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Short Communication

Mass beach stranding of blue button jellies (*Porpita porpita*, Linnaeus, 1758) along Odisha coast during summer season

B K Sahu*[,a], S K Baliarsingh[b], A Samanta[b], S Srichandan[b] & S Singh[c]

[a]Environment and Sustainability Department, CSIR-IMMT, Bhubaneswar – 751 013, India

[b]Indian National Centre for Ocean Information Services, Ministry of Earth Sciences, Govt. of India, Hyderabad – 500 090, India

[c]Xavier School of Sustainability, Xavier University, Bhubaneswar – 752 050, India

*[E-mail: birajkumar@gmail.com]

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Beach stranding of the jelly *Porpita porpita* (Linnaeus 1758) was observed in stretches from Astaranga to Puri (Odisha) during May 2016. A study was carried out by taking environmental parameters to decipher the possible causes. These jellies were abundant in the coastal waters during this period. It was found out that this jellyfish was observed in large numbers in this coast during March-May (summer season). From the satellite derived current and wind data, it was observed that the beach stranding was due to drifting of the jellyfishes favoured by shoreward current and wind.

[**Keywords**: Bay of Bengal, Hydrozoa, Jellyfish]

Introduction

Jellyfish (Phylum: Cnidaria) are ubiquitous in world ocean and their stings being commonly observed in warm tropical marine waters[1,2]. Swarms and blooms of this animal are natural phenomena, but their occurrence is increasingly associated with anthropogenic disturbance and alterations in coastal water biogeochemistry[3]. These swarms have become a menace for beach recreational activities. Some species of jellyfishes (e.g. *Pelagia noctiluca*) can cause skin rashes and inflammations[2]. Hence, it's imperative to predict such type of swarming in the coastal areas. The prediction of jellyfish stranding will help coastal management authorities to develop some sort of warning system towards the swimming and other recreational activities. In earlier studies by Keesing *et al.*[3] and Gershwin *et al.*[4], attempts were made to predict the blooming of jelly fish along Australian coast by understanding the role of environmental variables.

Mass jellyfish stranding in beaches of central Odisha, east coast of India have been reported during first week of May[5-7]. Based on the information from news reports and local fishermen, an assessment of this event was carried out to provide the scientific basis considering different environmental factors.

Materials and Methods

Field surveys were undertaken to different beaches immediately after information of jellyfish swarming in coastal waters of central Odisha. The beach stranding of jellyfishes was observed in different stretches of the coast line during first week of May 2016 from Astaranga to Puri (60 km beach distance; Fig. 1). Earlier information on the swarming from Odisha coast was collected from newspapers and fishermen.

In order to find the link with primary producers, inter-annual eight day average (January to May) chlorophyll-*a* concentration (proxy of phytoplankton biomass) and Sea Surface Temperature (SST) of coastal waters were retrieved from ocean colour satellite Moderate Imaging Spectroradiometer onboard Aqua satellite (MODISA) with aid of SeaDAS (v.7.4) software. Sea surface current was generated with aid of Regional Ocean Modelling System (ROMS). Wind speed and direction were obtained from European Centre for Medium-Range Weather Forecasts (http://www.ecmwf.int/).

Results and Discussion

Beach stranding of the jellyfish *Porpita porpita* (Linnaeus 1758) was observed in stretches from Astaranga to Puri during first week of May (Fig. 2). It was in discrete patches along the beach. During this period, the satellite retrieved average SST was 28.83 ºC and 29.40 ºC for the months of April and May 2016, respectively. From the satellite retrieved data, it was observed that the chlorophyll-*a* concentration starts increasing from the month of February (Fig. 3). So, this increase could be triggering the secondary production which is food for the button jelly[8].

Porpita porpita, commonly known as the blue button is native to tropical and sub-tropical waters of Pacific, Atlantic and Indian Ocean[9]. It belongs to family Porpitidae (Kingdom: Animalia, Phylum: Cnidaria, Class: Hydrozoa) and mostly inhabits in the surface water (pleuston). It maintains flotation by a disc-like chitinous float "pneumatophore", derived from the perisarc surrounded by soft living tissue. The pneumatophore consists of a colony of hydroids.

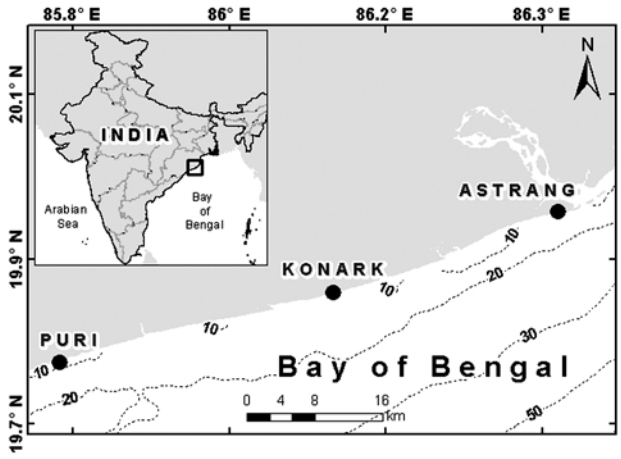

Fig. 1 — Map showing location of *Porpita* mass beach stranding (black dots) in Odisha coast

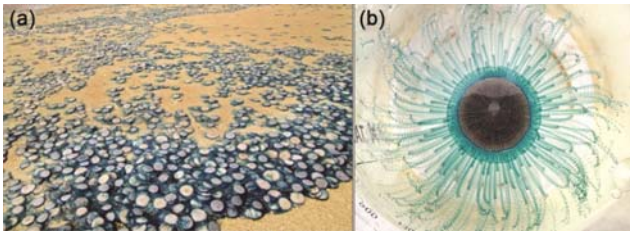

Fig. 2 — (A) Mass beach stranding of *Porpita porpita* in Odisha coast (Source: The Prameya, Daily News Paper[23]), (B) A live specimen of *Porpita porpita*

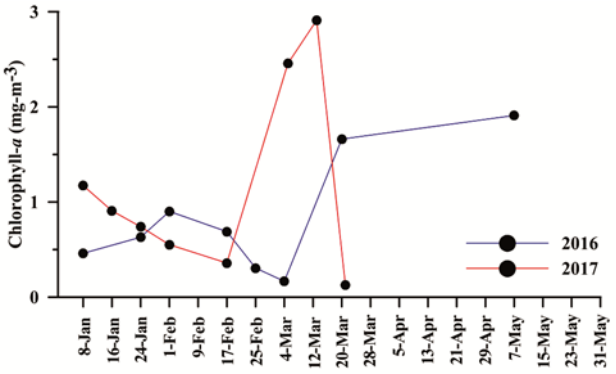

Fig. 3 — Variation of MODIS Aqua retrieved eight day averaged chlorophyll-*a* concentration during months of January to May in 2016 and 2017

These jellies have an imperceptible sting for humans and contain bioactive compounds having antimicrobial effect[10,11]. The nudibranchs *viz. Glaucus atlanticus* and *Glaucilla marginata* are predators of *Porpita*[12]. In addition, the shelled snails *Janthina* spp. construct rafts of bubbles to remain at the surface and prey upon *Porpita*[13,14]. It is also one of the preferred food items for neonate loggerhead turtles[15]. Interestingly, the stranding of nudibranch *Glaucus* sp. was also reported from the study area prior to *P. porpita* stranding[16]. Many researchers have pointed out the co-occurrence of *Porpita* on the shore with other pelagic biota. Shoreward movement of the species in association with *Janthina*, *Physalia* and *Glaucus* was reported from the east coast of Guam, west Pacific[17]. In west coast of India (Veraval), large number of *Porpita* was also found washed ashore in monsoon season[18]. In Odisha coast, Sahu and Panigrahy[19] reported the swarming of jellyfishes.

Studies of Zavodnik[20] and Graham *et al.*[21] shows that the distribution of jellyfish is determined by physical factors *viz.* tides, winds and currents and these factors supposed to cause them to concentrate or swarm near to shore. Other reason for swarming is availability of abundant food[8]. The food of *P. porpita* consists of mostly carnivorous calanoid copepods (~90 %), and crab megalopa and fishes comprise less (~10 %)[(ref. 22)]. It can be said that the increase in phytoplankton from February month would induce sufficient food for *P. porpita* that could lead to large aggregation/swarming. As the blooming of jellyfish was mostly observed during summer season, so it can be assumed that there might be a higher temperature preference for the species. Figure 4 shows a swarm of jellyfish off Rushikulya and it was observed from a coastal cruise during May 2017. So, it can be concluded that it is an annual event occurring during March-May (summer season).

Fig. 4 — A patch of *Porpita porpita* off Rushikulya estuary observed from a coastal cruise during May 2017

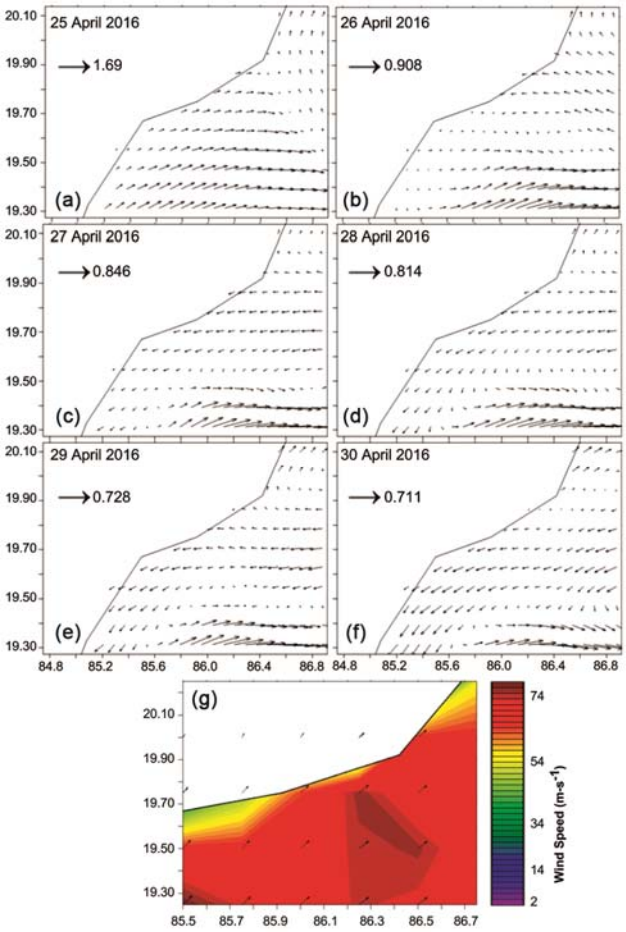

Fig. 5 — (A-F) Sea surface current (in meters per second) off Puri coast from 25 to 30 April 2016. (G) wind direction (arrow marks) and wind speed (colour contour) along coastal waters of central Odisha on 1 May, 2016. X axis represents longitude and Y axis represents latitude

The satellite derived current and wind data from the study region shows that during the event the direction of the current and wind is towards the shore (Fig. 5). It can be said that the swarms in the open water came to shores and caused the mass beach stranding. Keesing *et al.*[3] also got similar results in north-western Australian coast while studying the role of wind on beach stranding of a jellyfish *Crambione mastigophora* Mass (1903).

Conclusion

From the above observations, it can be concluded that the present mass beach stranding of *P. porpita* was attributed to offshore aggregation/swarming and further drift away to the beach due to shoreward current and wind. The beaches of central Odisha are major tourist hotspots; hence conduct of awareness campaigns and early warnings of these events will be beneficial for the beach goers. For accurate prediction of these events, more studies required on life cycle of these organisms and associated environmental factors.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Author Contributions

BKS and SKB conceived and conceptualized the study; SS (Sambit Singh) collected field information, BKS & SKB interpreted data; BKS prepared the first draft of the manuscript with critical input from SKB and SS (Suchismita Srichandan); AS acquired and processed chlorophyll, sea surface current and wind data. SKB prepared the graphical illustrations. All authors were involved in the revision and editing of the manuscript.

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