Short Communication:

Mass Accumulation of Macrophytes along the Northern and Eastern Coasts of Sri Lanka - A Case Study

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Abstract: A survey was carried out on November 09th, 2021 following the macrophyte accumulation along Sri Lanka's northern and eastern coasts. Collected macrophytes were identified into species level using "aquatic plants identification keys" and quantified using quadrats. From the study, the plants accumulated were identified as water hyacinth (*Eichhornia crassipes*). It is an invasive aquatic plant that can cause substantial negative ecological and socioeconomic impacts. The macrophyte accumulated per square meter ranged from 33 to 97. Based on the meteorological data such as rainfall, water current, wind and the distribution of species, it was assumed that these plants had been carried from India with the severe flood and high-velocity water currents originated in the Bay of Bengal. As an initial step, it is important to identify and analyze the accumulated plant species in order to take further action to learn about potential utilization methods of these macrophyte accumulations in the future.

Keywords: Aquatic plants, *Eichhornia crassipes*, invasive alien species, identification of plants, water hyacinth

The coastal areas from Thondaimanaru towards Point Pedro became an eyesore on the 08th November 2021 (Monday) morning with tonnes of aquatic plants piled up on the beaches (Fig. 1). The accumulation has been observed in the preceding days in the Northern and Eastern parts of Sri Lanka as the city continued to endure flooding in the aftermath of incessant rains. This heap-up has occurred in Jaffna beaches including Thondaimanaru, Akkarai, Point Pedro, Karainagar areas and in coastal regions of Trincomalee, Batticaloa and Ampara. The volume of macrophyte accumulated was unprecedented.

Fig. 1: Mass accumulation of Macrophytes along the Point Pedro coast.

A field survey was carried out to identify and analyse the distribution of macrophyte accumulated along the coast. Accumulated plants were collected, and morphometric analysis was performed based on shapes of leaves, leaf margins, leaf and stalk textures, length of petiole, and venation of leaves. Plants were identified based on two identification keys, the first help to classify aquatic plants based on life form and habitat and the second was useful to distinguish the species within the life form group (Warrington, 1994). Quantification of the macrophyte accumulation was carried out by using one square meter quadrats. Local people were interviewed to collect information regarding the plants and to inquire about any record of such incidents in the past.

The "Earth" meteorological website (earth.nullschool.net) provides near real-time visualization of global weather and oceanic conditions. From the meteorological website

data, the regions in India covering West Bengal, Chennai, Puducherry and Northern and Eastern parts of Sri Lanka received heavy rainfall due to the depression in the Bay of Bengal (Fig. 2).

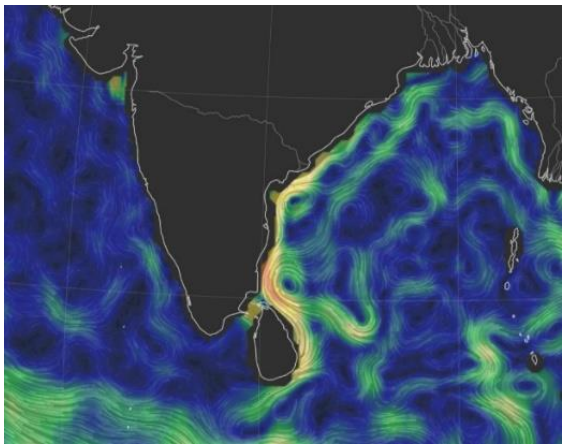

Fig. 2: Depression formed in Bay of Bengal

All the waterways are carrying copious amounts of floodwaters and it is coupled with storm surges due to depression in the Bay of Bengal. This caused the Northern and eastern coasts of Sri Lanka to pile up macrophytes with solid waste. The macrophytes accumulated were immeasurable. It is noteworthy that during this period, a similar incident was also recorded in Kovalam Beach, India (Fig. 3).

Fig. 3: Waste deposited on Kovalam beach.

The leaves of the plants collected were thick, shiny with a waxy layer, and dark green. Fig. 4 shows the macrophyte plant collected from Point Pedro beach. The elliptical to ovate, curved inward at the edges, 7 - 11 leaves of diameter 8 - 10 cm and length 8-12 cm were arranged in a basal rosette having a broad leaf blade with entire margins. The leaves had a thickened, spongy, bulbous, erect stalk (petiole) of about 25 - 45 cm and its base enclosed in a stipule. Leaf veins were dense, numerous, fine, and longitudinal. The roots of the plants are unbranched, fibrous, and feathery with a conspicuous root cap and purplish black.

Fig. 4: Structure of a water hyacinth plant collected at Point Pedro beach.

From the morphometric study, the plants accumulated were identified as water hyacinth (*Eichhornia crassipes*) (Penfound and Earle, 1948; Ayanda et al., 2020). The number of macrophytes accumulated per square meter ranged from 33 to 97. From the survey, it was found that this is the first incident of accumulation of water hyacinth along the Northern and Eastern coasts of Sri Lanka.

This paper is the first record of accumulation of *Eichhornia crassipes* on Northern coasts of Sri Lanka. *Eichhornia crassipes*, an invasive freshwater plant native to the Amazon Basin of South America spread to other parts of the world favorable to its development such as Australia, China, India, Indo-China, Japan, Siam and South Africa (Penfound and Earle, 1948). Water hyacinth is a perennial mat-forming plant that can be found in freshwater bodies such as ponds, lakes, rivers, streams, and artificial aquatic habitats. It shows tremendous growth in eutrophic water (Coetzee *et al.*, 2017; Pellegrini *et al.*, 2018). It is one of the notable invasive alien plants introduced to Sri Lanka through the

royal botanic gardens, Peradeniya and widespread island wide reservoirs, ponds, marshes and streams (Wijesundara, 2010).

It is known as one of the world's worst aquatic weeds with many negative ecological and socio-economic impacts. Dense interlocking mats of *E. crassipes* due to their rapid reproductive rate and complex root structure promote siltation in water bodies leading to an overall reduction in productivity due to the drop in light penetration to the submerged aquatic vegetation. Furthermore, there will be a decline in dissolved oxygen content available to aquatic organisms. This can lead to detrital production and reduce biomass and diversity of phytoplankton and benthic invertebrates (Coetzee *et al*., 2017; Villamagna and Murphy, 2010).

The accumulation of these macrophytes became a nuisance to the local fisherman community as interrupting movements of vessels, usage of fishing gear, mending of fishing gears, and salted dried fish production activities leading to a subsequent loss of livelihood. In addition, the natural scenic beauty of beaches, recreational activities, and tourism were affected due to the decomposition of the water hyacinth plants. Thus, the coastal community united to get rid of these plant matters from the beach within a week.

With the water current, varieties of Invasive Alien Species of plants can reach the shorelines of Sri Lanka from all over the world. Among them, water hyacinth has become the world's most invasive weed due to its rapid spreading ability, ecological adaptability, and negative impacts it causes on the environment, economy, and human well-being (Ayanda *et al.,* 2020). The optimum temperature necessary for the growth of this plant species ranges from 28℃ to 30℃ and favourable pH values between 6.5 - 8.5 (Dersseh *et al*., 2019). The temperature of the seawater recorded on the day is 28℃ and pH 8, which is favourable for the establishment and growth of water hyacinth. However, water hyacinth does not occur in water with an average salinity greater than 15 ppt (Penfound and Earle, 1948). Hence, *Eichhornia crassipes* reached the coastal regions of Sri Lanka but could not establish themselves as the salinity recorded on the day is 23.8 ppt and were destroyed due to the saline conditions that prevailed. Thus, we could state that we are safe from the devastation of Invasive Alien Species of water hyacinth. Invasive alien species related problems could be resolved by integrating university-based research to improve management and prevention operations, as well as effective communication tactics for a more effective delivery of public education about biological invasions.

The utilization of this plant includes biogas and biofuel production, medicinal functions, vermicomposting, compost production, and bioremediation (Ayanda *et al*., 2020). As a follow-up action, it is necessary to study the potential utilization methods of these accumulated plants in the future.

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