

COASTAL FISHERIES RESEARCH: STATE OF KNOWLEDGE AND NEEDS FOR GOA.

A.H. PARULEKAR
CSIR Emeritus Scientist
National Institute of Oceanography
Goa

1. BACKDROP

Coastal fisheries are a primary bioindustry, with long traditions deeply rooted in the past. In terms of quantum, 60% of world fish catch is taken from coastal ecosystems (Lie 1983)¹, which in Indian context is reported to be 62% (Devraj & Vivekanandan 1999)². In the year 1997, out of the total Indian marine fish catch of 2.7 million tons, 2.2 million tons was from coastal waters under 50 meters depth. This included 70,500 tons from coastal culture fisheries, mainly prawns from brackishwater and estuarine ecosystems.

Research and management has greatly helped in the development of marine fisheries, at large and coastal fisheries, in particular. As such fisheries development is the application of results of scientific research concerning the dynamics of fish population; their environment and their responses to environment including harvesting by man. Fishery unlike any other natural resources like petroleum, coal and minerals is of self-generating type, and, therefore the resource being renewable, can be developed, harvested and managed on a sustainable basis.

Like any other living resource, the fisheries also have pronounced seasonal and annual variations, due to natural and man-made changes, and hence, unlike industrial growth, the development of fishing industry can not be forecasted with greater degree of accuracy. In spite of such inherent drawbacks, economic importance has been a strong impetus for the exploration and harvesting of fishable resources from diverse but

highly productive coastal ecosystems. In terms of quantum, the annual yield from coastal fisheries in India has increased three times in the last 50 years, whereas in terms of net domestic product, there is eight fold increase, while the much publicized agricultural sector increased by only four folds in the same time frame.

2. STATUS:

2.1 Physiographic Features:

Goa with a coastline of 105 kms, is full of estuaries, creeks and backwaters formed by seven rivers - Tiracol, Chapora, Mandovi, Zuari, Sal, Talpona and Galgibag - having inland waterways of about 250 kms. Coastal waters upto 50 m depth, which are intensively being fished, measure 2850 km² out of the total exclusive economic zone of Goa of 90,850 km². Besides these, another 200 km² area on estuarine water spread and 18,000 ha in khazan lands and mangrove vegetation also contribute to coastal fisheries.

2.2 R & D - Institutional Capabilities:

Inspite of its small size, the importance and significance of fishery related research, has well being recognized, promoted and pursued in Goa. Besides the State Government controlled departments there are quite a few specialized Central Government supported and University sponsored, research and development terms, working in related spheres of coastal fishery investigations. Adequate infrastructure, in the form of trained manpower; boats and ships, well equipped laboratories; experimental and demonstration plants; hatchery; recirculation laboratory; extension, education and transfer of technology, exists in a well-developed and functional stage in Goa.

Some of the coastal fishery research related organizations with their sphere of activities, are as follows:

Organization & Unit	Activities
1. Government of Goa: <ul style="list-style-type: none"> - Directorate of Fisheries - Department of Science, Technology & Environment 	Development, Extension; Hatchery; Survey. Support to R & D efforts
2. Goa University <ul style="list-style-type: none"> - Department of Marine Science - Department of Marine Biotechnology 	Education & Research
3. Indian Council of Agriculture Research <ul style="list-style-type: none"> - ICAR Complex, Goa. - Central Marine Fisheries Research Institute - Central Institute of Fishery Technology 	Extension Fish Landing Data Gear; Crafts; Processing.
4. Fishery Survey of India	Exploratory work.
1. Marine Products Export Development Agency	Export Promotion - Marketing
2. National Institute of Oceanography	Resource Survey; Productivity; Monitoring; Coastal Aquaculture Development, Training & Transfer of Technology.

2.3 Capture Fisheries:

At the time of liberation of Goa in December 1961, the annual marine fish catch was estimated to be about 10,000 tons, including Daman & Diu. In three and half decades, the annual landings have reportedly increased by seven to eight times. Since, 1981, the marine fish production in Goa is showing a consistent growth rate of 5.1% (Malgavkar & Pai Panandikar 1988)³.

In the earlier years i.e. from 1965 to 1980, the catch consisted of over 72% of pelagic or near surface species like mackerels and sardines. In the post '75, the demersal or near bottom species like prawns, sciaenids, pomfrets, thread-fin bream, butter fish, soles and silver bellies, account for 62% of the annual catch (Parulekar & Dalal 1978)⁴. Annual fluctuations in catch composition also have, considerably been reduced. This reflects on a steady increase in the mechanized fishing, mainly stern trawling and to a lesser extent purse seining. However, almost all the mechanized boats, being less than 45 ft in overall length, thus limiting the range of operation within 50 m depth.

Besides the fish catch from coastal waters, on an average 2500 tons of finfishes and shellfishes are harvested from estuaries and freshwaters of Goa. Some estimates - potential and sustainable - of coastal fishery resources, as derived from:

- past catches and catch trends
- exploratory resource survey
- biological productivity measurements.

are available. Based on exploratory resource survey, Rao & Dorairaj (1968)⁵, reported the demersal fishery resource potential upto 70 m depth off Goa coast to be 47,558.81 tons with a sustainable yield of 28,535 tons. Prabhu & Dhawan (1972)⁶, also from an exploratory survey, forecasted the potential and sustainable demersal resource to be 10889.28 tons and 6533.65 tons, respectively, for coastal waters below 40 m depth. For pelagic fishery resource Parulekar and Dalal (1978)⁴, using primary productivity data in combination with past catch data and catch trends, projected it to be 21833.37 tons as

potential and 13100 tons as sustainable yield, up to 50 m depth. Similarly, based on demersal catch records in conjunction with benthic biomass and production data, Parulekar *et al* (1982), estimated the potential resource from shelf area of 9985 km² off Goa, to be 332 kg/ha as against the exploited yield of 77.12 kg/ha. Recently, Ansari *et al* (1995) has reported on the demersal fishery community and seasonal variations in Goa waters. Against the available resource estimates, the present annual catch at an average of 80,000 tons, is composed of 38% pelagic species and 62% demersal species. Parulekar & Dalal (1978)⁴, had projected the total potential resource for Goa to be 1,20,000 tons, out of which 73,000 tons, was from coastal waters below 50 m depth. From the results of the above quoted studies, it is indicative that from the traditional fishing grounds upto 50 m depth, any further increase in the fishing effort will not result in substantial increase in the catch of pelagic resources. Aerial and acoustic surveys, conducted by UNDP/FAO sponsored Pelagic Fishery Project, off the West Coast of India, particularly in the 40 and 80 m depth zone, have shown that large shoals of Mackerels and Sardines, do occur off Goa coast (Anon. 1973)⁹. By the introduction of purse seiners, there is an observed increase in the catching of pelagic resources off Goa, especially in the last fifteen years.

Other important fishery resources studied and reported from Goa are: Clams - *Meretrix casta* (Parulekar *et al* 1973)¹⁰, *Paphia malabarica* (Dwivedi & Parulekar 1974)¹¹, *Villorita cyprinoides* (Chatterji *et al* 1984)¹²; mussels and oysters (Parulekar *et al* 1978¹³; Parulekar & Qasim 1981¹⁴); commercially important prawns (Achuthankutty & Parulekar 1986)¹⁵ and Crabs (Chatterji *et al* 1994)¹⁶. Even, the problems in trawling and trawl resources of Goa have recently been identified and highlighted (Mhalathkar 1992)¹⁷.

2.4 Culture Fisheries/Coastal Aquaculture: Coastal aquaculture in a traditional way has been practised in Goa from times immemorial. Parulekar & Verlencar (1976)¹⁸ have researched and brought out the details of status and prospects of fish farming in Goa. Entrapped fisheries from khazan lands of Goa are also on record (Gopinath & Dani 1973)¹⁹.

Traditional practices of fish farming in Goa involve composite rearing of wild stocks. Despite the complete ignorance of modern methods of fish culture, the aquaculturists seem to know many relevant facts especially through practical experiences.

Some details of coastal aquaculture practices in Goa are as follows:

Type	Duration	Production (kg/ha)	Profitability (%)
Permanent Pond (agar)	Round the year	1060	100
Khazan (manas)	October-March	450	65
Salt-cum-Fish (mitache agar)	June-November	300	47

Annually about 30 tons of fish and prawns are harvested from traditional practices (Parulekar & Verlencar - op.cit). In recent times, while the permanent pond and khazan practices, have been updated and expanded with stocking of quality seeds; feed supplement and aeration, the fate of mitache agar type of practices is in jeopardy.

Over the last two decades, lot of R & D inputs has come in the culture fishery of Goa. Qasim *et al* (1977)²⁰; Parulekar (1979)²¹ and Parulekar *et al* (1982)²² have reported on the technique, economics and environmental physiology of mussel culture on floating rafts and long lines in Goa. Further, Parulekar *et al* (1984)²³ have documented results on the culture of edible bivalves in Goa. Recently, Kanti (1995)²⁴ has studied the ecobiology and culture of giant edible oyster, *Crossostrea gryphoides*, at Siolim in the estuary of Chapora river. Earlier, Dwivedi & Parulekar¹¹ have reported on the culture prospects of 'tisri', *Paphia malabarica*. Chemintz, in estuaries of Goa. Chatterji *et al* (1982)²⁵ have

reported on the culture of Grey Mullet, Mugil cephalus and recently Rattan (1994)²⁶ has studied the culturing of Pearl spot, Etroplus suratensis in Goa waters.

Under the sponsorship of (Council) Department of Science, Technology & Environment, Government of Goa, as also under consultancy of private entrepreneurs, the National Institute of Oceanography, Goa, has conducted specific research projects on coastal aquaculture, like, salt pans for fish culture (Anon 1987)²⁷; demonstration scale production of green mussels and oysters (Anon. 1988)²⁸; disused paddy fields for aquaculture (Anon 1988)²⁹; mining pits for fish farming (Anon, 1990)³⁰; feed resources (Ingole *et al* 1992)³¹; prawn seed resources (Anon. 1993)³² and cage culture of finfishes and marine organisms (Anon. 1996)³³. These R & D contributions also encompassed transfer of technology, extension and training.

3. FUTURE NEEDS

As a combined effect of increased pace of industrial development, enhanced level of harvesting of fishable resources; both through capture fisheries and coastal aquaculture, and most pertinently, the pressure of disproportionate increase in coastal population, an increasing variety and severity of impacts, have been evident in the coastal fisheries. In Goa, the impact of active fishers on the fisheries is severely felt. Number of active fishers have increased from 2.4/km² in 1961-62 to 4.3/km² in 1996-97, resulting in the stagnation of annual production of 2.9 tons/fisher in 1961-62 to 2.9 tons/fisher in 1996-97².

Some of the discernible impacts are: mass mortality; eutrophication or greening of water body; recurrence of ulcerative syndrome disease in freshwater and estuarine finfishes; baculovirus infections in farmed prawns; large fluctuations in capture fisheries; deoxygenation of coastal waters; sulphide formation in intertidal and shallow biotopes; obliterations of sensitive species like corals and overall ecological quality degradation of coastal ecosystems and resources, thereof.

In the last few years, the scale and magnitude of man-induced interference in the coastal ecosystems has increased, so much, that the self-cleansing or assimilative capacity has not only been reduced, but more pertinently, it is posing an imminent danger to human life because of possible deterioration in the quality of sea foods. A glaring example is the recent Supreme Court ruling on the environmental degradation due to mal-practices in coastal aquaculture operations.

With reference to coastal fisheries, major consequences of changes, as identified, are:

- direct effect of exploitation of fishery resources.
- long term variability in monitoring
- changes in the ecological quality, induced by human activities

If development and management of coastal fisheries are to be sustainable, existing scientific and technical information can better be mobilized and applied more effectively and efficiently to ensure sustainable rather than short term benefits.

From the ecological and resource consideration, a system to evaluate water quality based on the health of biota reflects directly on the scale and magnitude of deterioration. As the biota - organisms, communities and populations - integrate the overall as well as the specific effects of a combination of deterrents, biological monitoring of coastal ecosystems will reveal the impacts and give clues towards remedial measures for the restoration of ecology and conservation of living resources. Environmentally sound management of coastal fisheries will prevent the destruction of resource base on which sustainable development depends.

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