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Pleustonic colonies of cnidarians (*Physalia physalis*, *Porpita porpita* and *Velella velella*) found along the coastal belt of Sri Lanka

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Three species of the free-floating, colonial hydrozoans namely *Physalia physalis* L., *Porpita porpita* L. and *Velella velella* L., found along the coastal belt of Sri Lanka are reported here with their morphological descriptions and respective abundance. The study was conducted from March 2017 to April 2018, implementing monthly coastal surveys at 26 sampling stations along the coastal belt of Sri Lanka. The abundance of stranded colonies of those species was assessed using line transects and the specimens were identified taxonomically. Of the porpitids found in this study, *V. velella* was reported for the first time in Sri Lankan waters while *P. porpita* was re-reported trustworthy as its initial record was just a sighting. The siphonophore *P. physalis* was also re-reported and it always represented the lowest abundance among the stranded colonies of the three species. The highest abundance of all the species was from May to August on the southwest coast of Sri Lanka, and from November to February on the northeast coast. There was a significant size difference in colonies of each species between the two coasts.

[**Keywords**: Jellyfish, Monsoons, Spatio-temporal dynamics, Taxonomy]

Introduction

The surface-dwelling (pleustonic) hydrozoan group comprises the well-known "by-the-wind-sailor" *Velella velella* (Linnaeus, 1758), and the "blue button" *Porpita porpita* (Linnaeus, 1758). These two species are colonies of hydroids belonging to the same family, Porpitidae[1,2], and they primarily inhabit the ocean surface, especially in warmer parts of the oceans, in both hemispheres (from the equator to latitudes as high as 55°)[3,4]. But larvae and medusae could extend their habitats to a depth of several meters from the surface[2,5]. The bodies of these two species consist of two main parts: (1) the chitinous float; and (2) the polymorphic hydroid colony (different types of zooids).

Free-floating hydroid organisms also include the siphonophore *Physalia physalis* (Linnaeus, 1758)[6,7], which is well-known as the "Portuguese man-of-war", or "blue bottle". This species is common in both the tropical and subtropical oceans, distributed between 40° S and 55° N[8,9], and in the recent past has shown great strandings[10]. As in *P. porpita* and *V. velella*, the *P. physalis* also owns a float (pneumatophore) and a colony of polymorphic hydroids. Being dwellers of the uppermost layer of marine environments, *P. physalis* and those two porpitid species could easily be carried to the shore by water currents and winds[1,11-13].

Both Sri Lanka and India, the two neighbouring countries, generally get affected by two main monsoons. Wind and the surface water currents of the north Indian Ocean move towards the northeast during the southwest monsoon (May to September), while it reverses the direction towards the southwest during the northeast monsoon (December to February) in a seasonal pattern[14]. Three of these hydrozoan species have been reported from India during monsoon periods[13], but of them, *P. physalis* is the only species reported so far from Sri Lankan waters with a proper taxonomic description. In Sri Lanka, *P. physalis* (= *Physalia utriculus*) was first recorded in 1902 by Browne[15] using two specimens obtained from Galle, in southern Sri Lanka. Later in 2006 Fernando[16] documented this species as *P. utriculus*. Again in June 2018, a stranded colony was sighted at the beach of Dehiwala - Mount Lavinia, Colombo (6.83° N, 79.86° E)[17], while two specimens (NHMUK 1974.4.4.2) collected from Bentota, Galle (6.42° N, 80.00° E) have been deposited in the Natural History Museum, London[18].

In 1905, a float of a hydroid colony obtained from the Pearl Banks, Gulf of Mannar, Sri Lanka was identified as *Porpita* sp.[14]. Three *Porpita* specimens (NHMUK 1974.4.4.1) collected from Kinniya, Batticaloa (8.25° N, 81.33° E) in Sri Lanka have also been deposited in the Natural History Museum, London after identifying only up to the genus level[18]. Recently, the first occurrence of *P. porpita* was recorded from Valikamam North, Jaffna, Sri Lanka (9.81° N, 80.04° E), just as a sighting in April 2019(ref. 17). Hence, so far, no taxonomic description is documented on *P. porpita* which occurs in Sri Lankan waters.

Although *Velella* was reported from Sri Lankan waters by Fernando[16,19] and NARA[20], no records are available on its identification up to the species level. Therefore, this paper taxonomically describes the *V. velella* found for the first time in Sri Lankan waters. Moreover, the other two species of pleustonic colonial hydrozoans (*P. porpita* and *P. physalis*), are also taxonomically described here for the confirmation of their occurrences in Sri Lankan waters. In addition, we present the spatio-temporal dynamics of the occurrence and abundance of these three species along the coastal belt of Sri Lanka for one year.

Materials and Methods

The abundance of hydrozoan colonies stranded along the coastal belt of Sri Lanka was estimated in a gelatinous zooplankton survey ('*Waya-jel*-Survey' 2016–20) from March 2017 to April 2018 monthly. Three replicates of line transects (length 100 m × width 5 m) were set parallelly to the coastline at each of the 26 sampling stations (*St.*), which coincided in 11 coastal zones ($Z_{I–XI}$) around the country (Fig. 1 & Table 1). The stranded colonies found in each line transect were counted by walking along the transects. To minimise the temporal effect, colonies in each zone were counted on the same day while special care was taken to make sure that each sampling station is counted during the same time (±1 h) throughout the study period. In addition, float length/diameter measurements of randomly collected specimens from each coastal zone were performed by using a plastic ruler to the nearest millimetre. Altogether, 400, 1154 and 612 colonies of *Physalia*, *Porpita* and *Velella* species, respectively were randomly collected alive to perform a morphometric assessment with respect to float length/diameter. Of the collected specimens, only the best specimens were photographed.

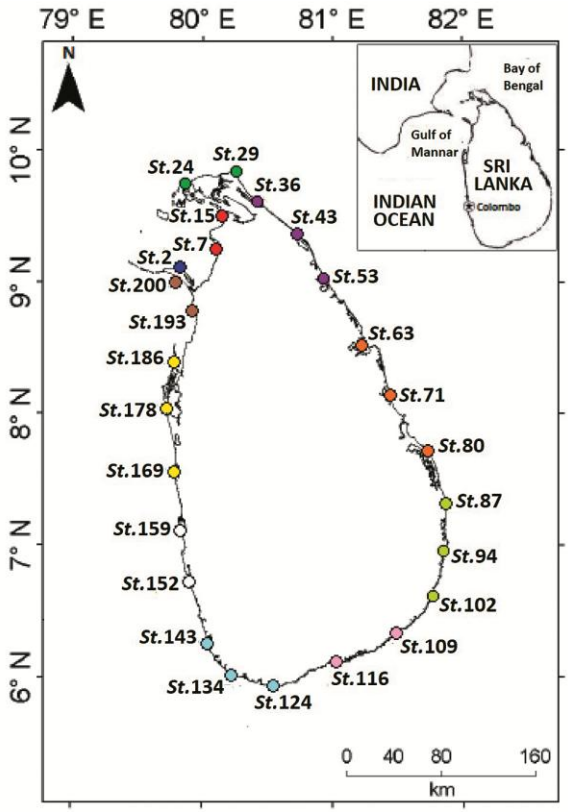

Fig. 1 — Twenty-six beach sampling stations (*St.*) of the "*Waya-jel*-Survey", where the present study was carried out at 11 coastal zones ($Z_{I–XI}$) which are demarcated by geographical locations in Sri Lanka. Adjacent sampling stations which coincide with the same coastal zone are represented by the same colour circles. Respective coordinates of these sampling stations are given in Table 1

Eight physicochemical parameters such as temperature, dissolved oxygen, pH, salinity, total dissolved solids, electrical conductivity, resistivity and turbidity of flushing water around the sampling beaches were measured each sampling day by using a digital multiparameter (HACH HQ 40 D) and a hand-held turbidity meter (HACH 2100P), and the coordinates of those sampling stations were recognized with a GPS machine (GARMIN 72H). Respectively, 45, 140 and 187 colonies of *Physalia*, *Porpita* and *Velella* collected from randomly selected sampling stations were taken to the laboratory in preserved form, using 5 % formalin/seawater, for the taxonomic examination. In addition, a few specimens of *Physalia* (n = 29), *Porpita* (n = 09) and *Velella* (n = 15) collected from four more localities in 1991, 1993 and 2014 were received to the Museum of the Department of Aquaculture and Fisheries, Wayamba University of Sri Lanka (MDAFWU) in preserved form, and those

Table 1 — The beach sampling stations (*St.*) of the "*Waya-jel*-Survey", where the present study was carried out at 11 coastal zones ($Z_{I–XI}$) of Sri Lanka

Coastal zone (*Z*)		*St.*	Latitude	Longitude
I	Pesalai	2	9.09° N	79.81° E
II	Nachchikkuda – Pooneryn	7	9.26° N	80.12° E
		15	9.49° N	80.19° E
III	Karainagar – Point Pedro	24	9.76° N	79.89° E
		29	9.82° N	80.25° E
IV	Thalayadi – Putumattalan – Kokkilai	36	9.63° N	80.40° E
		43	9.36° N	80.73° E
		53	8.99° N	80.96° E
V	Trincomalee – Panichchankeni – Kallady	63	8.57° N	81.24° E
		71	8.14° N	81.44° E
		80	7.71° N	81.72° E
VI	Nintavur – Komari – Okanda	87	7.35° N	81.86° E
		94	6.98° N	81.87° E
		102	6.63° N	81.77° E
VII	Amaduwa – Welipatanvila	109	6.28° N	81.43° E
		116	6.10° N	80.99° E
VIII	Polhena – Galle – Balapitiya	124	5.94° N	80.53° E
		134	6.01° N	80.25° E
		143	6.28° N	80.04° E
IX	Koralawella – Pamunugama	152	6.76° N	79.88° E
		159	7.11° N	79.84° E
X	Chilaw – Mampuri – Mutwal	169	7.60° N	79.79° E
		178	8.00° N	79.72° E
		186	8.32° N	79.76° E
XI	Silavathurai – Nadukkuda	193	8.75° N	79.95° E
		200	9.05° N	79.78° E

specimens were also inspected in this study. Identification of *Porpita* and *Velella* specimens was performed by following Schuchert[1] and Calder[2], and *Physalia* specimens were identified by following Bardi & Marques[8] in addition to the historical accounts from Linnaeus[21] and Lamarck[22]. Preserved specimens, in 5 % formalin/seawater solution, were housed in the MDAFWU after allocating accession numbers. The size differences of colonies found during the southwest (SW) and northeast (NE) monsoons and differences in physicochemical parameters of water were compared by using the *t*-test (Minitab 17 statistical software).

Results

Taxonomy of *Physalia physalis*

Systematics

Phylum: Cnidaria Verrill, 1865
Subphylum: Medusozoa Petersen, 1979
Class: Hydrozoa Owen, 1843
Subclass: Hydroidolina Collins, 2000
Order: Siphonophorae Eschscholtz, 1829
Suborder: Cystonectae Haeckel, 1887
Family: Physaliidae Brandt, 1835
Genus: *Physalia* Lamarck, 1801
Physalia physalis (Linnaeus, 1758) (Fig. 2)

Original name: *Holothuria phyfalis* Linnaeus 1758: 657. Sinhala name: *Kaak Horiya* (in Sri Lanka). Tamil names: *Kaakka Soriyan*, *Kaakkanetti* (in Sri Lanka).

Material examined

14 specimens (MDAFWU 2017/312–318; 2018/276–282), *St.* 24, December 2017 to January 2018; 1 specimen (MDAFWU 2017/254), *St.* 53, December 2017; 6 specimens (MDAFWU 2017/270–275), *St.* 124, July 2017; 1 specimen (MDAFWU 2016/1), Galle (around *St.* 134, coordinates unavailable), August 2014; 3 specimens (MDAFWU 2017/257–259), *St.* 134, June 2017; 4 specimens (MDAFWU 2016/2–5), Hikkaduwa (between *St.* 134 & 143, coordinates unavailable), June 2014; 21 specimens (MDAFWU 2017/291–311), *St.* 143, May 2017; 17 specimens (MDAFWU 2019/31–47), Mount Lavinia (between *St.* 152 & 159, coordinates unavailable), June 1993; and 7 specimens (MDAFWU 2019/48–54), Wellawatte (between *St.* 152 & 159, coordinates unavailable), July 1991.

Description of the colony

Float (pneumatophore) asymmetric, enantiomorphic, reaching up to 70 mm in length, with 5 – 30 wrinkles at the crest. The oral and main zones of the colony are parted by a basal internode (a gap region without polyps). Polymorphic organisms organized in cormidia, each cormidium forms a tripartite group, consisting of a gastrozooid (feeding polyp) associated with a tentacular palpon (tentacle-bearing polyp) and a gonodendron (compound reproductive structure). Gonodendron composing of male or female gonophores, nectophores, gonopalpons and jelly polyps. Tentacular palpon has a tentacle of dactylozooid (defensing polyp). Tentacles compressed, curly and of different lengths (usually single, long tentacles with a few short ones per single colony), can stretch out to a few meters below the float; spirally arranged nematocyst batteries are concentrated in denser regions of tentacles. Pneumatophore transparent to purplish; zooids and tentacles greenish to deep blue.

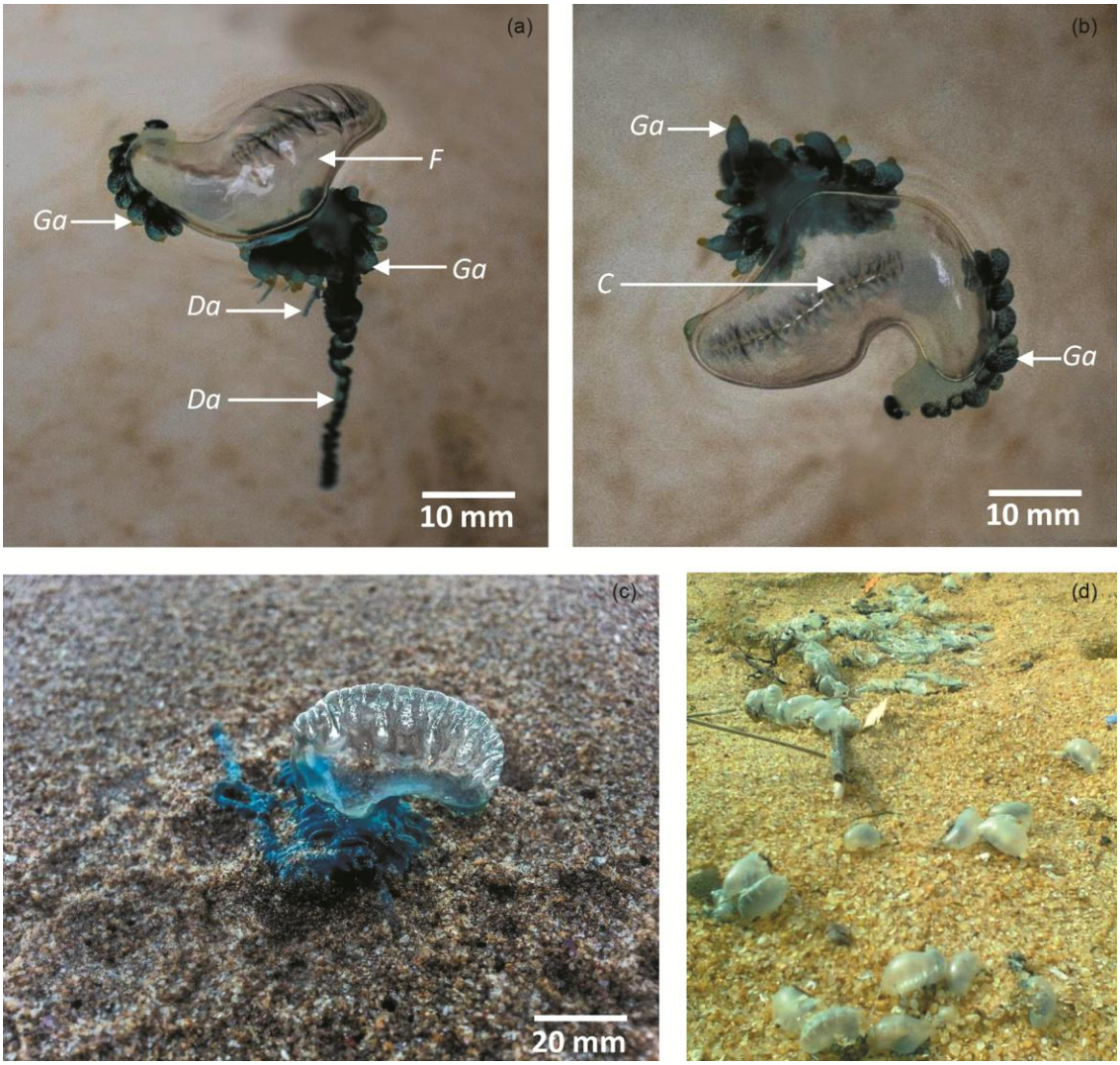

Fig. 2 — Colonies of *Physalia physalis* found in Sri Lanka (a–d): (a) side view; (b) top view; (c) close view of a beached colony in life; (d) several dead colonies stranded on the beach of Wellawatte (between *St.* 152 & 159) in September 2012. Abbreviations: *C* – crest, *Da* – dactylozooids, *F* – float (pneumatophore), *Ga* – gastrozooids. Image D by Malik Fernando

Taxonomy of *Porpita porpita*

Systematics

Phylum: Cnidaria Verrill, 1865
Subphylum: Medusozoa Petersen, 1979
Class: Hydrozoa Owen, 1843
Subclass: Hydroidolina Collins, 2000
Order: Anthoathecata Cornelius, 1992
Suborder: Capitata Kühn, 1913 (sensu stricto)
Family: Porpitidae Goldfuss, 1818
Genus: *Porpita* Lamarck, 1801
Porpita porpita (Linnaeus, 1758) (Fig. 3)

Original name: *Medusa porpita* Linnaeus 1758: 659. Sinhala name: *Nila Horiya* (in Sri Lanka). Tamil name: *Nawaka Soriyan* (in Sri Lanka).

Material examined

12 specimens (MDAFWU 2017/85–96), *St.* 24, December 2017; 1 specimen (MDAFWU 2017/253), *St.* 53, December 2017; 4 specimens (MDAFWU 2017/287–290), *St.* 134, June 2017; 1 specimen (MDAFWU 2016/6), Hikkaduwa (between *St.* 134 & 143, coordinates unavailable), June 2014; 54 specimens (MDAFWU 2017/618–671), *St.* 143, July 2017; 8 specimens (MDAFWU 2019/4–11), Mount Lavinia (between *St.* 152 & 159, coordinates unavailable), June 1993; 15 specimens (MDAFWU 2017/549–563), *St.* 169, September 2017; and 54 specimens (MDAFWU 2017/564–617), *St.* 178, October 2017.

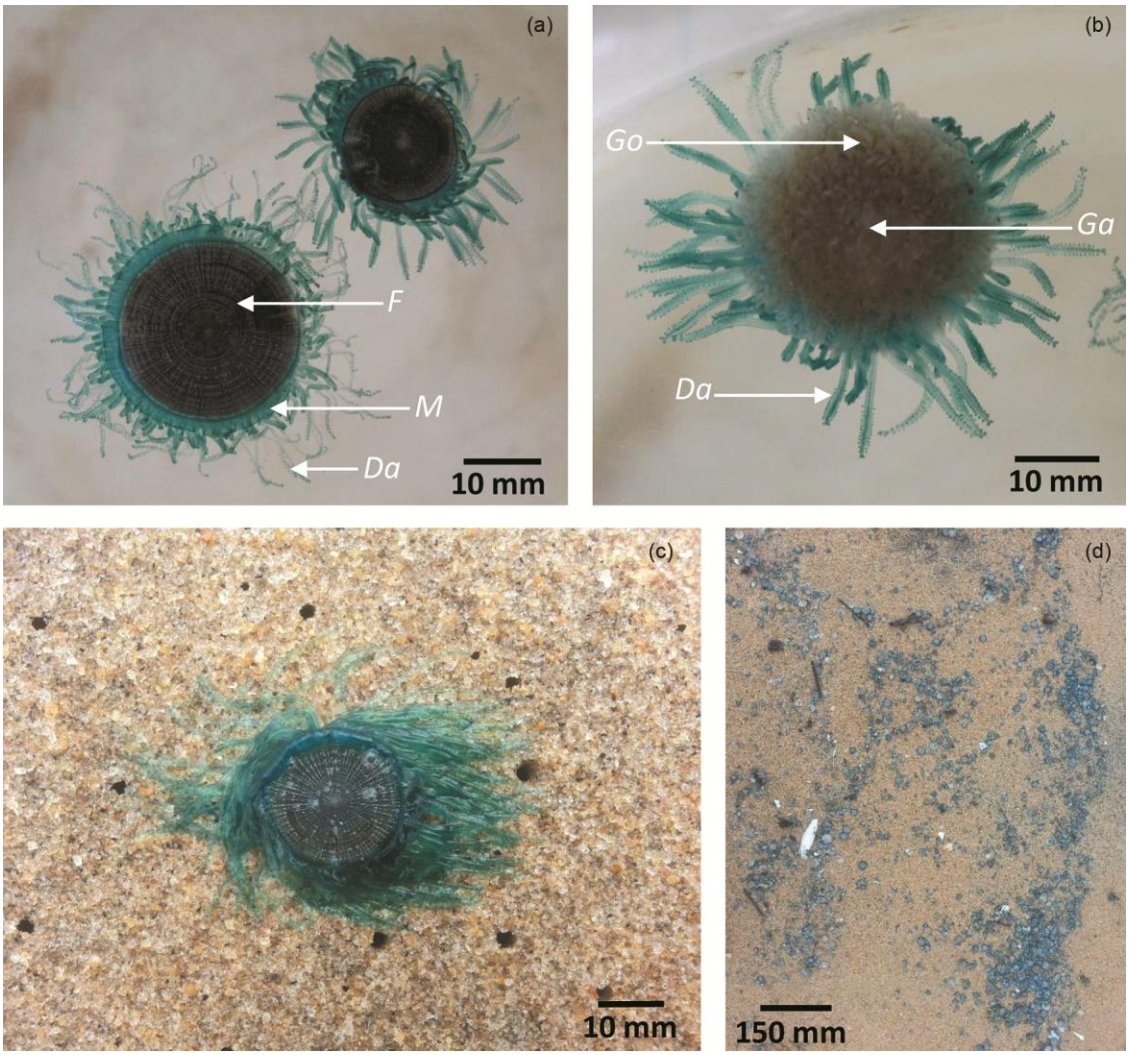

Fig. 3 — Colonies of *Porpita porpita* found in Sri Lanka (a–d): (a) aboral view; (b) oral view; (c) close view of a beached colony in life; (d) mass accumulation of dead colonies on the beach of Kokkilai (*St.* 53) in December 2017. Abbreviations: *Da* – dactylozooids, *F* – float, *Ga* – gastrozooids, *Go* – gonozooids, *M* – mantle

Description of the colony

Float round, up to 31 mm in diameter, with chitinous pneumatophore, dorsally covered by a disk-shaped mantle and polyps on its underside. Upperside flat, without tubercles, the central region consists of a small central opening and numerous radial rows of stigmata. Mantle larger than inner float and with free, flexible margin, the upper surface of the mantle with concentric ridges, beneath surface radiating endodermal canals. Internal chitinous float comprising of chains of concentric chambers. Under the surface of the float attached to polymorphic organisms including single, large, short and broad central gastrozooid, with a terminal mouth opening, without tentacles or obvious cnidocyst clusters. Central gastrozooid surrounded by numerous gonozooids and dactylozooids towards the periphery. Each strand in the peripheral hydroid colony has numerous branchlets, each of which ends in knobs of nematocysts. Tentacles short, capitate, arranged in three longitudinal rows, distally only on each dactylozooid. The centre of the float is silvery brown, mantle and dactylozooids usually light green to bright blue, and gonozooids whitish-yellow to brown in colour.

Taxonomy of *Velella velella*

Systematics

Phylum: Cnidaria Verrill, 1865
Subphylum: Medusozoa Petersen, 1979
Class: Hydrozoa Owen, 1843
Subclass: Hydroidolina Collins, 2000

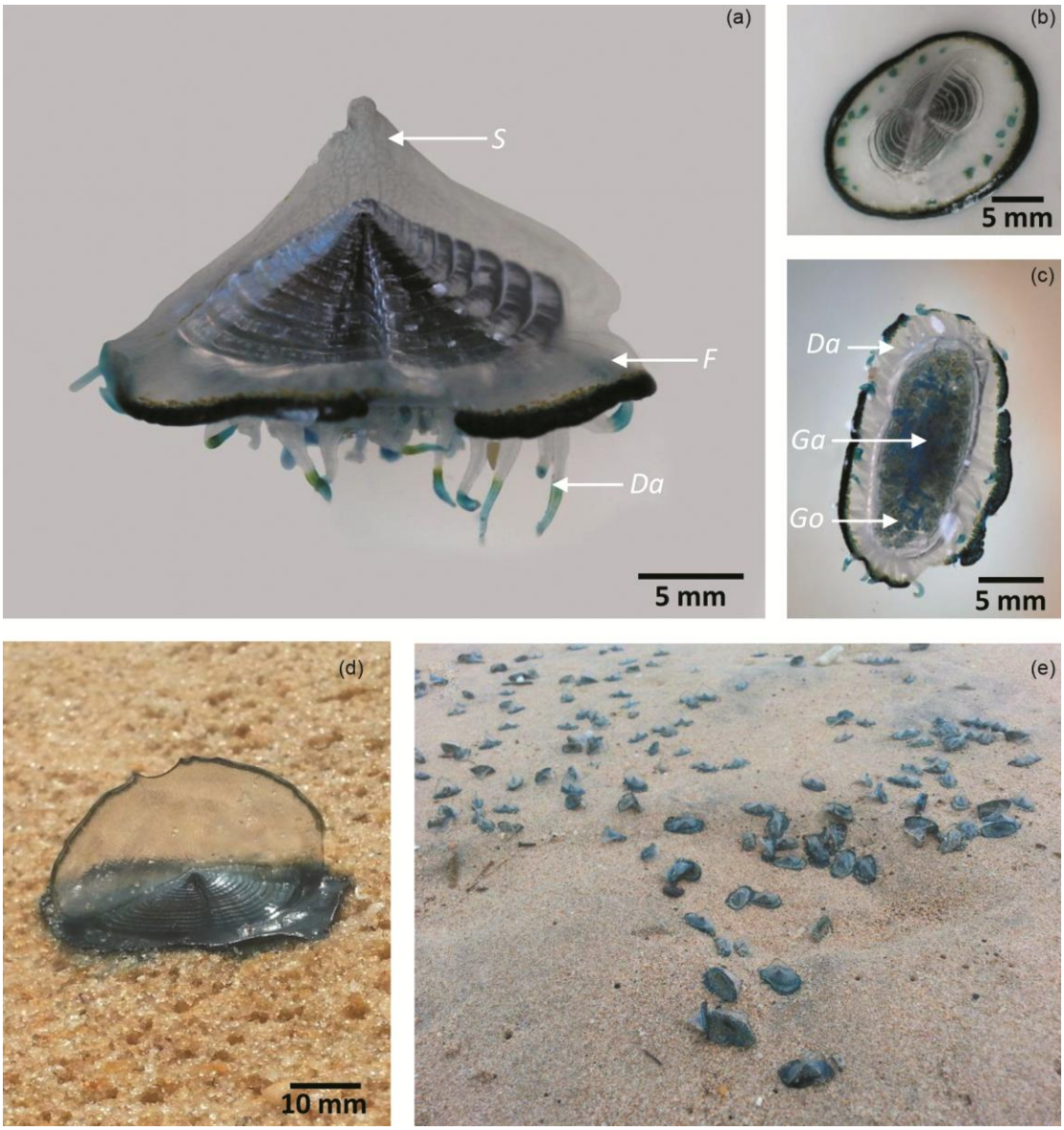

Fig. 4 — Colonies of *Velella velella* found in Sri Lanka (a–e): (a) view of the lateral side; (b) aboral view; (c) oral view; (d) close view of a beached colony in life; (e) mass accumulation of colonies on the beach of Nilaveli (between *St.* 53 & 63) in December 2013. Abbreviations: *Da* – dactylozooids, *F* – float, *Ga* – gastrozooids, *Go* – gonozooids, *S* - sail. Image D by Malik Fernando

Order: Anthoathecata Cornelius, 1992
Suborder: Capitata Kühn, 1913 (sensu stricto)
Family: Porpitidae Goldfuss, 1818
Genus: *Velella* Lamarck, 1801
Velella velella (Linnaeus, 1758) (Fig. 4)

Original name: *Medusa velella* Linnaeus 1758: 660. Sinhala name: *Ruwal Gaduwa* (in Sri Lanka). Tamil name: *Paaihal Soriyan* (in Sri Lanka).

Material examined

103 specimens (MDAFWU 2018/123–225), *St.* 29, January 2018; 17 specimens (MDAFWU 2018/239–255), *St.* 36, January 2018; 6 specimens (MDAFWU 2017/321–326), *St.* 124, July 2017; 61 specimens (MDAFWU 2017/409–469), *St.* 134, June 2017; and 15 specimens (MDAFWU 2019/14–28), Mount Lavinia (between *St.* 152 & 159, coordinates unavailable), August 1993.

Description of the colony

Float up to 40 mm long, with an internal, transparent, soft, chitinous pneumatophore, consisting of concentric air chambers forming a shallow cone, with a flat bottom. Upright, triangular or semi-circular sail on the upper side and polymorphic organisms on the underside. Sail oblique to the long axis of float

dorsally stretched S-shape and enantiomorphic. Float and sail are kept stiff by chitin support shielded by mantle tissue with a network of endoderm canals. Mantle ellipsoid, rectangular or slightly S-shaped in top view, larger than internal stiff support and with free, flexible margin. Small pores (stigmata) exist in low numbers along the base of the sail. Zooids include a large, middle gastrozooid, surrounded by a stripe of gonozooids and a peripheral band of tentacle-like dactylozooids in the direction of the periphery. Gonozooids are spindle-shaped with a swollen mouth region. On the proximal half of the hydranth, several medusae buds grow in clusters from short blastostyles. Dactylozooids elongated and tapering. The colouration of the float is deep blue or transparent with blue/green margin; medusae buds yellow-olive; sail shiny silver with a transparent mantle; dactylozooids bluish distally.

Temporal distribution and abundance of species

A clear spatio-temporal distribution of pleustonic hydroid colonies was evident along the Sri Lankan coastal belt. Their occurrence and respective abundance seem to be influenced by the monsoonal currents and wind patterns that occurred at different months of the year. From November to February, when NE monsoon is activated, live colonies were found in the NE coastal zones, especially at Z_{III}, Z_{IV} and Z_{V} while, from May to September, when SW monsoon is activated, colonies were found along the SW coastline mainly in the zones of Z_{VII}, Z_{VIII} and Z_{IX} (Fig. 5).

The highest abundances of these colonies were found between the *St.* 24 & 53, and *St.* 124 & 159 because these two coastlines are the greatly affected areas by NE and SW monsoons each year, respectively. During peak abundant seasons, altogether 250 colonies of these three species were found within 500 m^2 coastline (Fig. 5). Mass stranding cases (> 250 colonies/500 m^2) were occasionally reported with only *P. porpita* and *V. velella*. For example, the abundance of stranded *P. porpita* colonies at the *St.* 53 was > 500/m^2 in December 2017, while *V. velella* and *P. porpita* colonies were found > 5/m^2 at the *St.* 124 in July 2017. None of the species was reported from any of the sampling stations from March to April in both years.

Size variance of colonies

The length-frequency distribution of colonies belonging to three species was found to vary with

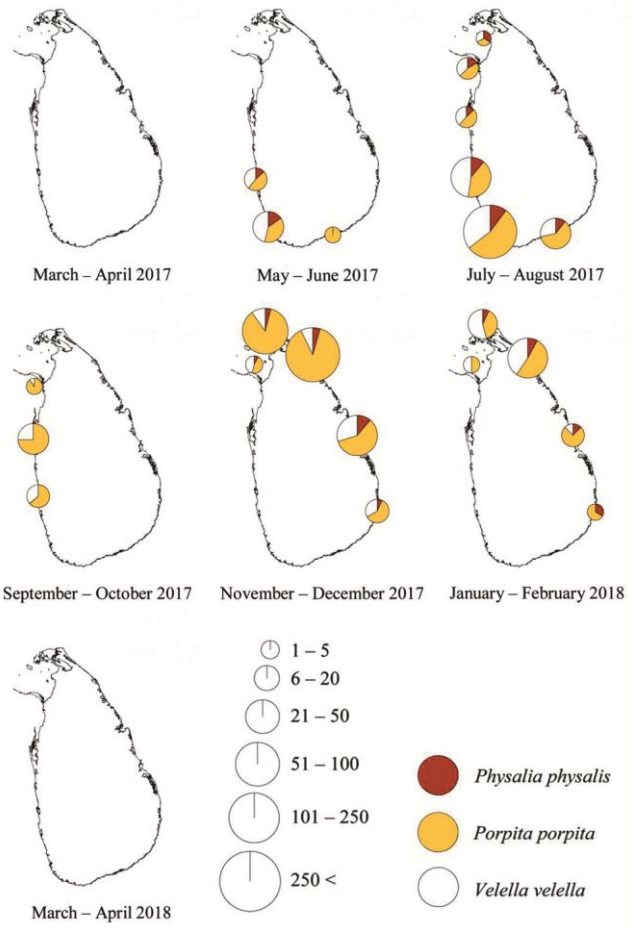

Fig. 5 — Spatio-temporal distribution and respective abundance (number of stranded colonies/500 m^2) of pleustonic hydrozoans along the coastline of Sri Lanka during six time-intervals within a year

time (Fig. 6), but the progression of modes was not evident, mainly due to the availability of species for a shorter duration (less than four months). But with the progression of the monsoon, the abundance of larger colonies appeared to be increasing in both coastal zones. The ranges of water quality parameters recorded during sampling were found to be common for the three species in each monsoon season, and these ranges among two monsoons overlap except for temperature (Table 2). There was no significant difference between the mean values of dissolved oxygen levels (p = 0.389), while the other parameters were significantly different between the two monsoons (p = 0.000).

Sizes of colonies of each species were found to be significantly different respective to the NW and SW coastlines (*P. physalis*, p = 0.028; *P. porpita* & *V. velella*, p = 0.000). While the mean float length of *V. velella* specimens found in this study was 15 mm

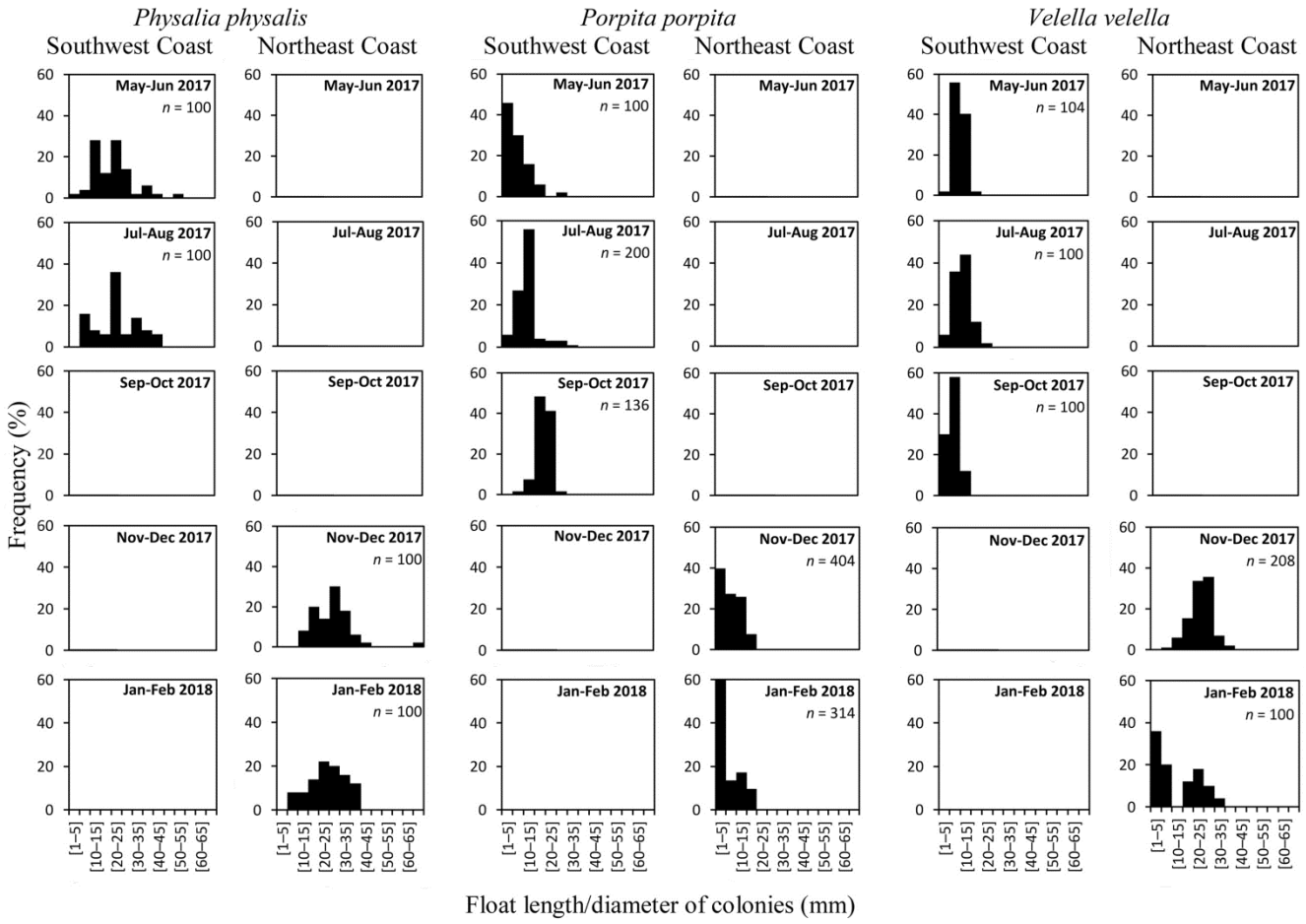

Fig. 6 — Length frequency distribution of three species of pleustonic colonial hydrozoans collected at southwest (SW) and northeast (NE) coastlines of Sri Lanka from May 2017 to February 2018. Note: No specimens were found in March and April in both 2017 and 2018

Table 2 — Sizes of hydroid colonies sampled, and the physicochemical parameters of flushing water of beaches respective to two main monsoon seasons of a year

Monsoon / Coast	Physicochemical parameters								Float length/diameter of hydroid colonies			
	Temperat-ure (°C)	DO (ppm)	pH	Salinity (ppt)	TDS (ppt)	EC (ms/cm)	Resistivit-y (Ω/cm)	Turbidity (NTU)	Species	N	Range (mm)	Mean ± SD (mm)
Southwest (SW)	27.4–31.9	5.3–12.5	7.3–8.7	18.3–33.5	17.7–32.0	32.9–61.4	21.0–33.8	4.2–18.4	*P. physalis*	200	5–55	23±10
									P. porpita	436	3–31	13±7
									V. velella	304	3–21	9±3
Northeast (NE)	24.0–27.3	5.9–12.4	7.1–8.1	18.4–32.6	17.9–31.4	34.1–60.3	19.7–34.4	6.2–22.7	*P. physalis*	200	8–70	26±10
									P. porpita	718	1–26	9±5
									V. velella	308	2–40	21±9

Abbreviations: DO (dissolved oxygen); TDS (total dissolved solids), EC (electrical conductivity); N (number of colonies / measurements); and SD (standard deviation)

(*n* = 612), specimens obtained from the SW coast (mean 9 mm; *n* = 304) were less than a half of the mean length (21 mm) of specimens from the NE coast (*n* = 308). Float diameters of *P. porpita* specimens (*n* = 1154) ranged from 1 to 31 mm (mean 10 mm), and sizes of specimens belonged to the NE coast were noticeably lesser (mean 9 mm; *n* = 718) than the specimens from SW coast (mean 13 mm; *n* = 436). The *P. physalis* colony with 70 mm float length (before preservation), which we have presented at the MDAFWU under the accession number 2018/254, was the largest specimen ever recorded from Sri Lanka because usually they were found with 25±10 mm long floats (*n* = 400).

Discussion

The colonies of *P. porpita* are commonly pushed towards the shore by heavy winds in association with *P. physalis* on the coast of Guam (Pacific Ocean)[23], but Fisner *et al*.[24] observed that *P. porpita* also beached at Pernambuco (Atlantic Ocean) together with *P. physalis*. Not only *Physalia* but *V. velella* was also reported along with *P. porpita* from Saurashtra Coast of Gujarat (Indian Ocean) by Pandya *et al*.[13]. Here, we found these three species together, but in different proportions, at the sampling localities in both SW and NE coastlines of Sri Lanka. *Velella velella* has two morphs (enantiomorphic), each one resembles the mirror image of the other[25,26]. In the present study, 97 % of specimens found from both SW and NE coasts represented the left-handed morph, while the rest had a right-handed morph. The occurrence of these dimorphic forms in *V. velella* helps in the survival of the species, thereby preventing total stranding in rough winds and also aids in dispersal[25]. The shape of the *Velella* sail is triangular-to-semicircular[27], and even the specimens found in the present study had both triangular and semicircular sails. Moreover, we found dimorphic forms (left and right-handed specimens) of *P. physalis* in Sri Lanka; and such forms had been reported in some other parts of the Indian Ocean as well[28].

Physalia physalis grows up to 300 mm in float length (Atlantic form), while the 'Indo-Pacific form' grows up to 175 mm[28]. *Velella velella* colonies reported from the Pakistan coast in May (the hottest season of the Northern Arabian Sea) 2014 had 12 mm long floats[29], while specimens reported from the central Californian cold waters were commonly within 50 to 60 mm in float length, but 130 mm long floats have also been reported from the same waters[25]. The float of *P. porpita* was reported to be grown up to 30 mm in diameter but more frequently it ranges within 10 – 20 mm[1]. The float diameter of *P. porpita* colonies reported from the South Asian countries, such as Bangladesh, India and Pakistan was in the range of 10 – 16 mm, 5 – 20 mm and 22 – 25 mm, respectively[5,13,30]. A *Porpita* specimen with a larger float (diameter 35 mm) has also been reported from Pearl Banks, Gulf of Mannar, Sri Lanka (off Z_{XI})[15]; and it is possible because occasionally *P. porpita* colonies could grow even up to 50 mm in diameter[1]. In the current study, a noticeable temperature difference along with a size difference in colonies was reported between the SW and NE coasts during the respective monsoon seasons. The size of colonies seems to be affected by the water temperature, however, this aspect needs to be further investigated for some other biotic and abiotic factors.

Three of these colonial species are known to play an important role in the marine ecosystem. For example, the depositions of organic matter on high-energy Pacific beaches are caused by the mass stranding of *V. velella*[31]; and the beached carcasses of *Velella*, *Porpita* and *Physalia* were observed to be consumed by ghost crabs *Ocypode* spp. during the samplings of this study. Pieces of these three species were also found in the gut of loggerhead turtle *Caretta caretta* (Linnaeus, 1758) collected near the Azores, North Atlantic Ocean[32]; while a nudibranch *Glaucus* sp. preyed upon *V. velella* and *P. porpita*, and a teleost *Trachinotus* sp. [as *Glaucus* sp.] prayed on *Physalia*[33]. Moreover, the teleost *Carangoides malabaricus* (Bloch & Schneider, 1801) [as *Caranx malabaricus*] searched for shelter under *P. porpita* [as *Porpita pacifica*] colonies[34]; and *V. velella* was parasitized by the isopod *Idotea metallica* Bosc, 1802 and the nudibranch *Fiona pinnata* (Eschscholtz, 1831)[35]. The octopod *Tremoctopus violaceus* delle Chiaje, 1830 utilized stinging tentacles of *Physalia* for defending against predators[36].

Not only ecological importance but also socioeconomic values have been linked with three of these colonial species. For example, *P. physalis* is exhibited in marine aquariums[37]; and it was also in the National Zoological Gardens, Dehiwala, Sri Lanka in 1980s[38]. *Physalia physalis* is highly hazardous to humans[39-41]; but *P. porpita* has a poor stinging ability[42] akin to *V. velella*, and so far, there is no case report on *P. porpita* or *V. velella* envenomation in Sri Lanka. According to our observations, *P. physalis* is the most dangerous gelatinous stinger that occurs in Sri Lankan waters, as a few fatality cases have been reported due to *P. physalis* envenomation among Sri Lankan fishers (*personal communication with coastal fishers*). Meanwhile, this severe stinger was reported to adversely affect the coastal tourism sector due to its potential of creating serious health issues, threatening coastal livelihood, especially during the main monsoon periods of Sri Lanka (*personal communication with coastal lifeguards and hotel owners*). However, *P. physalis* can be used for many applications in medicinal and pharmaceutical experiments (see Diaz-Garcia *et al*.[43]; Edwards & Hessinger[44]), because it has both low and high

molecular mass toxins with neurotoxic and hemolytic effects[44]. Moreover, there are some antimicrobial activities of bioactive compounds extracted from *P. porpita*[45]. Likewise, as pleustonic colonies of cnidarians are annually getting stranded in bulks along the coasts of Sri Lanka, they could be effectively utilized for different aspects, instead of turning them into wastes. The taxonomic and spatio-temporal data presented here may be helpful for further studies or formulating managerial recommendations to minimize their impact on coastal tourism and fisheries.

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Conflict of Interest

No competing or conflict of interest.

Authors Contribution

Sampling, Photographing, Taxonomic identification, Data analysis & Drafting the manuscript: KDK; supervising the entire study, securing the grant, reviewing and editing the initial draft: MDSTdeC.

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