

Shifting baselines and jellyfish blooms

Importance of Research in relation to jellyfish export potential

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Focal Points at a Glance

Jellyfish blooms in marine pelagic waters of India are understood to be on the increase. This aspect, considered from the angle of the increase in demand for them, calls for focal efforts at exploiting them for export. In this context, the author presents a picture of the jellyfish fishery status in Indian waters.

"We transform the world, but we don't remember it. We adjust our baseline to the new level, and we don't recall what was there."

Daniel Pauly

Jellyfish blooms

Jellyfishes, are free-swimming marine animals with a gelatinous umbrella-shaped body, primarily inhabiting oceans and belonging to the phylum Cnidaria. Of late, they are proliferating in the oceans world over, resulting in several ecological and social issues. In the marine ecosystem, these predatory organisms are used as a substrate for a number of associations (parasitism, commensalism, and symbiosis) and as a source of food by other free-swimming organisms such as nudibranchs, cephalopods, fish and turtles.

The jellyfish blooms or the unprecedented increase in the population of jellyfish, recorded more frequently in the last decade, can result in stinging or even killing tourist swimmers, breakage of set nets and clogging coastal power plant cooling water intakes (Astorga *et al.*, 2012). They also have indirect effects on fisheries by feeding on zooplankton and ichthyoplankton, and, therefore, are predators and potential competitors of fish. As jellyfishes devour huge quantities of plankton, small fish species may get deprived of food, thus screwing up the entire food chain.

Jellyfish blooming and its increased frequency in pelagic waters has generated lot of interest among marine researchers and several plausible reasons have been forwarded to explain this phenomenon, which includes anthropogenic causes such as eutrophication, an increase in hard substrates for polyp attachment as a

result of coastal development projects and aquaculture, exotic species introductions, overfishing and climate change (Dong *et al.*, 2010). The biodiversity survey along the coastal waters of southwest coast of India conducted by the researchers of the Department of Aquatic Biology and Fisheries, University of Kerala documented frequent occurrence of jellyfish blooms and mass mortalities of jellyfish and their deposition in beaches (Fig. 1). The survey also documented clogging of trawl nets, caused by jellyfish blooms (Fig. 2).

What is shifting baseline?

'Shifting baseline' or 'sliding baseline' is a term used to describe the way significant changes to a system are measured against previous reference points or baselines and denotes changes from the original state of the system. 'Shifting baseline syndrome' was first introduced by Pauly in 1995, when he suggested using anecdotal evidence to set baselines in fisheries science. In short, in a temporally changing ecosystem, those who first saw the ecosystem 50 years ago will have a different idea of "normality" than those who have only experienced it in the past 2 years. These different perceptions of normality are referred to as "shifting baseline syndrome".

For example, in the open ocean, sharks are the remaining pelagic apex predators, for which baseline population abundances are unknown. Sharks are among the least resilient fishes to intense exploitation because of their life histories, which are



characterised by a late age at maturity and low fecundity. Establishing a baseline for these shark populations is necessary to fully understand how industrial fisheries have impacted them, and are thus essential to their informed management and recovery. The predictions about their drastically declining population may be underestimates, since we have no baseline data. Same is the case with a contrasting phenomenon, increase in the population of jellyfishes in oceans world over. Regrettably, in this context, also few past records exist in India to compare the present populations of jellyfish and to place them in a historical perspective and to arrive at population-based assumptions.

Why Jellyfish bloom?

It is interesting to note that increase in population of jellyfishes along southwest coast of India in recent years is in tune with the increase in the occurrence of algal blooms in the coastal waters, which could be linked to increasing nutrient load of coastal waters. Already there are reports on jellyfish-induced water blockage in the cooling system and subsequent shut down of the atomic power plants in India (Masilamoni *et al.*, 2000).

The increase in small pelagic fish abundance in the ecosystem of northwest coast has been attributed to the impact of climate change parameters like increase in sea water temperature and oceanographic factors (CMFRI, 2011). The linkage of burgeoning population of jellyfish could also be related to the changes in the sea surface temperature. Because climate changes have complex ecosystem-level effects, the proximate causes of jellyfish increases are difficult to deduce. There are, however, reports that global warming might lead to increasing populations of jellyfish because it could affect its distribution, growth and larval production (Richardson *et al.*, 2009).

Pauly *et al.* (1998) recorded a sharp decline in mean trophic levels of global fisheries landings in world's oceans and this phenomenon, often referred to as 'fishing down marine food webs', indicates a gradual transition in landings from long-lived, late maturing high trophic level, piscivorous bottom fish towards short-lived early maturing low trophic level planktivorous pelagic fish. Fishing down the food web is also reported to occur all along Indian coast (Pauly *et al.*, 1998; Vivekanandan *et al.*, 2005; Bhathal and Pauly, 2008). In the clear

absence of fish species and turtles capable of feeding specifically on jellyfish, the population of jellyfish in Indian waters also would increase in the coming years.

Unfortunately, there are no reports on the population abundance of jellyfish from Indian coastal waters, in order to make an effective comparison. Further, our knowledge of how environmental factors affect jellyfish population size is meagre and in India and there have been no population based assumptions of jellyfish populations. There have been many hypotheses to explain jellyfish population explosion in coastal waters, which include increasing nutrient run-off from the land, especially during post-monsoon season (eutrophication), reduction of fish stocks, particularly the decline of predatory fishes and global warming.

Need for further research

Considering the increasing importance of jellyfish blooms on coastal waters, it is high time to set priorities of basic research to study their life cycles, horizontal and vertical distributions, seasonal occurrences, growth patterns under varying environmental situations, ecology and ecosystem role of individual species and to determine the key factors responsible for their blooming in coastal waters in order to predict the health of our coastal waters. Technologies in acoustic, aerial and underwater observations coupled with molecular identification tools such as DNA barcoding would facilitate easy jellyfish monitoring. The response of jellyfish to climate change in Indian coastal waters should also be studied both in field and in laboratory.

Jellyfish seldom find a place in the development of ecosystem modelling. Jellyfish inclusive models would help predicting the role of factors such as fishing, eutrophication and global warming in jellyfish blooms. The potential benefits, if any, as a result of blooming should also be studied, as the

export of jellyfish from India is increasing in recent years due to their ready availability. It is the need of the hour to focus our attention to find out the complex relationship between jellyfish and fisheries and the impact of jellyfish blooms on ecology of the oceans in general and on the long-term sustainability of fishery resources in particular.

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Figure 1: Jellyfish *Netrostoma coeruleus* Maas washed ashore at Sanghumughom beach, Kerala



Figure 2: Jellyfish *Netrostoma coeruleus* Maas caught in trawl net operated from Kollam, Kerala