. homarus* constitute the lobster fishery off Tharuvaikulam coast. Information on the spiny lobster resources of the Gulf of Mannar is rather limited. The study on the lobster fishery off Tharuvaikulam is based on the observations made on the lobster catches landed during the period 1990-'92.

During the two year period of study the average annual landing of lobsters at Tharuvaikulam centre was estimated at 1.6 tonnes (Table 1). The average monthly landing ranged from 36 kg in September to 399 kg in June. *P. ornatus* was the dominant species throughout the period with its monthly landings ranging from 32 kg in August to 390 kg in June constituting on an average 90% of the total lobster catches landed at Tharuvaikulam. The average monthly composition of *P. ornatus* ranged from 68% in October to 97.9% in April. The composition exceeded 90% in April, June, July, December and January. The *P. homarus* constituted

TABLE 1. *Estimated average monthly catch (kg) of* P. ornatus *and* P. homarus *landed by bottom-set gill nets at Tharuvaikulam during the years 1990-'92*

Months	Catch of *P. ornatus*	Catch of *P. homarus*	Total catch
April	284	6	290
May	69	9	78
June	390	9	399
July	76	7	83
August	32	9	41
September	32	4	36
October	68	32	100
November	90	24	114
December	109	12	121
January	148	7	155
February	82	19	101
March	100	26	126
Total	1,480	164	1,644

only a negligible proportion from April through September and in January. During the rest of the months also the landing was poor ranging from 12 to 32 kg only. The average monthly composition of *P. homarus* ranged from 2.1% in April to 32.0% in October.

TABLE 2. *Size range and mean size (in mm) of* P. ornatus *landed at Tharuvaikulam during the years 1990-'92*

Months	Male			Female		
	Min	Max	Mean	Min	Max	Mean
April	211	247	223.8	209	261	242.3
May	192	283	233.7	192	363	259.5
June	222	342	265.4	212	320	250.8
July	173	284	218.6	119	283	234.6
August	— Data inadequate —					
September	132	182	148.9	135	320	214.6
October	120	285	163.6	117	300	173.4
November	125	227	161.5	129	199	166.8
December	140	252	171.9	140	218	171.8
January	135	233	181.2	130	291	182.9
February	154	291	200.7	161	259	200.8
March	128	310	226.7	167	342	214.7
Annual	120	342	199.6	117	368	210.2

The size of *P. ornatus* during the two year period of observation ranged from 120 to 342 mm in total length in male and from 117 to 363 mm in total length in female. The average mean sizes recorded for male and female were 199.6 and 210.2 mm. Large-sized lobsters measuring more than 300 mm in total length were observed in June and March in the case of male and May, June, September, October and March in the case of female. Small-sized lobsters measuring less than 130 mm in total length were encountered in the catches during October-November and then in March in the case of male and in July, October and November in the case of female (Table 2). The mean size recorded for male ranged from 148.9 mm in September to 265.4 mm in June. In female the mean size ranged from 166.8 mm in November to 259.5 mm in May. In *P. homarus* the size ranged from 100 to 192 mm in male with mean size at 149.4 mm and from 110 to 271 mm in female with mean size at 162 mm.

The sex ratio in *P. ornatus* indicated a predominance of females during most of the months constituting on an average 58.4%. The composition of female exceeded 70% from May to August. However, female constituted less than 40% in February (Table 3). During the two year period of observation ovigerous female of *P. ornatus* was never encountered in the catches. On the other hand, in *P. homarus* only one female measuring a total length of 253 mm and carapace width of 96 mm and weighing 700 g was observed with berry on 4th April 1992.

The lobsters were auctioned in the landing centre itself. The price of the lobsters varied depending upon their size. During the period of investigation the maximum price was fetched by lobsters weighing between 400 and 600 g. However, during the later part of the investigation due to the export of lobsters in live condition, lobsters weighing more than 500 g fetched the maximum price. During the two year period the maximum price ranged between Rs. 200/ and Rs. 600/ per kg.

The foregoing account clearly shows that the lobster fishery at Tharuvaikulam centre is at low magnitude as compared to the fishery at other important lobster landing centres of India. Nevertheless, it may be mentioned here that the bottom-set gill nets are operated off Tharuvaikulam mainly for exploiting the crab resources and the capture of lobsters from the ground is only incidental. However, the study brings out that *P. ornatus* dominates the inshore lobster resources in the Gulf of Mannar off Tharuvaikulam. Further, the total absence of ovigerous females of *P. ornatus* from the ground suggests that this species spawns releatively in deeper waters.

TABLE 3. *Sex ratio of* P. ornatus *landed at Tharuvaikulam during the years 1990-'92*

Months	No. of lobsters sampled	Male (%)	Female (%)
April	18	44.4	55.6
May	11	27.3	72.7
June	72	25.0	75.0
July	28	28.6	71.4
August	5	20.0	80.0
September	12	58.3	41.7
October	55	52.7	47.3
November	154	53.2	46.8
December	92	47.8	52.2
January	93	40.0	60.0
February	51	65.4	34.6
March	48	36.8	63.2
Annual	639	41.6	58.4

The authors express their gratitude to Dr. P.V. Kagwade, former Head of Crustacean Fisheries Division, CMFR Institute for her valuable suggestions. They express their gratitude to Dr. G. Sudhakara Rao, Head of Crustacean Fisheries Division for critically going through the manuscript.

*** Prepared by M. Rajamani and M. Manickaraja, Tuticorin Research Centre of CMFRI, Tuticorin-628 001.**

Sex change in hound shark, along Madras coast*

The big eye hound shark, *Iago omanensis* has been recorded from the continental shelf off Bombay and Kutch region along the west coast and the Gulf of Mannar in the east coast. During regular observations at Madras fishery harbour on 28th July, 1994 about 150 kg of *Iago omanensis* was noticed in the trawl catches and thereafter six more trips were made to the centre and during each trip about 50 kg of this shark was noticed. More than sixty numbers in the size range of 295-745 mm were collected for detailed study.

This observation was of much interest, for many "male" hound sharks were found carrying developing embryos in their uteri. The number of such "males" was far more numerous that it cannot be dismissed as an abnormal case.

Description of reproductive organs

Based on the sexual behaviour of individual sharks three categories were recognised in the fishery as described below:

a. ***True males:*** Sexes are distinguishable externally in elasmobranchs as males are provided with claspers and the females with thelica. In males, the claspers were well developed (Fig. 1). They grow proportionately to the total length of the shark till they attain maturity. So in a fully mature male the claspers measure 10-13% of the total length of the individual shark (Table 1). The smallest mature, true male measured 290 mm with a clasper length of 35 mm (12%). Internally a pair of testes develop one on either side of the vertebral column (Fig. 2). In all the true males observed, seminal fluid was found stored in the seminal vesicle and sperm oozed out on application of a mild pressure indicating the spawning season.

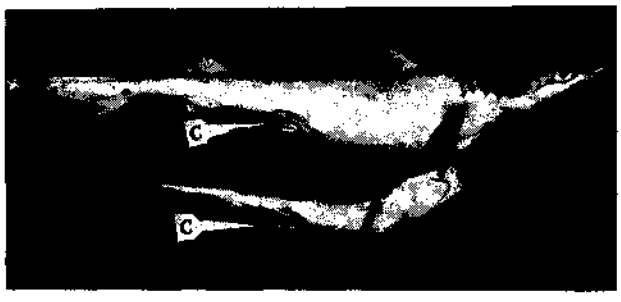

Fig. 1. A true male (smaller size) 310 mm TL having well developed fully calcified and rigid claspers (C) and a functional female (large size) with less developed and soft claspers (C) bearing embryos.

b. ***True females:*** In the adult female a single ovary and a pair of oviducts are present, the lower side of the oviduct being expanded to accommodate the developing embryos.

c. ***Functional females:*** These sharks appear externally as males with the presence of claspers, but are fully functional females with ovary and embryos. The claspers are partially developed with imperfect grooves and are uncalcified. Presence of testes could not be traced internally. Other associated male reproductive organs like vasa differentia and seminal vesicles are also absent. So the claspers from these functional females appear to be functionless and may be just out growths of soft tissues. All the sharks examined were mature ones in the size range of 318-485 mm with the exception of one shark measuring 745 mm, the largest one in

TABLE 1. *Values of clasper length percentages of the total length (True males)*

Total length (mm)	Weight (g)	Clasper length (mm)	% in total length
290	65	35	12.1
300	80	40	13.3
300	90	40	13.3
315	95	40	12.5
315	100	38	12.1
322	104	38	11.8
335	128	40	11.9
350	140	45	12.9
355	152	40	11.3
355	158	48	13.5
360	160	48	13.3
365	150	46	12.6
365	145	48	13.2
408	200	41	10.0
450	350	45	10.0

Fig. 2. A true male with a pair of testes (T) and claspers (C).

this observation. The 'claspers' observed in all these cases were measured and found to form 6-8% of the total body length (Table 2).

TABLE 2. *Size of mother sharks and sex ratio of embryos in functional females and true females*

Size range in total length (mm)	Weight range (g)	Length of claspers (mm)	% clasper in total length	No. of embryos	Sex ratio of F M
Functional females					
301-350	135-150	23-28	7-8	2-3	1 : 2
351-400	140-250	22-30	6-8	3-8	1 : 2
401-450	205-350	28-32	6-7	7-8	1 : 1.7
451-500	370-410	22-35	6-7	6-8	1 : 3.4
745	780	52	7	8	Not distinguishable
True females					
300	82	-	-	2	1 : 1
301-350	132-145	-	-	2-4	1 : 2
351-400	190-230	-	-	3-4	1 : 3
401-450	208-250	-	-	6-8	1 : 1.7
451-500	315-380	-	-	7-8	1 : 1.9
501-550	385-395	-	-	8	1 : 7
					1 : 2.4

Intra uterine and ovarian development

A maximum of eight embryos have been observed per litter (Fig. 3). The number of emrbyos per litter varied between 2 and 8 depending on the size of the mother shark (Table 2). Mature ovary with fully yolked ova (diameter 6-8 mm) ready to be spawned was also seen within the females of advanced pregnancy (Fig. 4). In other words, both ovarian and uterine cycles function simultaneously. These fully yolked ova are to be spawned immediately after parturition.

The number of developing embryos coincide with the number of mature ova present in the ovary at the same time. So the number of mature ova also indicates the fecundity of the species. In most of the cases upto 8 fully mature ova were traced. Only three specimens with 10 mature ova were seen without any embryos in the oviduct, which indicated that the shark was ready for ovulation and subsequent fertilization and development. The fully developed embryos which resembled miniature adults measured between 140 and 150 mm having connection with the mother shark through a well developed yolk sac placenta. The size at birth may be around 150 mm.

Fig. 3. Eight embryos measuring 135 to 140 mm TL removed from a 530 mm functional female; the embryos are with yolk sac placenta (YP).

Fig. 4. Embryos (E) in the uterus; the developing ovary (O) is also seen.

Remarks

Functional hermaphroditism is common in a few species of marine fishes of the family Serranidae. But sexual abnormality, hermaphroditism and sex reversal are not common in elasmobranchs. Two instances of hermaphroditism in *Scyliorhinus caniculus* were reported by King (*J. Zool.*, **146**: 312-314, 1966). Another case of hermaphroditism was reported in electric rays by Nair and Soundararajan (*Indian J. Fish.* **20**(1): 260-264, 1973). Compagno (*Fish. Bull.*, **69**(3): 615-626, 1971) observed partially developed and uncalcified claspers with eggs and early embryos in the oviducts of *I. omanensis* (Total length: 440 mm). In the present observation similar specimens with claspers, ovary with eggs and embryos in all stages of development formed more than 40% of the sharks examined. The size of each such shark was within the ranges of sexual maturity of each sex and no size below this maturity range was recorded. The sex ratio changed from young to adult. The embryonic sex ratio was 70 males to 30 females, but in the adult the ratio changed to 25 males, 33 females and 42 functional females having partially developed claspers. The presence of undeveloped claspers in these females is difficult to explain in the present context. Whether these sharks develop as males initially and reverse their sex as females later just before or at the onset of puberty retaining the external male symbol, or they are females from the earlier stage with claspers defunct could not be established. Histological studies on the reproductive tissues of the juveniles may help to know whether the sex reversal takes place as in the case of serranid fishes which change sex with age.

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On the nesting site and hatchlings of olive ridley turtle observed at Muller, Near Vizhinjam, southwest coast of India*

Five species of marine turtles of our waters have been included in the Wild Life (Protection) Act 1972 and are considered as endangered species. The olive ridley *Lepidochelys olivacea* is one among them. A major threat to this species in general, is their incidental trapping in gillnets, hooks and line and trawlers. This turtle comes to the beach for nesting purpose. The present account deals with a nesting site found on the beach near Vizhinjam, Trivandrum, Kerala.

Eighteen numbers of just hatched-out hatchlings of olive ridley turtle were collected on 22.12.'94 from a nest on the beach of Muller near Vizhinjam (Fig. 1). The place is said to be a good nesting ground for this turtle.

Fig. 1. Muller beach where young ones of olive ridley were observed.

The morphometric measurements of 18 hatchlings were taken and are given in the Table 1. The average carapace length of hatchlings was 46 mm and width 41 mm, the mean plastron length was 35 mm and width 29 mm. The average head and filpper length were 28 and 39 mm respectively, and their width was averaged to 16 and 14 mm respectively. The average weight of the young ones was 19.5 g. After taking the measurements the hatchlings (Fig. 2) were released into the sea on the same day.

Table 1. *Morphometric measurements of hatchlings of* Olive ridley *turtle* Leptochelys olivacea *observed at Muller near Vizhinjam on 22-12-94*

S. No.	Carapace Length (in mm)	Carapace Width (in mm)	Plastron Length (in mm)	Plastron Width (in mm)	Head Length (in mm)	Head Width (in mm)	Flipper Length (in mm)	Flipper Width (in mm)	Weight (in g)
1	50	45	35	30	30	16	40	15	17.5
2	45	40	36	30	26	15	41	15	18.0
3	45	40	35	30	30	16	40	15	15.5
4	45	42	38	30	30	16	40	15	18.0
5	45	43	37	28	29	16	40	15	18.5
6	45	40	36	27	29	16	40	15	18.5
7	45	40	37	32	28	15	40	14	19.0
8	47	42	35	30	27	16	40	15	20.0
9	47	42	37	30	30	16	40	15	20.0
10	42	40	35	28	28	15	38	14	20.0
11	45	42	30	29	30	16	38	15	20.0
12	46	42	37	32	29	17	40	14	21.0
13	47	42	35	28	29	17	40	14	20.5
14	46	41	33	30	30	16	40	14	21.5
15	46	40	37	29	30	16	40	14	20.5
16	44	38	35	28	28	17	40	14	21.0
17	47	42	35	34	30	16	39	14	21.0
18	44	37	35	28	28	15	38	15	22.0
Total	822	738	638	533	521	286	710	258	351.5
Mean	46	41	35	29	28	16	39	14	19.5

Bhaskar (*Ind. Fore.*, No. 11, 1981, p. 707-711) and Bhaskar and Whitaker (*Bull. Cent. Mar. Fish Res. Inst.*, No. 34 1983, p. 94-97) gave an account of the nesting beaches of the sea turtles along the Indian coast. Biswas (*Rec. Zool. Surv. India*, No. 79, 1981, p. 275-302) gave an account of the nesting beaches of olive ridley of the Bay of Bengal. Some of the important nesting grounds of this species along the Orissa coast were studied recently by Silas *et al.* (*Mar. Fish. Infor. Serv., T & E Ser.* No. 50, 1983, p. 1-12) and *Mar. Fish Infor. Serv., T & E Ser.* No. 64, 1985, P. 1-19). Nesting site and hatchlings of Hawksbill turtle (*Ertmochelys imbricata*) of Tirunelveli coast of Tamil Nadu were reported by Bastian Fernando (*Mar. Fish Infor. Serv. T & E Ser.*, No. 50, 1983, P. 33-34)

आंध्रा प्रदेश में झींगा कृषि - एक सिंहावलोकन

जी. सुधाकर राव

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान, कोचिन - 14

भारत में झींगा खेती करने योग्य 2 करोड हेक्टयर खारा पानीयुक्त निम्न तट भूमि उपलब्ध है। यह और इसकेलिए विकसित की गई तकनोलजी से आकृष्ट होकर कई नवागन्तुक जो छोटे और बडे पैमाने के हैं, भारत के समुद्रवर्ती तटों में झींगा खेती में लगे हुये हैं।

झींगा खेती की दृष्टि से आंध्र प्रदेश सब से अनुकूल देखा गया है और यहाँ सब से अधिक खेती की जा रही है। वर्ष 1994-95 के दौरान भारत ने 107700 हेक्टयर में करीब 82910 टन झींगों का संवर्धन किया और इस से 1658 करोड रुपया पाया था। इसका आधा भाग आंध्रा प्रदेश से ही मिला था। तीव्र और अर्धतीव्र संवर्धन खेतों का 90% आंध्रा प्रदेश में स्थित है। लेकिन झींगा खेती के फैलाव के साथ ही साथ पारिस्थितिक तंत्र में प्रतिकूल प्रभाव भी हुआ है। इसलिए 1994 से लेकर यहाँ के झींगा उद्योग में संकटस्थिति उभर कर आया है। इसका कारण खारा पानी में झींगा खेती करने की अवैज्ञानिक रीति है जो कृषकों ने अविदग्धों से अपनाया है।

मिट्टी

खेती शुरू करने से पहले खेत की मिट्टी की उचितता पर निरीक्षण आवश्यक है। इसकेलिए उचित मिट्टी का संघटन 55-60% रेत, 20-25% चिकनी मिट्टी और 10-20% गाद है। इस प्रकार की मिट्टी से खेत की चारों तरफ बंधों का निर्माण कम व्यय पर कर सकता है।

खेती की रूपकल्पना

पानी निकास पर उचित ध्यान देते हुये खेत की रूपकल्पना की जानी है। खेत के मध्य भाग से पानी वितरण करने की केन्द्रीय जल निकास पद्धति इसकेलिए अनुयोज्य है।

चूनायन

चूना का प्रयोग अम्लीय मिट्टी के निर्वण केलिए किया जाता है। आंध्रा प्रदेश के खेतों की मिट्टी अम्लीय नहीं है। इसलिये यहाँ के खेत सज्ज करते वक्त चूनायन नहीं करना है। रोगों का कारण चूनायन हो सकता है।

उर्वरक

खारा पानी और शुद्ध जल मछली खेती में उर्वरक के प्रयोग में भिन्नता है। शुद्ध जल में पानी का विनिमय नहीं होता है, सिर्फ प्रतिपूर्ति होती है इसलिए उर्वरकों से मिलनेवाली उर्वरता बाहर जाकर नष्ट नहीं होती है जबकि खारा पानी में की जानेवाली झींगा खेती में पानी के निकास होने पर उर्वरक भी बाहर जाकर समीपस्थ पारिस्थितिक तंत्र को मलिन करता है। लेकिन ऐसा विवाद भी चलता है कि उर्वरकों के प्रयोग से पानी में पादपप्लवकों की बढती होती है जो झींगों का खाद्य है। पर यह सच है कि झींगे पादपप्लवकों को खाता नहीं और इसका खाद्य अंग इसको खाने के अनुरूप नहीं है। इसलिए झींगा खेतों में किसी प्रकार के उर्वरक का प्रयोग उचित नहीं। इसी प्रकार मार्केट में देशी और आयातित झींगा गुटिकायें उपलब्ध है। ये झींगा संवर्धन केलिए अच्छा देखे गये है पर पुराने माल के उपयोग से विपरीत असर होने की संभावना है। कुछ खाद्य निर्माता ऐसी दावा करते हैं कि उनके खाद्य रोग निरोधक है। वास्तव में ऐसा कोई खाद्य नहीं है जो जलजीवी संवर्धन प्रणाली में रोग निरोध का कार्य करता है।

झींगा खेतों में अशन रीतियों पर चलाये अध्ययन ने व्यक्त किया कि अधिकांश खेतों में आवश्यकता से अधिक भोजन-सामग्री दिया जाता है जिस से पानी का प्रदूषण होता है। झींगों की अशन रीति समझकर ही खिलाना है और इसकेलिए "स्नोरकेल" नामक एक रीति विकसित की है जिसके ज़रिए पानी के नीचे जाकर निरीक्षक आधे घंटे तक झींगों के अशन स्वभाव का निरीक्षण कर सकता है। इन निरीक्षणों के आधार पर झींगों को अनुकूलतम खाद्य से खिलाना है।

विटामिन

विटामिनों के संबंध में अस्पष्टता है क्यों कि कई खाद्य निर्माता ऐसी दावा करते हैं कि झींगों की पौष्टिक बढती केलिए आवश्यक विटामिन उनके गुटिका खाद्य में निहित है। असल में *पी. जापोनिकस* की विटामिन अपेक्षिता पर कुछ अध्ययन कर चुके हैं पर *पी. मोनोडोन* की विटामिन अपेक्षिता पर कोई विनिर्दिष्ट अध्ययन नहीं हो चुके हैं। यह भी सबको मालूम है कि गुटिका खाद्य में निहित अधिकांश सिन्थेटिक विटामिन पानी में जल्दी विलीन होनेवाले हैं इसलिए विटामिनों की छोटी कनिका मात्र झींगे ले सकते हैं।

जल प्रबंध

जल प्रबंध पर उचित ध्यान दिये बिना झींगा खेती हो रही है। झींगा खेत की उचित पानी गहराई एक मीटर है। इससे कम होने पर पानी का तापमान बढकर झींगों का नाश होगा। गहराई इस से अधिक होने पर जैवरासायनिक वस्तुओं के उद्गम से पानी में अमोनिया और हाइड्रजन सल्फाइड बढ जाएगा जिसके फलस्वरूप ऑक्सिजन कम हो जायेगा।

पारदर्शिता

पानी की पारदर्शिता "सचिडिस्क" नामक उपकरण से मापन कर सकता है। अनुकूलतम सचडिस्क दृश्यगोचरता 30 से मी है जो पादपप्लवकों की बढती और विलीन ऑक्सिजन के अनुरक्षण केलिए अनुकूल है।

तापमान

अनुकूल तापमान 25-35°C है। पानी का विनिमय शामको या सबेरे करना भी उचित है।

लवणता

1.55 पी पी टी लवणता परास में *पी. मोनोडोन* जी सकता है, पर इस जाति के संवर्धन केलिए अनुकूल लवणता 15-20 पी पी टी है। 15 पी पी टी का लवणीय पानी वायुमंडल से ऑक्सिजन का अच्छा अवशोषण करता है। इसलिए पी पी टी के इस स्तर का अनुरक्षण करना अच्छा होगा। प्रति लीटर पानी में ऑक्सिजन का स्तर 5 मि ली रखना सब से अनुकूल है फिर भी 3.5 मि ली से नीचे जाना वाँछनीय नहीं। दिन में पादपप्लवकों से ऑक्सिजन निकलने से ऑक्सिजन ज्यादा होंगे पर रात में इसका विपरीत प्रक्रम से ऑक्सिजन कम होता है इसलिये पादपप्लवकों की बढती पर नियंत्रण लाना चाहिए।

प्राकृतिक खारा पानी का पी एच 7-8 है। झींगों केलिए अनुकूल पानी पी एच 7.3 से 8 है। इसलिए झींगा खेतों में उर्वरकों और चूनायन की ज़रूरत नहीं पडती। ऐसे करने से पानी में अमोनिया का अंश बढकर झींगों की मृत्युता होती है।

वातन

वातन सभी घटकों के अनुकूल नियंत्रण केलिए उचित है। वातन से संभरण शक्ति बढ जाती है। कई प्रकार के वातन प्रचार में है। इस में "डिफ्यूसर्स" अच्छा निकला गया है। दूसरा

है "चार्निंग" टाइप वातन जिसका प्रयोग करने पर निकास करनेवाला प्रदूषित पानी समीपस्थ पारिस्थितिक तंत्र को मलिन करता है और इस प्रदूषित पानी का उपयोग फिर से करने पर झींगों का नाश होता है।

डिफ्यूशन टाइप वातित्रों का उपयोग करने पर विसर्ज्य और उच्चिष्ट वस्तुयें नीचे बस जाती है जिस पर बाक्टीरिया विघटन होता है और तद्द्वारा पानी का शुद्धीकरण होता है। इस प्रणाली में पानी विनिमय कम कर सकता है। पर लवणता अनुरक्षण पर ध्यान रखना चाहिए।

रोग और प्रतिरोधी दवायें

पानी का प्रदूषण मुख्य रोग कारण है। जलकृषि में चिकित्सा आसान इसलिए नहीं कि दवा एक एक को करके देना मुश्किल है। भारी मात्रा में देने से खर्च ज़्यादा होता है। इसलिए रोग लक्षण देखने पर पकडना ही उचित है।

ऐसा कुछ बाक्टीरिया, पादप और जलजीवी है जिसका पालन खेतों में करने से प्रदूषण का नियंत्रण कर सकता है। भले ही इन में कुछ खेतों में होता है पर संवर्धन खेतों में अवशिष्ट ज़्यादा होने से ये पर्याप्त नहीं होते। आजकल कुछ बाक्टीरिया मिश्रण मिलता है पर खर्च ज्यादा होने से वाणिज्यिक संवर्धन खेतों में उपयोग नहीं कर सकते। शंबु, बडी सीपी आदि निस्यंदनकारी जीवी है जिसका सह पालन उचित होगा।

1994 की दुरवस्था

आंध्रा तट पर 1994 अक्तूबर में हुए बाढ के कारण खारा पानी का विनिमय नहीं हो सका। पानी का खारापन बनाये रखने केलिए चूना और कई प्रकार के रासायनिक वस्तुयें डाले थे। फिर भी 60% झींगे नष्ट हुए।

वैज्ञानिकों ने निरीक्षण के बाद साबित किया कि रोग "वैट स्पोट सिन्ड्रोम" है, पर इसके कारक वैरस पहचान नहीं सका। दूसरा अनुमान है कि पानी का पी एच कम होने पर हुआ अमोनिया विषायन है। जो भी हो आंध्रा प्रदेश की झींगा खेती में हुआ यह पराजय झींगा कृषकों को सूक्ष्मदृष्टि से इसका विश्लेषण करके उचित रीति से झींगा कृषि करने का पाठ प्रदान करता है।

पोर्ट्यूनिड कर्कट, *कैरिब्डिस (कैरिब्डिस)* *फेरियाटस* माँगलूर तट की एक उद्गामी मात्स्यिकी

के.के. सुकुमारन, बी. श्रीधरा और वाई. मुनियप्पा

सी एम एफ आर आइ का माँगलूर अनुसंधान केन्द्र, माँगलूर

आमुख

माँगलूर तट की समुद्री कर्कट मात्स्यिकी जो यंत्रीकृत ट्रालरों से पकडी जाती है, मुख्यत: पोर्ट्यूनिडे कुटुंब के *पोर्ट्यूनस* और *कैरिब्डिस* वंश के है। इनमें *पोर्ट्यूनस* (पोर्ट्यूनस) *सॉंगिनोलेन्टस, पोर्ट्यूनस* (पोर्ट्यूनस) *पेलाजिकस* और *कैरिब्डिस* (कैरिब्डिस) *फेरियाटस* की जातियाँ काफी बडी होती हैं और वाणिज्यिक दृष्टि में बहुत मूल्यवान भी है। इनमें *पी. (पी) सॉंगिनोलेन्टस* और *पी. (पी) पेलाजिकस* अभी हाल तक पकड में प्रचुर थे जबकि *सी. (सी) फेरियाटस* और अन्य कर्कटों को जोडकर पकड 10% से कम थी।

पोर्ट्यूनिड कर्कट की वर्धित पकड का कारण यहाँ की मत्स्यन रीति में लाया गया परिवर्तन है। यहाँ गहरे तल के अल्प विदोहित और अवशोषित संपदाओं के विदोहन केलिए अपनाया गया एकल दिवसीय मत्स्यन बहु दिवसीय बनाया गया और 100 मी गहराई में मत्स्यन करने लगा। इसके फलस्वरूप *सी (सी) फेरियाटस* के अवतरण में काफी वृद्धि हुई।

सी. (सी) फेरियाटस मात्स्यिकी

माँगलूर और माल्प के यंत्रीकृत ट्रालरों में *सी. (सी) फेरियाटस* की वार्षिक पकड 1992-93 में 64,659 कि. ग्रा थी और 1995-'96 में यह बढकर 3,29,479 कि. ग्रा बन गयी।

मौसमी प्रचुरता

1992-93 के दौरान आनायन अगस्त से मई तक करने पर भी इस कर्कट की उपस्थिति केवल फरवरी से मई तक की छोटी अवधि में ही देखी गयी थी।

1993-94 दिसंबर से मई तक इसकी उपस्थिति हुई। हाल में (1994-95 और 1995-96 में) अक्तूबर से मई तक इसकी उपस्थिति हुई और अवतरण में भी भारी वृद्धि हुई। इसका अवतरण इतना अधिक था कि परंपरागत जातियाँ *पी. (पी) साँगिनोलेन्टस* और *पी. (पी) पेलाजिकस* क्रमश: दूसरे और तीसरे स्थान पर हो गये।

माहिक पकड में भी व्यतियान हुआ था। 1993 अक्तूबर की न्यूनतम पकड 147 कि ग्रा थी तो 1996 जनवरी में मिली अधिकतम पकड 78,595 कि ग्रा थी। *सी. (सी) फेरियाटस* का प्रतिशतता योगदान उतना उच्च था कि यह अक्तूबर, 1994 के कुल कर्कट अवतरण के 98.7% था।

सी. (सी) फेरियाटस अधिकत: 25 मी से अधिक गहराई में बहुदिवसीय ट्रालरों में प्राप्त होता है। वर्तमान अध्ययन यह व्यक्त करता है कि इस जाति की वार्षिक पकड 1992-93 के 50.3% से 1995-96 में 87.2% हो गयी। यह भी नहीं वार्षिक कर्कट अवतरण में कुछ घटती आने पर भी *सी (सी). फेरियाटस* के आवरण में कमी नहीं थी।

सी. (सी) फेरियाटस की जैविकी

सी. (सी) फेरियाटस ज्वारनदमुखियों या पश्चजलों में देखी जाती है। यह पूर्णत: एक समुद्री जाति है। नर जाति में पृष्ठवर्म की चौडाई 41 से 145 मि मी और मादाओं में यह 36 से 140 मि मी में विविध था। लिंग अनुपात के अनुसार नरजाति संख्या में अधिक थी। अधिकांश मादा जाति अपरिपक्व या परिपक्व होने वाले गर्भाशययुक्त थी। पूर्ण परिपक्व अंडाशययुक्त कर्कट नगण्य था। जनवरी से मई तक की अवधि अंडजनन काल देखा गया।

माँगलूर तट के यंत्रीकृत ट्रालरों से विदोहित कर्कट संपदाओं में *सी. (सी) फरियाटस* सबसे प्रमुख है। यंत्रीकृत ट्राल मत्स्यन के विकास और मत्स्यन केलिए उपयुक्त आधुनिक उपकरणों की सहायता से इस जाति का अवतरण आनेवाले सालों में और भी बढने की संभावना है।

तरुवायकुलम की शूली महाचिंगट मात्स्यिकी पर एक टिप्पणी*

तरुवायकुलम तमिलनाटु के दक्षिणपूर्व तट पर टूटिकोरिन के निकट स्थित एक मत्स्यन गाँव है। यहाँ साल भर बोटम-सेट गिल जालों का प्रचालन होता है। यहाँ की प्रमुख पकड तरुण कर्कट *पोर्ट्नस पेलाजिकस* है। लेकिन कभी कभी चिंगटों की भी उपस्थिति पकड में होती है। इस में प्रमुख होती है *पानुलिरस ओरनाटस और पी. होमारस।* तरुवायकुलम के शूली महाचिंगटों पर बहुत कम सूचना उपलब्ध है। यह लेख 1990-92 के दौरान तरुवायकुलम में प्राप्त चिंगट पकड पर प्रकाश डालता है।

परिणाम और चर्चा

दो सालों की अध्ययनावधि में तरुवायकुलम केन्द्र में चिंगटों का औसत वार्षिक अवतरण 1.6 टन आकलित किया था। औसत माहिक अवतरण ने सितंबर के 36 कि.ग्रा से जून में 399 कि.ग्रा में विविधता दिखायी। पकड में *पी. ओरनाटस* प्रमुख था। *पी. ओरनाटस* का माहिक मिश्रण अक्तूबर के 68% से अप्रैल में 97.9% में विविधता दिखायी। *पी. होमारस* की उपस्थिति नगण्य थी।

इन दो सालों की अवधि में *पी. ओरनाटस* के नर जाति की कुल लंबाई 120 से 342 मि मी तक और मादा जाति की कुल लंबाई 117 से 363 मि मी तक देखी गयी। नर और मादा जाति की औसन लंबाई क्रमश: 199.6 और 210 मि मी थी। जून और मार्च महीनों में 300 मि मी तक लंबाई वाले नर चिंगट और मई, जून, सितंबर, अक्तूबर और मार्च में बडे आयाम की मादा चिंगट दिखायी पडी। छोटे आयाम के नर जाति सितंबर से नवंबर तक और मार्च की पकड में उपस्थित थे और मादा जाति जुलाई, अक्तूबर और नवंबर में। नर जाति का माध्य आयाम सितंबर के 148.9 मि मी से जून के 265.4 मि मी में विविध था। मादा जाति में यह नवंबर के 166.8 मि मी से मई के 259.5 मि मी में विविध था। *पी. होमारस* का आयाम नर जाति में माध्य आयाम 149.4 मि मी के साथ 100 से 192 मि मी के बीच और मादा जाति के माध्य आयाम 162 मि मी के साथ 110 से 271 मि मी के बीच दिखाया पडा।

लिंग अनुपात में मादा जाति प्रमुख थी। मई से अगस्त की अवधि में मादा जाति 70% से अधिक थी। लेकिन फरवरी में यह 40% से कम थी। अध्ययनावधि की पकड में अण्डवाही *पी. ओरनाटस* की प्राप्ति नहीं हुई थी। लेकिन 4 अप्रैल, 1992 में 253 मि मी लंबाई 96 मि मी पृष्ठ वर्म और 700 ग्रा भार की एक मादा *पी. होमारस* को देखी गयी थी।

चिंगटों को अवतरण केन्द्र में ही नीलाम कर दिया गया। आयाम के अनुसार इसको दाम मिला था। 400 और 600 ग्रा भार के चिंगट उच्च मूल्य पाते थे। पिछले तीन सालों में प्राप्त अधिकतम मूल्य प्रति कि ग्रा पर 200/- और 600/- रु के बीच देखा गया।

भारत के अन्य प्रमुख चिंगट अवतरण केन्द्रों की तुलना में तरुवायकुलम केन्द्र काफी पीछे है। यहाँ प्रचालित बोटम-सेट गिल जाल प्रमुखत: कर्कट संपदाओं को पकडने केलिए है और इन में चिंगटों की प्राप्ति केवल आकस्मिक है। यद्यपि अध्ययन यह व्यक्त करता है कि *पी. ओरनाटस* की प्रमुखता मान्नार खाडी के उपतट चिंगट मत्स्यिकी में है और यहाँ अंडवाही रहित *पी. ओरनाटस* मादाओं की अनुपस्थिति यह व्यक्त करती है कि यह जाति गहरे जल में अंडजनन करती है।

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*टूटिकोरिन अनुसंधान केन्द्र, टूटिकोरिन के एम. राजामणि और एम. मानिक्कराजा द्वारा तैयार की गयी रिपोर्ट।

मद्रास तट में हून्ड शार्क, *इवागो ओमनेनसिस* का पुनरुत्पादकीय स्वभाव

बडी आँखोंवाला हून्ड शार्क, इवागो ओमनेनसिस बंबई और कच के दूरवर्ती, महाद्वीपीय शेल्फ और मान्नार की खाडी में पाने की रिपोर्ट मिली है। लेकिन मद्रास तट में 24 जुलाई 1994 की ट्राल पकड में करीब 50 कि ग्राम शार्क मिला था।

पुनरुत्पादन की दृष्टि से इस पर किया गया निरीक्षण कुतूहल जगानेवाला था क्यों कि कई "पुरुष" सुराओं के गर्भाशयों में विकासोत्मुख भ्रूण थे। इस प्रकार के "पुरुष" सुरा संख्या में ज्यादा थे और यह एक साधारण परिघटना मानी जाती है।

लिंग विवरण

प्रत्येक सुराओं के लैंगिक स्वभाव के अनुसार इन्हें 3 कोटियों में बाँटा गया है।

क. सच्चा पुरुष सुरा

पुरुष उपास्थिमीनों में मिश्रित लिंग लक्षण दिखाया पडता है पर बाह्य लिंग अवयवों से लिंग विवेचन कर सकता है।

पुरुष सुराओं के अंस पख मध्य से सुदृढ़ आलिंगक विकसित होता है। परिपक्वता होते वक्त मछली बढने के साथ ही साथ यह भी बढ जाता है। वैसे पूर्णत: परिपक्व एक सुरा की कुल लंबाई के 10-13% होगा आलिंगक का आकार। स्त्री सुराओं में आलिंगक नहीं होगा। पुरुष सुराओं के मेरुदंड की दोनों तरफ वृषणों का एक जोडा होगा। पुरुषों में शुक्राशय में शुक्र तरल और दबाव पर शुक्राणु का प्रवाह होता है।

ख. स्त्री सुरायें

स्त्री सुराओं में आलिंगक नहीं होता है। वयस्कों में एकल अंडाशय और एक जोडी अंडनाली होती है। अंडनाली के निम्न भाग विकसित होकर बढनेवाले भ्रूणों का वहन करता है।

ग. प्रकार्यक स्त्री सुरायें

इनको आलिंगक होने के कारण देखने में पुरुष सा लगता है पर स्त्री प्रकार्ययुक्त अंडाशय और भ्रूण इन में होता है। इन में वृषण नहीं दिखाये पडते और अन्य पुरुष पुनरुत्पादकीय अंग जैसे वासा डी फेरन्शया और शुक्राशय भी। इस से यह व्यक्त होता है कि इन में दिखाये पडनेवाला आलिंगक प्रकार्यरहित है और यह सिर्फ नरम ऊतकों से विकसित बाह्य अवयव है।

अंतरा गर्भाशयी और अंडाशयी विकास

भ्रूणों की संख्या मादा सुराओं के अनुसार बदलती थी। अंतिम गर्भस्थावस्था की सुराओं में परिपक्व अंडाशय और पीतयुक्त स्फुटन क्षम अंडा उपलब्ध था। अत: इन सुराओं में एक साथ ही गर्भाशयी और अंडाशयी चक्रण होता है। एक ही समय पर विकासोन्मुख भ्रूणों और अंडों की संख्या में तुलना दिखाई पडती है। इसलिए परिपक्व अंडों की संख्या से इसकी जननक्षमता का अन्दाज़ लिया जा सकता है। कई सुराओं में आठ तक परिपक्व अंडे दिखाये पडे थे। पूर्ण विकसित भ्रूण वयस्क मछलियों के लघु प्रतिमान है जिसका आकार 140-150 मि मी है। जन्मावस्था में इसका आकार करीब 150 मि मी है।

अभ्युक्तियाँ

प्रकार्यात्मक उभयलिंगता सेरेनिडे कुटुंब की समुद्री मछलियों की कुछ जातियों का साधारण स्वभाव है। पर उपास्थिमीनों में लिंगीय असाधारणता, उभयलिंगता और लिंग परिवर्तन साधारण नहीं है। *एस. कानिकुलस* और इलक्ट्रिक रे मछलियों में उभयलिंगता के बारे में रिपोर्ट प्राप्त है। वर्तमान निरीक्षण में 40% सुराओं में आलिंगक, अंडाशयों में अंडे और भ्रूण दिखाये पडे थे। इन स्त्री जातियों में दिखाये पडे अविकसित आलिंगकों

के बारे में कुछ निर्णय लेना अब मुशकिल है क्यों कि यह साबित करने की सूचना उपलब्ध नहीं है कि ये स्त्री जातियों में लिंग परिवर्तन होता है कि नहीं या आंलिगकों की प्रकार्यात्मकता कभी होती है कि नहीं। इसलिए इनके तरुणों के पुनरुत्पादकीय कलाओं की ऊतकीय अनुसंधान करना पडेगा क्यों कि सेरेनिड मछलियों में आयु के अनुसार लिंग परिवर्तन दिखाया पडा है।

पी देंवदोस और हमीद बाचा, सी एम एफ आर आइ का मद्रास अनुसंधान केन्द्र, मद्रास

विषिंजम में ओलिव रिडले कछप का नीडन और बच्चों की उपस्थिति

भारतीय समुद्र में दिखाये जानेवाले कच्छपों की 5 जातियों को वन्य जीवी संरक्षण अधिनियम 1972 में जोडकर खतरे में पडे हुये माने गए हैं। ओलिव रिडले *लिपिओडोइशेला ऑलिवेसिया* इन में से एक है। ये साधारणत: गिल नेटों और काँटा-डोर ट्रालरों में फँसे हुये दिखाये पडते है। नीडन पर यह समुद्र तट पर आ जाता है। केरल के विषिंजम समुद्र तट पर इस कच्छप का नीडन स्थल दिखाया पडा था। यहां से इसके 18 बच्चों का संग्रहण किया और आकार मापन के बाद समुद्र में जाने दिया। विषिंजम के मुल्लर तट ओलिव रिडले का अच्छा नीडन स्थल देखा गया है।

भारतीय तटों में कच्छपों के नीडन पर भास्कर और विटाकर ने सी एम एफ आर आई बुल्लेटिन सं. 34 में विवरण दिया है। विस्वास ने भारतीय जीव विज्ञान सर्वेक्षण रेकोर्ड सं. 79 में बंगाल की खाडी के ओलिव रिडलों के नीडन पर रिपोर्ट की है। हाल ही में सिलास आदि ने उडिसा तटों में दिखाये पडने वाले इसके नीडन स्थलों पर अध्ययन किया है। बास्टिन फेरनान्डो ने तमिलनाडु के तिरुनेलवेली के हाकसबिल कच्छपों के नीडन स्थल के बारे में और रत्नगिरी तट के ऑलिव रिडले के बारे में कटकार ने रिपोर्ट की है। फामरोत और जॉनस ने केरल तटों के लेथर बाक टर्टिल के नीडन पर रिपोर्ट की है।

सी एम एफ आर आइ के विषिंजम अनुसंधान केन्द्र के एस.कृष्ण पिल्लै द्वारा पेश की गई रिपोर्ट

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