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Salpivory by Colonial Reef Corals at Curaçao, Southern Caribbean

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Abstract: A salp swarm was observed in Director's Bay, Curaçao in July 2021, where salps were caught and consumed by three scleractinian colonial reef corals: Madracis auretenra, Locke, Weil & Coates, 2017; Meandrina meandrites (Linnaeus, 1758), and Montastraea cavernosa (Linnaeus, 1767). The first two scleractinians are newly recorded salpivores. Since the coral polyps were collaborating, predation was not restricted by polyp size. This is the first detailed report on salpivorous corals in the Caribbean.

Keywords: polyp collaboration; Salpidae; salpivores; salpivorous; salp swarm

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Salps (Phylum Tunicata, Family Salpidae) are transparent, gelatinous zooplankton that may occur in large densities (swarms) in the open ocean, where they form a food source for a variety of predators. Most salpivores are fishes, but other pelagic animals (e.g., heteropod snails) and penguins have also been reported to eat salps [1–3]. Salps may be accessible to benthic predators after they reach the bottom through currents and vertical migration [4,5]. When they die and sink to the ocean floor, their dead bodies may also be eaten by benthos [6]. It is only recently that detailed information has started to become available on corals (Phylum Cnidaria, Class Anthozoa) as salp predators [5,7,8].

These salpivorous corals include reef-dwelling scleractinians [5,8], which implies that salps ingested by stony corals contribute to the food web of coral reefs. Since salps are relatively large planktonic animals (either as solitary zooids or colonial, fusiform ones) and most of the observed predatory corals had big mouths (>1 cm wide), the capability to eat salps was linked to the predator's large gape [5,8]. This is consistent with observations of large-mouthed solitary corals and sea anemones eating jellyfish, which are also large gelatinous plankton [9,10]. Based on observations in the Mediterranean, however, it is known that the colonial scleractinians *Phyllangia americana* and *Astroides calycularis*, both with relatively small mouths (<1 cm wide), are also able to catch and consume jellyfish [11,12]. Interestingly, in the latter coral species, the polyps were observed to cooperate in order to catch large prey [12].

So far, only limited information is available on Caribbean reef coral species preying on large gelatinous plankton, and to our knowledge there is no photographic evidence available for this. In Panama (southwestern Caribbean), the massive scleractinian *Montastraea cavernosa* was observed to eat salps [13], whereas in Curaçao (Southern Caribbean), the foliose scleractinian *Agaricia agaricites* was observed to act as a salpivore (R.P.M. Bak, pers. comm.). Both coral species are colonial and prominent reef builders and widespread and common in the tropical West Atlantic.

During recent surveys at Curaçao (10 July 2021), one of us (LJVtH) observed a salp swarm in Director's Bay (12°03′59″ N, 68°51′38″ W) at depths of 5–10 m, where they were

wave-swept or swimming slowly and aggregating near the sea floor (Video footage as Supplementary Material). The timing is consistent with February–August as the usual period of salp swarms off the southwestern part of the USA [14]. The salps are translucent in water and the in situ photographs reveal very little about the morphological characters that are used to distinguish salp taxa (Figure 1a,b). Since several salp species are known to occur in the Caribbean [15], it is impossible to identify the animals accurately and therefore it is most reliable to refer to them as Salpidae sp. It is noteworthy, though, that one salp species in particular, the widespread *Salpa fusiformis*, has been reported in Curaçao [16].

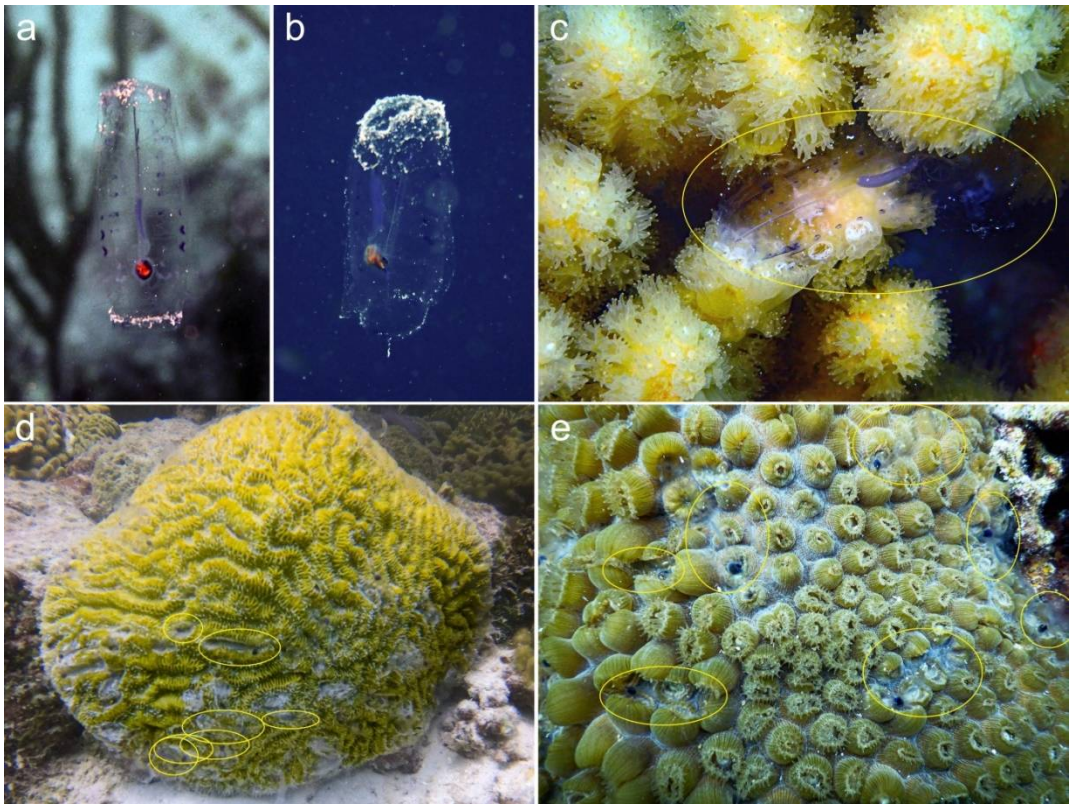

Figure 1. Salpivory by scleractinian corals at the coral reef in Director's Bay, Curaçao. (**a**,**b**) Solitary zooids of Salpidae sp. above the reef; test length: ca. 5 cm. (**c**) A salp (marked by yellow ellipse) trapped by several polyps in a branching colony of *Madracis auretenra*. (**d**) A large number of salps (some marked by yellow ellipses) caught by a massive coral colony of *Meandrina meandrites*. (**e**) A few salps (yellow ellipses) captured by a massive colony of *Montastraea cavernosa.* Photo credits: (**a**,**b**): Jason Baer; (**c**): LJVtH; (**d**): Mark Little; (**e**): Antoni Luque.

Three common reef-dwelling scleractinians had their tentacles extended in the daytime, trying to catch the salps: *Madracis auretenra*, *Meandrina meandrites*, and *Montastraea cavernosa* (Figure 1c–e). The latter was also reported earlier [13], but the first two were newly recorded as salpivores. The bodies of the salps that were captured by the coral polyps showed signs of early decomposition (Figure 1d,e), a process that we assume to be associated with ingestion. When polyp size is taken into account, the branching *Madracis auretenra* is the most remarkable, because its polyps are very small (ca. 0.3 cm wide when extended), whereas those of the other species are larger, with *M. cavernosa* reported as having extended polyps that are ca. 1.3 cm in diameter [17].

The present observations include new results: (1) two scleractinian species were newly recorded as salpivores (*Madracis auretenra* and *Meandrina meandrites*); (2) since salp swarms occur frequently, salpivory by reef corals is probably more common and widespread than previously assumed; (3) large coral colonies are able to catch and digest several salp zooids simultaneously (Figure 1d,e), in contrast to solitary corals that can capture one or two zooids at a time [5,8]; and (4) predation on salps does not appear to be limited by polyp

size. Although *Madracis auretenra* with small polyps was supposed to be more selective in its diet by preying on smaller copepods than *Montastraea cavernosa* with large polyps [17], a restriction by polyp size does not appear to apply to salpivory.

In conclusion, both solitary and colonial corals can be salpivorous and since salp swarms appear to be occurring frequently on reefs, it is probably just a matter of time before additional new records of salpivorous coral species will be added. Furthermore, aquarium experiments may help to study the timing of capture and ingestion of salps by corals more precisely, since it is not always clear whether corals eat large prey entirely or whether they expel some parts [18]. Moreover, some large prey species (such as sea slugs) are preferred over others and consumed more quickly by corals than others [19], which indicates that more studies should be done on the ingestion of large gelatinous plankton by corals [5,7–9,11–13]. This plankton should also include ctenophores, which are also gelatinous but so far have not been reported as prey of corals.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/d13110560/s1, Video footage (two clips) of a salp swarm on the reef of Director's Bay, Curaçao.

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