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CAGE CULTURE IN MAHARASHTRA: PRESENT AND FUTURE PROSPECTS

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Introduction

Sea farming is a popular area of aquaculture practice throughout the world. In Asian countries, it is rapidly growing to meet the increasing demand of high value marine fishes. Although India has a tradition of aquaculture, sea farming ventures on commercial scale were lacking. In this context, Central Marine Fisheries Research Institute started open sea floating cage culture activities in 2006-07 with Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Government of India assistance. Indigenous cage of 15 m diameter was fabricated following Norwegian open sea floating cage design and launched at Visakhapatnam. There was a technical setback with the design of cage, and consultation with Indian Institute of Technology, West Bengal helped to overcome technical issues with the cage structure. Open sea floating cage diameter was reduced to 6 m and 14 new open sea floating cages were launched at Sutrapada (Gujarat), Vasai (Maharashtra), Mangalore (Karnataka), Cochin (Kerala), Pulicat (Tamil Nadu), Nellore, Kakinada, Baruva (Andhra Pradesh) and Balasore (Odisha) in participation with National Fisheries Development Board (NFDB).

Initial results with 6 m diameter cages were encouraging at various places for farming marine finfishes and shellfishes including Asian sea bass, cobia and spiny lobsters. But, high capital requirement of Rs. 5,50,000/- for fabrication and installation of 6 m diameter High Density Poly Ethylene (HDPE) cage was unaffordable and in turn affecting adoption of technology by rural fishers along the coastline. Identification of need and desire of fishers to reduce down initial cost investment led to development of 6m diameter Galvanised Iron cage frame which successfully reduced down the initial investment from Rs. 5,50,000/- to Rs. 1,00,000/-. GI cage frame is likely to last for 4 to 5 years, making open sea floating cage culture a sustainable and economical venture.

Activities in Maharashtra:

Open sea floating cage culture in Maharashtra started through pilot project funded by DAHD&F, Govt. of India at Nevare, district Ratnagiri. But, due to social issues in the region, faced setback in pursuing open sea floating cage culture activities in Maharashtra. In 2009, spiny lobster cage culture in floating cages was started in 6 m diameter HDPE cages at Kalamb, district Thane. The cages were stocked with150 no. juvenile lobsters and cultured for five months, the juveniles were grew upto 300 to 350 gm body weight, showing better growth in open sea floating cages. In 2011, the Mumbai Research Centre of CMFRI made changes to cage design by reducing the size of frame to 3 m diameter on suggestions received from fishers. The trial of 3 m diameter open sea GI cage without collar was conducted at Kalamb, district Thane and 200 no's of juvenile lobsters collected from trawl bycatch were stocked. The attempt was successful and after culture period of 117 days, lobster crop of 24.6 kg was harvested with 79% survival. About ten 3 m diameter open sea floating cages were launched and stocked with lobsters at Bharadkhol, Dighi, Turumbadi, Sasawane, Bagmandla, Aadgaon and Borli Mandla in Raigad district and at Dahanu in Thane district. The centre also launched four square shaped open sea floating cages at Aachra Bundar, district Sindhudurg in 2013 and stocked two cages with Silver pompano *Trachinotus blochii*. The Centre has been identified by the Institute to conduct open sea cage culture activities in Raigad district under Tribal Sub Plan (TSP) project during 2013. Presently, the Centre has identified tribal fisher societies and installed two 6 m diameter GI cages at Shrivardhan and stocked with 1000 juvenile lobsters collected from trawl bycatch.

Fig.1: **Circular 6 m diameter HDPE cage launched at Kalamb, Thane District.**

Fig. 2: **Circular 3 m diameter GI cage without collar launched at Kalamb, Thane District.**

Fig. 3**: Square shaped GI cages lanched at Aachra Bundar, Sindhudurg District.**

Fig. 4: **Circular 6 m diameter GI cage launched at Shrivardhan, Raigad District.**

Table 1: . **Infectious diseases observed in cage culture**

S No.	Disease	Causative Agent	Diagnosis/Symptoms	Fish species affected	Treatment
Viral diseases					
1	Viral nervous necrosis (VNN)	Nodavirus (RNA virus)	Lethargy, anorexia and abnormal swimming **(plate 1)**	*Lates calcarifer*	No treatment available
2	Iridoviral disease	*Iridovirus*	Fish becomes lethargic and anaemic. Gills haemorrhagic. The fish will turn black and lose appetite. On closer clinical examination the gills will appear very pale and may bleed when handled and blood may also leak into the iris giving a 'red eye' appearance. Internally, a pale spleen is characteristic of this disease. **(plate 2)**	*Lates calcarifer* **(plate 2)**	No treatment available
3	Lymphocystis	*Iridovirus*	Massive enlargement of the cell within the dermis layer of the fish skin **(plate 3)**	*Rachycentron canadum* *Lates calcarifer*	Good water quality and best management practices minimize death

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Bacterial diseases					
1	Pasteurellosis	*Photobacterium damsela*	Enlarged spleen and kidney with white nodules **(plate 4)**	*Rachycentron canadum and Lates calcarifer*	Oral administration of flumequine, oxolinic acid, trimethoprim-sulfamethoxazole, amoxicillin. *Lates calcarifer*: Ampicillin and florfenicol administration through feed.
2	Streptococcosis	*Streptococcus iniae*	Clouding of cornea resulting in blindness. *Lates calcarifer:* Darkening of body, erratic swimming, haemorrhage in kidney, spleen, intestine and liver. **(plate 5)**	*Rachycentron canadum*	Oral administration of erythromycin, trimethoprim-sulfamethoxazole, amoxicillin *Lates calcarifer*: Erythromycin and spiramycin.
3	Vibriosis	*Vibrio anguillarum*	Exopthalmia, lesions on the base of pectoral fins, haemorrhagic gonads **(plate 6)**	*Rachycentron canadum*	Oral administration of flumequine, oxolinic acid or flurophenicol
4	Vibriosis	*Vibrio parahaemolyticus, V.*	Congestion and appearance of red	*Lates calcarifer and snapper*	Good husbandry practices and

		anguillarum and V. alginolyticus	boils on body surface. Darkening of body. **(plate 7)**		adequate nutrition.
5	Bacterial enteritis	*Vibrio alginolyticus*	Inflammation of intestine and greenish liver **(plate 8)**	*Rachycentron canadum*	
6	Mycobacterium infection	*Aeromonas hydrophila*	Ulcerative dermal lesions, exophthalmia, hyper and hypopigmentation and lethargy	*Rachycentron canadum*	No treatment
7	Tail rot/Gliding bacterial disease	*Flexibacter spp.*	Erosion and damage of caudal fin **(plate 9)**	*Lates calcarifer*	Use of Oxytetracycline medicated feed or bath in Sodium Nifurstyrinate
8	Mycobacteriosis	*Mycobacterium marinum*	Superficial ulcers and Exophthalmia. In advance stage lesions spread to liver, heart, mesentery etc.	*Lates calcarifer*	
9	Nocardiosis	Gram-negative bacterium	Anorexia, inactivity, skin discolouration and emaciation. **(plate 10)**	*Lates calcarifer*	No effective therapy available. Clean environment is an important factor in preventing

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Parasitic diseases					
1	Neobenedeniasis	*Neobenedenia melleni*	Lesions near eyes causing blindness **(plate 11)**	*Rachycentron canadum*	Freshwater bath for juveniles for 4 to 6 min.
2	Sea Lice Infestation	*Rachycentron canadum : Parapetalu occidentalis* (Gills) and *Caligus oviceps* (Body surface) *Lates calcarifer*: *Argulus* spp., *Caligus* spp. And *Lernanthropus* spp.	Gill and dermal necrosis. *Lates calcarifer:* Infestation of parasites causes anaemia in fish. **(plate 12)**	*Rachycentron canadum* and *Lates calcarifer*	No treatment
3	Amyloodiniosis	*Amyloodinium ocellatum*	Microscopic examination of gills show trophonts **(plate 13)**		Copper and chloroquinediphosphate
4	Licmophorasis	*Licmophora sp.*	Rusty or yellow sheen on the skin		Net exchange every 10 days
5		*Octolasmis spp.*	Gills and carapace **(plate 14)**	*Panulirus polyphagus*	
6	White spot disease	Cryptocaryon sp.	White pustules or numerous minute, greyish vesicles burrowing under the epidermis **(plate 15)**	*Lates calcarifer*	Moving cages to sufficient depth and currents prevent the free swimming infective stages