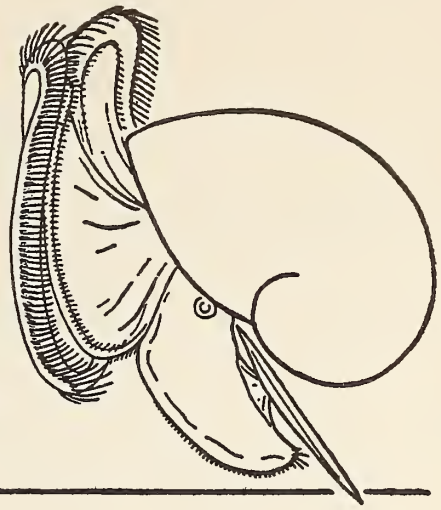
THE VELIGER



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Observations on Beach Strandings of the *Physalia* (Portuguese-Man-of-War) Community [1]

BY

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(1 Text figure)

INTRODUCTION

Physalia physalis (Linnaeus, 1758), the Portuguese man-of-war, is often associated with a number of other species. These may include the coelenterates *Velella velella* (Linnaeus, 1758), the by-the-wind sailor; and *Porpita umbella* (Müller, 1776); 5 species of purple snails of the genus *Ianthina*: *I. janthina* (Linnaeus, 1758); *I. pallida* Thompson, 1841; *I. prolongata* Blainville, 1822; *I. umbilicata* d'Orbigny, 1840; *I. exigua* Lamarck, 1816; the non-shelled snails *Glaucus marinus* (DuPont, 1763) and *Fiona pinnata* (Eschscholtz, 1831); and *Nomeus gronovii* (Gmelin, 1791), the man-of-war fish. A community (an assemblage of animals that is normally found together), is indicated. The community has not been studied *in vivo* and few observations of behavioral relationships have been noted at sea or in the laboratory. Such a scarcity of information is certainly due in part to the ephemeral nature of the community and the invariably unpleasant consequences of close contact with it. Until the community can be intently observed at sea, we can only try to understand its makeup and interactions by putting to good use the occasional strandings of the community on our beaches.

A word of caution is in order for those who may work with this assemblage. *Physalia* is a difficult animal to work with, as a sensitivity to its toxins is quickly developed even if careful handling techniques are used. Dr. C. E. Lane and his group had to terminate their valuable investigations into the toxins of *P. physalis* for this reason (LANE, 1960, 1967; LARSON & LANE, 1970). One of us (F. O. B.) became so sensitive to the presence of *P. physalis* near the end of this study that he experienced headache, inflammation of the eyes, copious mucus production in the nasal and sinus areas and general discomfort during collecting and measuring sessions even though thick rubber gloves were worn. All of the authors agreed that it would be prudent to terminate this study at the end of one stranding season.

The data presented here represent the species, their sizes and numbers seen in 10 strandings of the *Physalia* community which occurred on the Crandon Park Beach at Key Biscayne, Florida (25°43′N; 80°10′W) during the winter of 1971-1972.

METHODS

The beach at Crandon Park was checked daily for strandings of the *Physalia* community from October, 1971 through October, 1972. All specimens of species belonging to the community were collected from a section of the beach the length of which depended on the magnitude of the stranding. When less than 60 *Physalia* were collected, a light stranding is indicated. When more than 60 *Physalia* were collected, the number usually depended on the length of time available at the laboratory that day for processing the collection.

Strandings of sufficient proportions for analysis were collected on 10 occasions during the period December 6, 1971 to April 11, 1972. Upon collection, specimens were brought directly to the laboratory, sorted to species, counted and measured to the nearest millimeter. The coelenterates and *Glaucus marinus* were measured by placing them lengthwise on a meter stick. The shelled gastropods were measured at their largest shell diameter with vernier calipers.

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The length of the float of *Physalia physalis* was measured. Measurement of the float cannot be extremely accurate because of its great flexibility. The length of the skeleton of *Velella velella* was used in its measurement. The diameter of the skeleton of *Porpita umbella* was used.

Each stranding was studied for possible relationships indicated by concurrent occurrence and numerical ratios.

Local weather conditions associated with the strandings were analysed.

Three species of young sea turtles were fed on *Physalia* and their reactions noted.

Several strandings of a few individuals of the community occurred a day or two after the major strandings. The animals in such strandings were not collected as they were thought to be remnants of the previously measured stranding.

HYDROGRAPHIC AND WEATHER CONDITIONS LEADING TO STRANDINGS

Kennedy (1972) recently reported on a study of the distribution of *Physalia physalis* conducted by airplane. Monthly observations from low altitude flights over the offshore waters of Florida, Alabama, and the Caribbean Sea made evident the presence of *P. physalis* in at least small numbers the year round throughout the area. Sightings were most consistent in the Yucatan Channel and the Straits of Florida; but by far the largest aggregations were seen in the northern Gulf of Mexico some 160 km south of Panama City, Florida.

Current patterns derived from drift bottles released at points south of the Yucatan Channel (Brucks, 1971) indicate a fairly even division of surface waters flowing northward through the Channel with the western half continuing northward to the northern Gulf of Mexico and the eastern half turning eastward through the straits of Florida.

The animals that are taken into the Gulf of Mexico evidently become concentrated in density of specimens per unit area by gyres or reproduction in the northern Gulf, or both. The northeasterly winds of the winter season apparently move many of the animals into areas where they may be swept southward into the Straits of Florida.

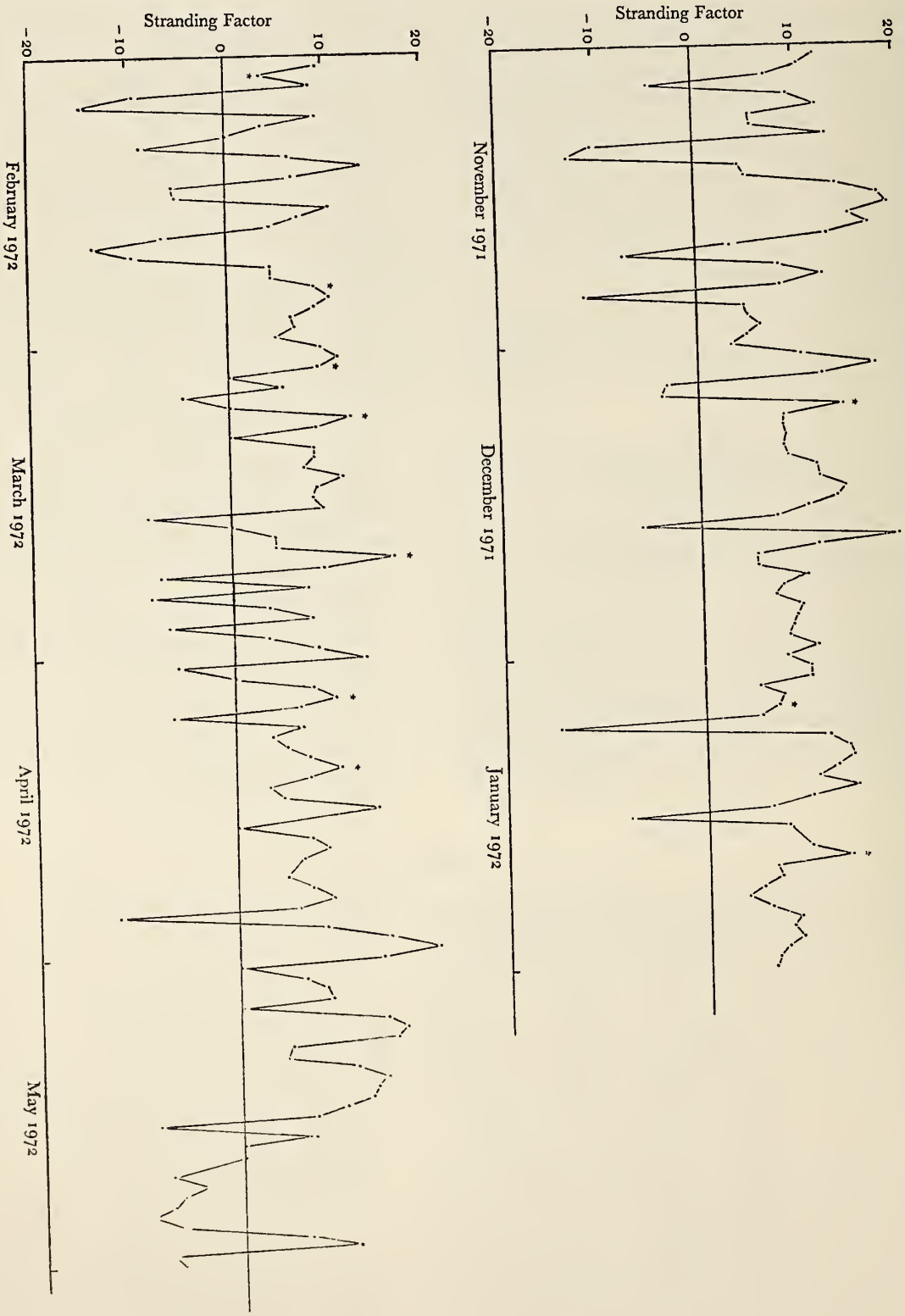
Strandings of the *Physalia* community along the southeast coast of Florida are generally known to occur after several days of strong easterly and southeasterly winds. Local wind speeds and directions in Miami were analysed for a "stranding factor" as a precondition needed to produce a stranding.

The daily average wind speed was multiplied by the sine of the angle between the daily average wind direction and southeast. Winds from the northwest semicircle were multiplied by a negative sine factor. The data were put in graphic form and the dates of strandings superimposed. It may be taken from Figure 1, which presents these data, that strandings are strongly correlated with a stranding

Table 1

Percent of animals of each species that occurred in the various strandings

Date	*Physalia physalis*	*Velella velella*	*Physalia umbella*	*Ianthina janthina*	*Ianthina pallida*	*Ianthina prolongata*	*Ianthina umbilicata*	*Glaucus marinus*
Dec. 6, 1971	94	0	0	6	0	0	0	0
Jan. 5, 1972	100	0	0	0	0	0	0	0
Jan. 20, 1972	99	0	0	1	0	0	0	0
Feb. 2, 1972	100	0	0	0	0	0	0	0
Feb. 23, 1972	41	30	8	1	16	2	1	2
Mar. 2, 1972	89	5	0	5	2	0	0	0
Mar. 7, 1972	70	14	3	1	1	0	6	4
Mar. 21, 1972	52	2	2	1	0	2	0	42
Apr. 4, 1972	8	91	1	0	0	0	0	0
Apr. 11, 1972	80	20	0	0	0	0	0	0


Stranding Factor
-20
-10
0
10
20
November 1971
December 1971
January 1972
February 1972
March 1972
April 1972
May 1972

factor as explained above. Since such a stranding factor is evident both before and after the local *Physalia* season, there is an indication that the animals may not be available for stranding except during a certain part of the year. The absence of a stranding on such dates as December 15 and January 13 indicates that there may not be a continuous movement of the community past the shores of southeast Florida during the *Physalia* season.

RESULTS

On 10 occasions during the period December 6, 1971 to April 11, 1972, specimens of the *Physalia* community were collected from the shoreline at Crandon Park, Key Biscayne, Florida. Three species of coelenterates, *Physalia physalis, Velella velella, Porpita umbella*; and 5 species of gastropod mollusks, *Ianthina janthina, I. pallida, I. prolongata, I. umbilicata,* and *Glaucus marinus* were seen.

Table 1 presents the stranding dates and the percentage of each stranding that each species constituted. It may be taken from Table 1 that during the first part of the season only *Physalia physalis* and *Ianthina janthina* occurred, and that during February and March the greatest number of species was represented. During the last month of the season only the coelenterates were represented in the strandings.

The various snails evidently feed mostly on the coelenterates but it is not known in most cases which species of coelenterate is eaten or is preferred by each species of snail. The *Ianthina* feeding on a *Porpita* figured by Gunapati & Rao (1959) appears to be either *I. pallida* or *I. umbilicata* to Bayer (1963). Halstead (1965) notes that *Glaucus marinus* actively feeds on the nematocysts of *Physalia* and subsequently uses them in its own defense. Bayer (*op. cit.*) observed *I. janthina* feeding on specimens of *P. physalis* and *Velella velella* as well as *I. pallida*. Laursen (1953) found the radular apparatus of *I. janthina* in another specimen of the same species.

The appearance of only *Physalia physalis* and *Ianthina janthina* in 2 strandings suggests that *I. janthina* is a predator of *P. physalis*; *I. prolongata, I. umbilicata,* and *Glaucus marinus* were seen only in strandings which contained *Velella velella* and *Porpita umbella. Ianthina pallida* occurred only in strandings which contained *V. velella.* The *V. velella* collected during the stranding of February 23 were being heavily preyed on by *I. pallida* with some 39% of the specimens bearing attached snails. The relatively large number of *G. marinus* seen on March 21 indicates that this animal feeds on *P. physalis*. The gastropod mollusk *Fiona pinnata*, which is known to occur with this assemblage at times (Bayer, 1963), was not collected. *Nomeus gronovii,* the man-of-war fish, was not involved in the strandings as they desert the *P. physalis* shortly before the jellyfish are washed ashore (Baskin, 1965). The great variability seen in the species composition of the strandings indicates that the community has a very loose structure with most or all relationships being on the predator-prey level.

Each species was analysed for a trend in size through the season. Only *Physalia physalis* exhibited an obvious trend, that being from small to large as the season progressed (Table 2).

DISCUSSION

Members of the *Physalia* community are often seen at sea but, with few exceptions, have not been closely observed in their natural habitat. Woodcock (1944) has observed the sailing performance of apparently left sailing and

(← on facing page)

Figure 1

The stranding factor for *Physalia physalis* in the Miami area during the *Physalia* season of 1971-1972. Dates of strandings are marked with an asterisk (*). Factor computation is explained in the text

Table 2

Size of *Physalia physalis* during the *Physalia* season of 1971 - 1972

Date	Number of Specimens	Float length (mm) Mode	Mean	Median	Specimens over 100 mm in length (%)
Dec. 6, 1971	64	11 - 20	30	25	0
Jan. 5, 1972	61	21 - 30	27	24	2
Jan. 20, 1972	67	21 - 30	32	30	0
Feb. 2, 1972	62	31 - 40	35	34	0
Feb. 23, 1972	98	11 - 20	25	22	1
Mar. 2, 1972	57	41 - 50	69	59	16
Mar. 7, 1972	50	31 - 40	48	38	10
Mar. 21, 1972	68	51 - 60	54	53	6
Apr. 4, 1972	44	61 - 70	78	79	16
Apr. 11, 1972	44	31 - 40	60	46	25

right sailing dimorphic forms of *P. physalis* and has studied the animals' float-dipping behavior (1971). He has, as well, noted that small *Physalia* sail much more slowly than large *Physalia* (1956) and that "during calm weather the tentacles may extend many meters below the sea surface, but when driven along by even a moderate wind, these tentacles stream out behind the float with only a few centimeters of vertical extension" (1944).

The *Physalia* community is quite possibly a major food source of several species of sea turtles. True (1884) noted that *Eretmochelys imbricata imbricata* Linnaeus, the Atlantic Hawksbill Turtle, eats the Portuguese man-of-war. The Atlantic Loggerhead Turtle, *Caretta caretta caretta* Linnaeus, has also been seen eating *Physalia* (Carr, 1952).

We introduced *Physalia physalis* into tanks holding young specimens of 3 species of sea turtles: *Caretta c. caretta; Chelonia mydos mydos* Linnaeus, the Atlantic Green Turtle; and *Dermochelys coriacea coriacea* Linnaeus, the Atlantic Leatherback Turtle. All 3 species actively attacked and ate the coelenterates with no apparent ill effects.

As mentioned previously, the coelenterates of the *Physalia* community provide food for the other members of the community, including all the species of *Ianthina* studied here and *Glaucus*. Also Baskin (1965) observed *Nomeus gronovii* eating the tentacles of *P. physalis* and found the coelenterates' tissues in the fishes' gut.

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