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A neustonic and pelagic sea slug (*Glaucus atlanticus*) on the shore of Chennai

Due to the extensive work of Churchill *et al*. (2014), it has become evident that *Glaucilla* and *Glaucus* are different genera under the Family Glaucidae (Class: Gastropoda; Order: Nudibranchia) by the presence of a short posterior end of the body and by the arrangement of cerata in multiseriate groups. Molecular analyses indicate that the family Glaucidae is in fact, closely related to Facelinidae (Martynov *et al*. 2019). *Glaucus* species can float on the surface of water due to their ability to maintain their buoyancy by swallowing air and holding it in gastric cavities. Their distribution is a function of the gyre systems, ocean currents driven by wind so they can become stranded (Pinotti *et al*. 2019). The specimens used for this study were collected along the shore of Chennai at Nochi Nagar (13.027854ºN, 80.27793ºE), Tamil Nadu, India on 6–7 March 2023. The specimens were preserved in 10% formaldehyde to observe morphological features. All identifications were based on Churchill *et al*. (2014).

Glaucus atlanticus (Forster, 1777)
(Fig. 1)

***Diagnosis*.** The adult specimen is dark blue and silver, ranging in size from 2 cm to 3 cm. Cerata are found in three pairs of clusters on either side of the body. Each cluster is uniseriate or has a single row of cerata from the peduncle, which is indicative of the genus. The rhinophores and oral tentacles are very short. The posterior end is long. The dorsal side has a distinct silver reflective pigment from the head to the posterior end and on either side flanked by dark blue colouration. The cerata are dark blue. The juveniles ranged from 0.5 cm to 1 cm in length.

***Distribution*.** Strandings in India: Chennai, Tamil Nadu; Vishakapatnam, Andhra Pradesh.

***Oceanic Distribution*.** North Pacific and South Pacific gyres; North Atlantic and South Atlantic gyres and Indian gyres.

Figure 1. Some live *Glaucus atlanticus* Sea Slugs from Chennai Coast, India

The stranding of *G. atlanticus* especially in large numbers leads to several questions being raised. Large-scale strandings of *Glaucus atlanticus* have previously been recorded in India (Srinivasulu et al. 2012). The stranding of *G. atlanticus* in India is largely dependent upon the Indian gyre, which consists of the south equatorial current and the west Australian current. The population of the gyre depends on the Q_{10} which is a measure of the degree to which a certain biological activity depends on the

temperature. Thermal sensitivity in aeolids shows decreased activity at lower temperatures and high activity at higher temperatures. Thermal sensitivity is an important factor in the distribution of nudibranchs (Clark 1975). *Glaucus atlanticus* specimens are driven by the Indian Ocean gyre and could have been pushed to the shore by seasonal wind patterns. The species was found stranded on the shore along with *Porpita* species, which they feed on. It can also be postulated that ENSO events can lead to the passive displacement of these species. It was reported by the Indian Meteorological Centre (Monsoon Mission Climate Forecasting System or MMCFS) that La Niña was transitioning into ENSO-neutral conditions during the time of the stranding. ENSO or El Niño Southern Oscillation changes the temperature of the water in the southern and eastern tropical Pacific Ocean. ENSO neutral conditions bring about warm air over the equatorial Pacific region which in turn affects the monsoon patterns in India. There has been a triple dip in La Niña events since September 2020, which in the transition stage into ENSO-neutral conditions is bound to have an impact on the wind and current patterns in the Indian gyre, which in turn plays a significant role in the distribution and stranding of *G. atlanticus*.

It is also relevant to discuss the oil slick on the Nagapattinam coast, Tamil Nadu at the same time as the stranding. It is a mere 304 km away from the stranding location. This could be a contributing factor to the stranding since winds are altered by oil slicks. The wind drags caused by oil slicks alter the winds and ocean current circulation. Anthropological interferences displace such animals from their niches, which makes it important to track changing monsoon patterns (Wyrtki 1973), which most definitely have an impact on the stranding of pelagic species and may even serve as indicators of global warming.

Apart from these factors, the availability of food, the suitability of the environment for reproduction, geophysical aspects of the environment, and the overall ecology also play an important role in species distributions (although not necessarily displacement). The Indian gyre influenced by ENSO-neutral events coupled with the wind drag effect of the oil slick at Nagapattinam could have contributed to the location of the stranding of this species at Chennai, Tamil Nadu. In any case, further interdisciplinary studies are required to delineate the displacement pattern of these organisms.

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