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OUT of the SHELL

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Workshop on Integrated Coastal Management

The following article is based on the summary report prepared by Muriel Cole, Intergovernmental Oceanographic Commission (IOC), UNESCO.

Introduction

A workshop was held 2 days prior the Coastal Zone Canada '94 conference to introduce representatives from developing countries to Integrated Coastal Zone Management (ICM). It focussed on the importance of community participation to provide them with an opportunity to consider and resolve issues associated with ICM at both the national and local levels. It was jointly organized by the Coastal Zone Canada Association, the University of Rhode Island (URI)'s Coastal Resources Center (CRC) and the Coastal Resources Research Network, supported by the International Development Research Centre (IDRC) Canada. The workshop was attended by a total of 60 participants from 28 countries who were sponsored by IDRC, the Canadian International Development Agency (CIDA) and the Commonwealth Secretariat.

Integrated Coastal Management for the 21st Century

Biliana Cicin-Sain, Professor of Marine Policy, University of Delaware and Editor, Ocean & Coastal Management Journal, presented background information and a post-Rio assessment. Concepts of interdependence are key - interdependence between environment and development, between the developed and the developing world, and between sectors. Chapter 17 of Agenda 21 emphasizes capacity building and gives political legitimacy to pro-active multi-sector management.

Cicin-Sain reviewed the progress that has taken place since the Rio Conference, citing some successes but a lack of funding in many areas. The Climate Change Convention entered into force in March 1994, as did the Convention on Biological Diversity in December 1993. The Commission on Sustainable Development, created under the UN Secretary-General to implement and monitor the progress following the Rio Conference, has held two sessions. Cicin-Sain gave examples of new national level institutions and processes established as well as financial commitments by developed nations and restructuring and replenishment of the Global Environmental Facility. Nordic countries are in the lead in these processes. A positive development has been a refocusing of existing UN resources, particularly for small island states. However, developing countries need to have a greater say in how resources are spent.

With regard to Oceans and Coasts, substantial activity is taking place, though with limited funds. This Workshop is an example. Other activites are: a Straddling Stocks Conference which has resulted in a draft treaty completed in August 1994 as an amendment to the Law of the Sea (LOS) treaty; a Conference on Sustainable

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Edible Oyster Spatfall in India: A Review

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INDIA

Edible oyster culture in India has not yet reached commercial level because of the negligible demand in domestic markets, failure to develop proper processing technology for export abroad (Durve, 1974) and other biotechnical and socioeconomic problems indicated by Mohan Joseph (1993). The present utilization of edible oysters, obtained from small-scale fisheries of the coastal waters and backwaters of India, is mainly for the production of lime from the shell.

Among the three commercial species of edible oysters occurring in India, the Indian backwater oyster, *Crassostrea madrasensis* (Preston), is the predominant one in the southwest and southeast coasts, possessing good growth rate and palatability. Currently, efforts are being made for the commercial scale farming of edible oysters, for which proper government legislation is to be formulated (personal communication with Dr. K. Palaniswamy, Assistant Development Officer, National Bank for Agriculture and Rural Development, Bombay).

The State of Tamil Nadu on the east coast (Fig. 1) is the birthplace of coastal aquaculture development in India. Studies of edible oyster culture and spatfall were made at Pulicat Lake, located a few miles north of Madras city (Hornell, 1908, 1910). Attempts were made to collect the spat by laying lime coated tiles in crates and then transferring the spat to the beds for fattening, based on methods in practice at that time at Arcachon in Southern France. This method was discontinued as early as in 1913 presumably because of the lack of demand for oysters in the local market (Durve, 1974).

On the west coast near Bombay, another species of edible oyster, *Saccostrea cucullata* (Von born), commonly known as rock oyster, was studied by Awati and Rai (1931). The spatfall of this oyster was observed from March to mid-June and also from October to February with the main spatfall being in summer months (around April).

Spat collection of *C. madrasensis* by Sunder raj and Devanesan (1955) showed that good spatfall occurred at Pulicat Lake near Madras. Maximum spat settlement was on glass-sheets coated with cement followed by flooring tiles. The breeding biology of *C. madrasensis* studied by Rao (1951, 1953, 1956) and Rao and Nayar (1956)

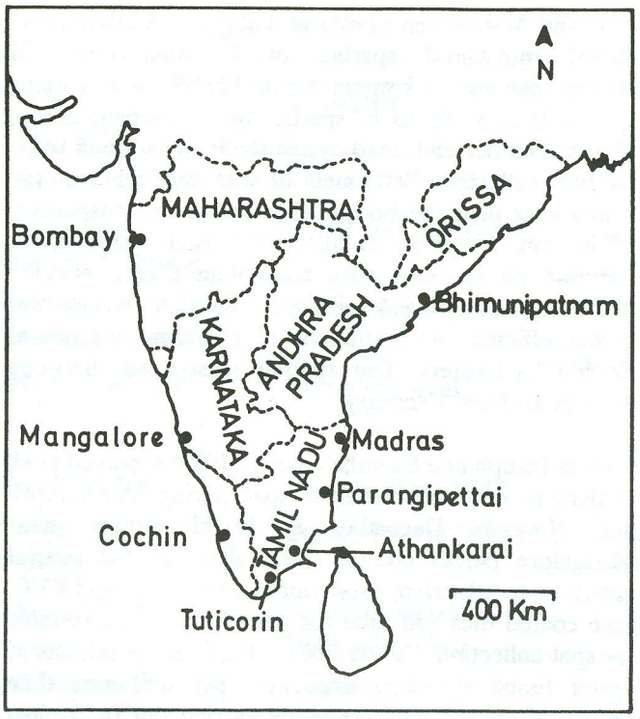

Fig. 1. Map of Peninsular India showing the locations of oyster spat-fall studies.

revealed that this species breeds continuously with peaks in summer and monsoon in the marine waters, while in backwaters it has restricted breeding corresponding to the peak periods in the marine environment. Silas et al. (1982) noted that this species has two spawning seasons during April-May and August-September.

Rao et al. (1983) studied the spatfall of *C. madrasensis* at Athankarai (Vaigai estuary), near Mandapam during 1973-78 and observed peak spatfall during January - April. They used various cultch, such as oyster shells, wood, concrete slabs, flat or curved roofing tiles, coconut shells (all were coated with lime/cement) and bamboo strips (without lime coating). The curved tiles proved to attract the most spat. Thangavelu and Sundaram (1983) also observed at Tuticorin that the lime coated roofing tiles were the most effective for spat collection followed by corrugated asbestos sheets, oyster and mussel shells.

Muthiah (1987) carried out extensive studies on *C. madrasensis* spat settlement during 1978-90 at Tuticorin using various cultch materials, i.e. oyster shells, coconut shells, asbestos sheets, mussel shells, PVC tubes and lime coated roofing tiles (24x15 cm). He found that summer (April-May) was the peak spatfall season during the study years and the lime coated tiles were the best cultch. Spat settlement was also found to be higher on the concave surface of the cultch than on the convex surface. Effective methods for large scale collection of oyster spat were achieved using lime coated roofing tiles by Nagappan

Nair and Mahadeven (1983) at Tuticorin. Reuban et al. (1983) monitored spatfall of *C. madrasensis* in Bhimunipatnam backwaters during 1977-79 using various spat collectors. Peaks of spatfall were observed during March-October and dead oyster shells were found to be the best collectors. Settlement of spat was higher on the cultch kept near the bottom than those kept suspended off-bottom. Purushan et al. (1983) used oyster shells, concrete panels, clay tiles, aluminium sheets, wooden planks, nylon ropes and coir ropes, of which, the clay tiles proved efficient (84 spat/0.2 m^2 tile) in spat collection at Cochin backwaters. The spatfall season was between January and mid-February.

Mohan Joseph and Shantha Joseph (1983) observed peak settlement of *C. madrasensis* spat during March-April and November-December at Mulki estuary, near Mangalore (south coastal Karnataka). Of the several cultch materials tried, used automobile tyres, rigid PVC, lime coated tiles and asbestos were found to be suitable for spat collection. Cultch smeared with crude extracts of oyster tissue attracted more spat per unit area than untreated cultch. Another study carried out by Mohan Joseph (1993) in the same area revealed that the maximum spat settlement was on oyster shells followed by asbestos and tyre flaps. Mid water panels and bottom panels collected more spat than near surface panels and the rough surfaced cultch had higher spat density. Deposition of silt and fouling of cultch have been found to be set-backs in natural spat collection.

Chandrasekaran and Natarajan (1993) have studied the edible oyster spatfall at Parangipettai backwaters during 1982-83 in two different locations, a mangrove site and a backwater canal site. At the mangrove aite, the spatfall was negligible on the panels which were exposed at mid-tide level probably due to the exposure and heavy siltation. Good spat settlement was recorded at the canal site throughout the year, with peak settlement (17.5 spat/100 cm^2) during August-October (late pre-monsoon and monsoon seasons). Six different types of materials were used; asbestos sheets, used automobile tyre flaps, oyster shells, coconut shells, curved roofing tiles without lime coating and lime coated roofing tiles (Fig. 2). The lime coated tiles served as the best spat-collectors with a maximum settlement of about 362 spat per tile. More spat were found on the concave side than on the convex side of the curved collectors, such as, lime coated tiles (2.3:1), tiles without lime coating (2.5:1), coconut shells (6.7:1) and oyster shells (3.2:1). The spat settlement was higher on the bottom tiles than on the off-bottom tiles.

The oyster (*C. madrasensis*) spatfall observed at Muttukadu backwaters, near Madras during 1986-87 by Sarvesan et al. (1990) revealed that the peak spat

Fig. 2. Various types of cultch materials installed for spat-fall monitoring in a mangrove area of Parangipettai back waters.

settlement was in September 1986 and March 1987 on lime coated roofing tile held in crates. An average of 55 spat/tile and a maximum of 109 spat/tile were recorded. The settlement was good in the areas closer to the sea and negligible at the sites where freshwater influx was heavy.

Discussion and Conclusion

A summary of oyster spatfall at various locations on the west and east coasts of India is given in Table 1. The locations of lower latitude (Cochin in the west coast and Athankarai on the east coast) showed almost the same periods (January - February/April) of spatfall seasons, whereas the locations of higher latitudes (Bombay, Mulki, Bhimunipatnam and Muttukadu) recorded heavy spatfall from the month of March. The temperature is lower at the higher latitude (around Bombay and Bhimunipatnam) than in the locations of lower latitude (around Cochin and Athankarai) in "winter" (December - February). The temperature increase during the post-winter transition period of February and March is greater at the higher latitudes than in the lower latitudes, and that might have influenced the breeding and spatfall in March.

Spatfall in wet season occurred either during the rains or immediately after. The marked change in salinity, either the decline during rainy season or increase post-monsoon, might have caused the active breeding and peak spatfall of oysters during the above periods.

Among the various inexpensive cultch materials tried, the lime coated curved roofing tiles have been generally found to be the efficient spat-collectors for large scale operations (Fig 3.). The lime coated tiles can be recycled

Table 1. Summary of edible oyster spat-fall seasons at various locations in India.

Location	Latitude	Species	Spat-fall season(s)	Authors(s)
West Coast				
Bombay	15°50′	*S. cucullata*	March-June, October-February	Awati and Rai, 1931
Mulki/Mangalore	15°35′	*C. madrasensis*	March-April, November-December	Mohan Joseph, 1993
Cochin	10°	*C. madrasensis*	January-February	Purushun, et al., 1983
East Coast				
Bhimunipatnam	15°21′	*C. madrasensis*	March-October	Reuben et al., 1983
Muttukadu	10°38′	*C. madrasensis*	March, September	Sarvesan et al., 1990
Parangipettai	10°14′	*C. madrasensis*	August-October	Chandrasekaran and Natarajan, 1993
Athankarai	5°50′	*C. madrasensis*	January-April	Rao et al., 1983
Tuticorin	5°48′	*C. madrasensis*	April-May	Muthiah, 1987

with a fresh coating of lime and the juvenile oysters can be removed easily from the tiles, without causing much damage to them during transplantation.

Commercial oyster farming in full-scale requires sufficient quantities of healthy spat, for which, it would be essential to identify the exact peak spatfall periods (in terms of days). When such commercial operations are planned in Indian coastal waters, a continuous monitoring program of natural breeding of oysters for larval abundance and spat settlement at each proposed major oyster farming location is mandatory prior to the start of operations.

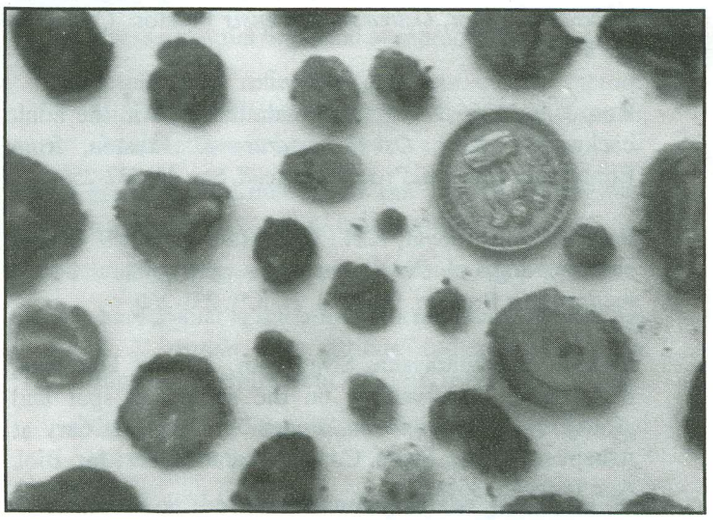

Fig. 3. Oyster spat approximately 5-25 mm in size collected using lime coated tiles exposed for a period of one month.

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