

Recurring fish mortalities at Versova stress exigency for new strategies of conservation

V.V.Singh & S.G.Raje

Central Marine Fisheries Research Institute, Bombay Research Centre, Army & Navy Bldg, 2nd Floor,
148 - M.G. Road, Bombay 400 001, India

Versova is an important fishing village of Bombay district and Versova creek is situated near the sources of organic and industrial pollution which discharge their waste indiscriminately into it. However, recently increasing incidents of fish mortality along with depletion of fish catch have affected the fishermen to a large extent. Out of 12 different types of nets with a total number of more than one thousand nets which were operated here, only seven types with about three hundred nets are remaining in operation. During October 1988 mortality of many commercially important species like *Mugil*, *Cynoglossus*, catfishes and sciaenids was noticed. Subsequent mortalities were observed during 1991, 1993 and 1995 with more number of species. Monitoring of creek water which was mostly a blend of black, brown and gray colour with foul smells revealed that many times dissolved oxygen is absent here when in adjoining areas it is up to 4 ml/l, pH of the creek was always in lower range and even salinity value dropped up to 1.29×10^{-3} due to added influx of fresh water by way of domestic and industrial discharge and making it unsuitable for marine organisms.

Versova is an important fishing village of Bombay district and is located in the north-west region of the city. Traditional fishermen community here has adopted recent advances in modern fishing methods within a relatively short period¹⁻³ and also has demonstrated that cooperative efforts can bring revolutionary changes in fisheries⁴ and related activities like construction of boats⁵, fishing catch disposal and transportation⁶ and in employment generation. The combined efforts of local community has put the Versova in the list of major fish landing centres of Bombay along with Sassoon Docks and New Ferry Wharf.

Versova creek is situated near the sources of organic and industrial pollution which discharge their wastes indiscriminately into it. Deteriorating conditions in nearshore coastal waters of Versova were being observed by the fishermen in the past few years. However, recently increasing incidents of fish mortality along with depletion of fish catch especially in inshore bag nets (locally called as Bokshi net) have affected the fishermen to the extent that many small fishermen claim to have lost their business. Fishermen claim that shore seines, drag nets, muddy nets (creek specific localised version of stake net), crab and lobster traps, poll and lines and hand lines, which were

operated profitably along with handpicking of oysters and bivalves are no more in use due to unchecked pollution.

It is a matter of great concern that out of twelve different type of nets or fishing methods with a total number of more than one thousand nets and pickers which were operated at Versova, only seven types with about three hundred nets and pickers are remaining in operation (Table 1).

Table 1—Fishing nets and methods prevalent in past and present at Versova creek

Sr. no.	Type of net/ fishing method	Numbers in past (during seventies)	Present numbers (1995)
1.	Bokshi net	70	30
2.	Stake nets	37	06
3.	Shore seine	08	00
4.	Dharan net	05	02
5.	Cast net	325	175
6.	Drag net	37	05
7.	Mudy net	72	00
8.	Crab traps	145	50
9.	Lobster traps	14	00
10.	Oyster pickers	55	00
11.	Bivalve pickers	200	00
12.	hand line	150	20
	Total	1118	288

In the light of above a close watch was maintained into any such phenomenon resulting into mass mortalities of fishes. By this continuous observation an insight was developed for the source of pollution, resultant mortalities, possible reasons of mortalities and practical plan of action.

A close watch was maintained on the Versova creek for any fish mortality. Regular water samples were collected to observe essential physico-chemical parameters like temperature, pH, salinity and dissolved oxygen from January 1991 to December 1995 from the adjoining areas. Five stations were selected for the study and data on fishing methods and net operation was collected by participatory rapid rural appraisal (RRA) method which is a learning approach whereby outsiders gather information about a situation but it involves local people⁷.

Versova village is situated along the creek having discharge points of industrial and sewage wastes in the vicinity of the creek. The "bokshi" net and hand trawling boats were operated in this area while other major fishing gears were operated in the nearshore waters. Major fishing gears in the nearshore waters are "dol net" and "trawl net". The creek and nearshore coastal waters can be classified as special ecosystem where intensity of pollution decreases from creek towards offshore due to higher dilution and assimilation capabilities of the watermasses.

There are a number of sources which contribute towards pollution at Versova. During the last decade many small industrial units like steel, rubber, plastic, dye and other miscellaneous industries have come up in Malad and Goregaon area. Untreated chemical and industrial wastes from these units are released into the creek indiscriminately. Versova village and landing centres are situated along the creek and sewage wastes are also discharged regularly into it. Fishermen also dry fishes along the shore and whatsoever waste from dried fishes is left there is washed into the creek during high-tide alongwith other organic wastes.

The first incident of fish mortality was noticed on 10 October 1988. Local fishermen observed a variety of fishes floating on the surface of water in large quantities in dead or dying condition. The fishes of many commercially important species

like *Mugil* spp, *Cynoglossus* spp, cat fishes, sciaenids etc. were scooped by cloth, nets, baskets or even by hand in good quantities. Commercially unimportant and leftout fishes were washed ashore along the beach as this phenomena continued for two days. Again on 9 January 1989, during low tide juveniles of *Cynoglossus* spp were found floating on the surface in dead or dying condition and were collected by scooping. These specimens were in the size range of 15-33 mm in length.

Another incident was observed on 4 October 1991 and this incident also resembled earlier incidents the only difference found was that fishes of *Sillago sihama* species were also present in the inshore catches prior to the incident but somehow they were not observed among the dead fishes, which were mainly *Mugil* spp, catfishes and sciaenids.

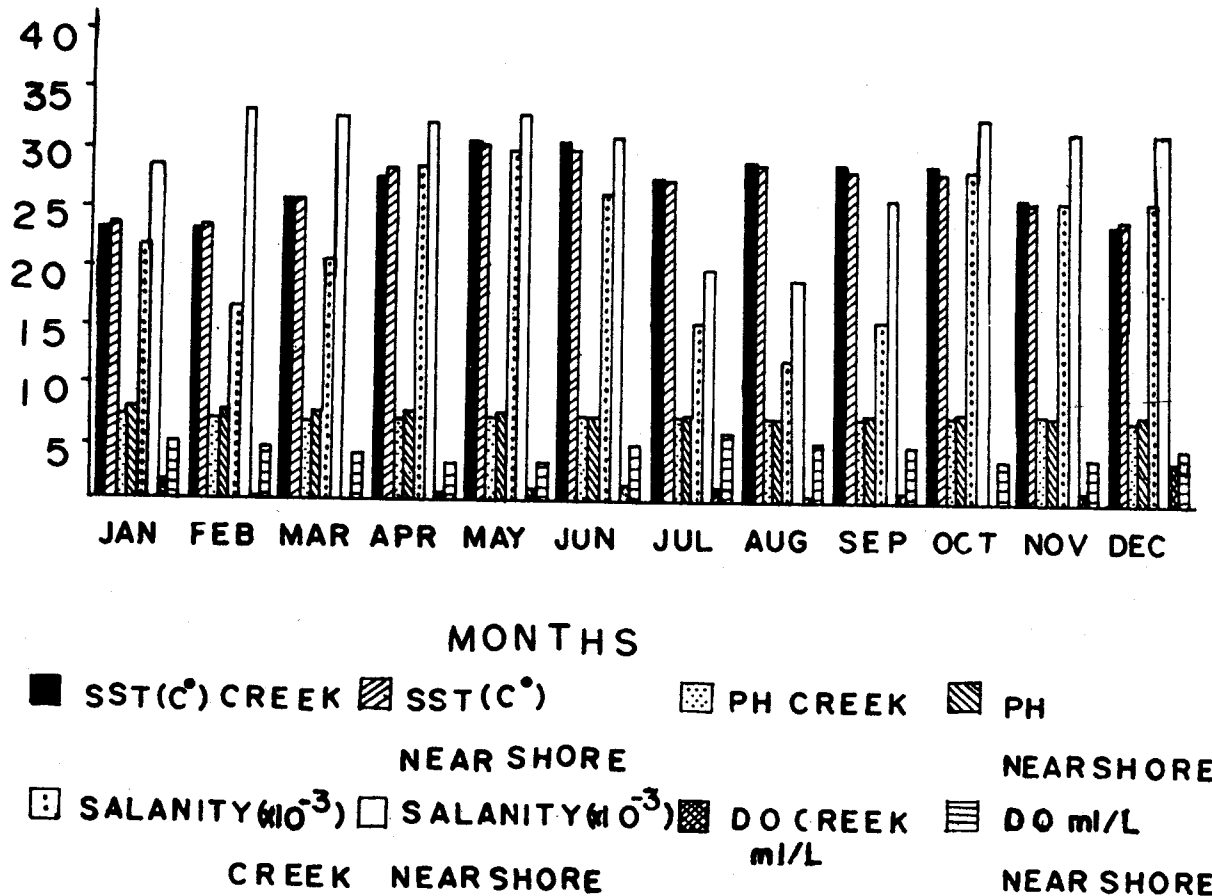
Recently fish mortalities were observed at Versova on 29 June 1993 and dead fishes were mostly of *Mugil* species, and also on 15 July 1993 sciaenids were found dead.

Analysis of important parameters of creek water was undertaken regularly. For comparison the samples from the nearshore waters were also analysed for annually pooled averaged data from 1991-95 (Fig. 1). Visual observations indicated that most of the time, colour of the creek water was a perfect blend of black, brown and grey, some times having patches of multicoloured oil slick also.

Foul smell of various chemicals, sewage and other gases was a regular feature here which became more pronounced during the low-tide period. The temperature values showed marked seasonal variations. However, the difference from the nearshore water was not much.

It is well known that indiscriminate discharge of acids and bases is quite disturbing to ecological balance. This can be monitored through pH as normal pH of oceanic waters is maintained by carbonate system at around 8.0 (± 0.2) slightly basic. If large amount of pollutants are introduced into the system carbonate reactions get offset. In Versova creek also pH was found low in comparison to the nearshore water indicating pollution.

The salinity of the nearshore water was found in the range of 11.51 to 36.06×10^{-3} . The salinity



Pooled data from 1991 to 95

Fig. 1—Water quality in creek and nearshore areas of Versova

values dropped up to 1.29×10^{-3} in the creek mainly due to the influx of fresh water in the sewage and industrial waste. This lower salinity also caused stress to the marine fishes.

Dissolved oxygen is very important parameter of water quality and is regarded as index of physical and biological processes which are going on in the water. The main source of DO in water are - diffusion of oxygen from the air and photosynthetic activities taking place in water. However, in Versova creek due to presence of thin oil slick diffusion from air is limited and due to the presence of oxygen demanding pollutants e.g. organic wastes, there occurs a rapid depletion of the dissolved oxygen from the water quite frequently leading to a no oxygen situation, while it is around 4 ml/l in the nearshore area. This may also contribute to a sudden fish kill in the creek.

Versova is one of the thoroughly investigated areas in the field of biological oceanography and pollution⁸⁻¹¹. It is less polluted when compared with the Mahim or Thana creeks. There had been an existing creek fishery but the scenario is changing now.

It is not the lower values of pH, salinity or dissolved oxygen which are responsible for fish mortalities but the resultant mortalities are an outcome of synergistic or combined effect of all complex processes going on in the ecosystem due to varied sources of pollution. Under such conditions combined effect of two or more materials acting together becomes greater than the expected effect from simple sum of individual effects. It is a fact that most toxic materials increase their toxicity under low pH which was also a regular condition here along with other indicators of pollution in creek water.

Due to non-implementation of any conservation measures in this area, at present the situation has become grave. Even now, it is not too late to take some drastic steps by the law enforcing agencies. However, as industrial activities can not be stopped completely a rational limit on the indiscriminate discharge should be imposed. This should also be monitored in the area as there may be certain industries releasing hazardous wastes at certain time interval.

Therefore, from the above account it is clear that the various uses of Versova coastal area are in conflict between developmental work and exploitation of fishery resources. Careful management can limit these disturbances and minimize conflicts but it demands thorough scientific monitoring and contact between all types of prospective users and stakeholders, researchers and law enforcing agencies. All these activities if taken on priority basis can avoid irreversible harm to ecosystem and marine life here.

The most appropriate new strategy in the present context appears to be the application of the principles of the integrated coastal zone management (ICZM) system as it is a most appropriate process to anticipate and respond to long-term concerns and needs while addressing present day challenges and opportunities.

The ICZM involves the comprehensive assessment, setting of objectives, planning and

management of coastal systems and resources taking into account traditional, cultural and historical perspectives and conflicting interests and uses. It is a continuous and evolutionary process for achieving sustainable development which is the need of the time in the case of Versova area.

The authors are thankful to Dr. M. Devaraj, Director and Dr. C.S.G. Pillai, Head FEMD, CMFRI, Cochin for encouraging and forwarding this paper and also to Dr. Kuber Vidyasagar, Sr. Scientist, for help in making computer graphs. Technical help received from Mr. Sujit S. K. in collection and analysis of water samples as well as in processing of the data is also acknowledged.

References

- 1 Raje S G & Badonia R, *Fishing Chimes*, 5 (1987) 49.
- 2 Raje S G & Singh V V, *Fishing Chimes*, 10 (1991) 44.
- 3 Raje S G & Singh V V, *Fishing Chimes*, 12 (1992) 47.
- 4 Raje S G & Singh V V, *Fishing Chimes*, 13 (1993) 51.
- 5 Raje S G & Singh V V, *Fishing Chimes*, 14 (1995) 42.
- 6 Raje S G, Singh V V & Sarang J D, *Mar Fish Infor Serv, T & E ser*, 121 (1993) 8.
- 7 Cruz Federico A, *OUT of the SHELL* 3#3 (1993) 1.
- 8 Gajbhiye S N, Nair V R & Desai B N, *J Indian Fish Ass*, 10 & 11 (1980-81) 31.
- 9 Nair V R, Gajbhiye S N & Desai B N, *Indian J Mar Sci*, 10 (1981) 66.
- 10 Gajbhiye S N & Desai B N, *Mahasagar - Bull Natn Inst Oceaogr*, 14 (1981) 173.
- 11 Nair V R, Gajbhiye S N & Syed F H, *Indian J Mar Sci*, 12 (1983) 183.