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An Ecological Impact of Jellyfish Occurrence in Marine Environment

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SUMMARY

A variety of natural (winds, tidal fronts, surface currents, water temperature, salinity, turbidity, dissolved oxygen) and anthropogenic (water quality deterioration, overfishing, translocation, habitat modification) factors play pivotal roles in triggering jellyfish aggregations. Jellyfish aggregation events in the forms of their swarming in coastal waters and beach strandings have resulted in ephemeral nuisances such as water quality deterioration, food chain alterations, hindrance in seawater uptake by power plants, clogging of nets during fishing operations, and tourism declines. Therefore, it is important to determine the environmental conditions that trigger jellyfish swarming, in order to develop effective monitoring and prediction strategies. This study additionally proposes a conceptual framework towards development of a jellyfish monitoring system for Indian waters using satellite and model data.

INTRODUCTION

Fascinating, elegant, and mysterious to watch in the water, take a jellyfish out of the water, and it becomes a much less fascinating blob. This is because jellyfish are about 95 percent water. Lacking brains, blood, or even hearts, jellyfish are pretty simple critters. They are composed of three layers: an outer layer, called the epidermis; a middle layer made of a thick, elastic, jelly-like substance called mesoglea; and an inner layer, called the gastrodermis. An elementary nervous system, or nerve net, allows jellyfish to smell, detect light, and respond to other stimuli. The simple digestive cavity of a jellyfish acts as both its stomach and intestine, with one opening for both the mouth and the anus. These simple invertebrates are members of the phylum Cnidaria, which includes creatures such as sea anemones, sea whips, and corals. Like all members of the phylum, the body parts of a jellyfish radiate from a central axis. This “radial symmetry” allows jellyfish to detect and respond to food or danger from any direction. Jellyfish have the ability to sting with their tentacles. While the severity of stings varies, in humans, most jellyfish stings result only in minor discomfort.

Figure: 1. Only about five percent of the body of a jellyfish is solid matter; the rest is water

Ecological impacts of Jellyfish bloom and occurrence

Jellyfish can interfere in the coastal and estuarine ecosystem functioning in many ways. Global warming caused by climate change may be one of the significant reasons for increase in jellyfish population. Besides climate change, eutrophication may favor jellyfish bloom. There are also many important reasons for

enhancing jellyfish population such as aquaculture, changes in salinity, introduction of nonnative jellyfishes. The organisms such as zooplankton, ichthyoplankton are mostly affected by them which indirectly affect fisheries. Jellyfish feeds on the same kinds of prey as adult and young fishes, so if fish are removed from the ecosystem, jellyfish are likely to enrich in number. Dense population may have direct negative effects on human enterprise; specifically, they interfere with tourism by stinging swimmers, fishing by clogging nets, aquaculture by killing fish in net-pens and power plants by clogging cooling-water intake screens. The interaction of jellyfish with existing fish species within an ecosystem can be quite complex, and determined by many factors. Jellyfish can be detrimental to fish populations in two ways: firstly, by those species of jellyfish that directly predate on fish eggs and larvae; and, secondly, by those species that act in competition with other predatory fish for this food source, bearing in mind that usually the top predatory fish claim the highest commercial value.

Interactions can be positive to a fishery, in that jellyfish can also provide a source of food for adult and sub-adult fish. What is interesting, in terms of maintaining the balance of the fishery ecosystem, is the potential impact that large numbers of jellyfish, or jellyfish blooms' can have on fish populations and the wider-scale impact on a commercial fishery. Diets of many species of jellyfish overlap with the diets of zooplanktivorous fish such as anchovies, herrings and sardines. When overfishing includes these species, there could be significant unconsumed zooplankton, and jellyfish populations might expand, because of the alleviated competition for food. Additionally, the commercial removal of jellyfish predators, such as salmon, mackerel and butterfish, could further spur jellyfish population expansion. However, this outcome is less clear as many jellyfish populations can be controlled by predation from other jellyfish and gelatinous species. One study points to a more sinister outlook for what jellyfish blooms might mean to a fishery. Not only may jellyfish blooms indicate overfishing of larger top predator marine species, but also large jellyfish populations, once established, may suppress fish production in a recovering fishery, through competition and predation on fish larvae. Once an ecological system has reached a point of stability as in this case, which is the jellyfish succeeding at the top of the food chain, the removal of its dominance may prove difficult, potentially preventing the recovery of the fishery, even if fishing effort of the fish was reduced. Distributions of jellyfish populations are notoriously sporadic and unpredictable, and little is known about why or when they may occur in large numbers or jellyfish blooms'. Meteorological conditions, currents, water temperature, salinity and predation may play a significant role in determining the population size.

Venom and toxicity

A sting by a highly toxic box jellyfish, such as the Australian box jellyfish, will cause a person to feel extreme pain and may cause paralysis, cardiac arrest, and death. These effects can appear in just five minutes. For other species with weaker toxins, such as the Caribbean box jellyfish (*Tripedalia cystophora*), the sting may cause days of pain but not death. In some cases, a box jellyfish sting can cause Irukandji syndrome which presents as muscle cramps, vomiting, agitation, and even heart failure whose symptoms may begin about a half hour after being stung. For all box jellyfish stings, the severity largely depends upon how much skin comes into contact with the tentacles.

CONCLUSION

They are sometimes described as the earthquake indicator. In Indian context, focus on jellyfish study is limited. Jellyfish bloom together with overfishing may lead to decline fish yield. There is no doubt, the ocean researchers come across the jellyfish bloom events during their field samplings, but hardly report and publish, the fact may be that they are either concentrating in their respective project objectives or neglecting to publish such events . However, in anticipation of adverse impacts of toxic cnidaria on coastal water quality and productivity, the authors tried to highlight the event to attract the scientists to make further research.

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