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First In Situ Observation of Sperm Release in *Corynactis carnea* (Anthozoa: Corallimorpharia) from Patagonia, Argentina

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Abstract: Jewel sea anemones constitute a relatively small group of solitary cnidarians, a sister group of scleractinian corals. In the southwest Atlantic Ocean off Argentina, two species of jewel sea anemones have been found: *Corynactis carnea* and *Corallimorphus rigidus*. *Corynactis carnea* is a common and abundant species in shallow water of northern Atlantic Patagonia, but reproductive data on this species is scarce; the species is known to reproduce asexually. During a SCUBA diving survey in an Atlantic rocky reefs (20 m depth) in Patagonia, we observed for the first time specimens of *C. carnea* releasing sperm, eight days after the full moon and during the summer season while spawning has been previously observed in at least three species of *Corynactis*, but all were recorded as occurring in winter.

Keywords: reproduction; rocky reefs; jewel sea anemones; cnidaria

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Jewel sea anemones (Cnidaria: Corallimorpharia) constitute a relatively small group of cnidarians, including nearly 50 valid species [1]. Meanwhile, scleractinian corals (Scleractinia) and sea anemones (Actiniaria) have over 1300 and 1200, respectively [2]. Similar to sea anemones, they are solitary and lack a skeleton, but the presence of acrospheres (globular ends of tentacles with numerous nematocysts), their internal morphology (absence of basilar muscle and a weak mesenterial musculature) and cnidom are more analogous to scleractinian corals [3–6]. The phylogenetic position of corallimorpharians among anthozoans has been debated [2], although recent molecular studies have shown that corallimorpharians and scleractinian corals are sister groups [7].

Both sexual and asexual reproductive aspects of jewel sea anemones have been reported for few species. Sexual reproduction involves the release of the gametes into the water, where polyps can be either male or female, although sex change of a particular polyp is possible [8]. Asexual reproduction includes pedal laceration, budding and longitudinal fission, resulting in the formation of a large aggregation of specimens [9].

Corallimorpharians are not a diverse group in the southwestern Atlantic Ocean off Argentina. To date, only two species of jewel sea anemones have been reported from the area: *Corallimorphus rigidus* and *Corynactis carnea* [1]. *Corynactis carnea* is a common and locally abundant species that inhabits the shallow waters of northern Atlantic Patagonia and the deeper water off Buenos Aires province (to 199 m) [1]. In the Atlantic Patagonian rocky reefs, *C. carnea* can be locally dominant; Bravo et al. [10] measured the percent coverage of *C. carnea* in four distinctive rock inclinations (horizontal, vertical, overhang and cave floor) and found that this species is dominant in the overhanging surfaces with a mean cover of 61.4%. Corallimorpharians are known to compete with other invertebrates for space (e.g., scleractinian corals) [11], but no data regarding competition are available for

this species so far, and no scleractinian corals are known from the area in shallow waters (unpublished data).

Corynactis carnea is a small (usually less than 15 mm in polyp height and about 10 mm of oral disc diameter in vivo) and eye-catching species, as it usually displays bright fluorescent colors (yellow, green, orange, pink, and white). It is commonly known to reproduce asexually by longitudinal fission, and thus it is possible to observe many individuals displaying the same color, known as clones (see Figure 1). Although they can look similar as a colony, a physiological integration does not exist [12]. Available data regarding the sexual reproduction of this species is scarce, with only a few mentions of the presence of gametes in taxonomic works (e.g., [1,13]). Here, we report for the first time an in situ observation of sperm release in *C. carnea* in the shallow waters of Atlantic Patagonia (Argentina).

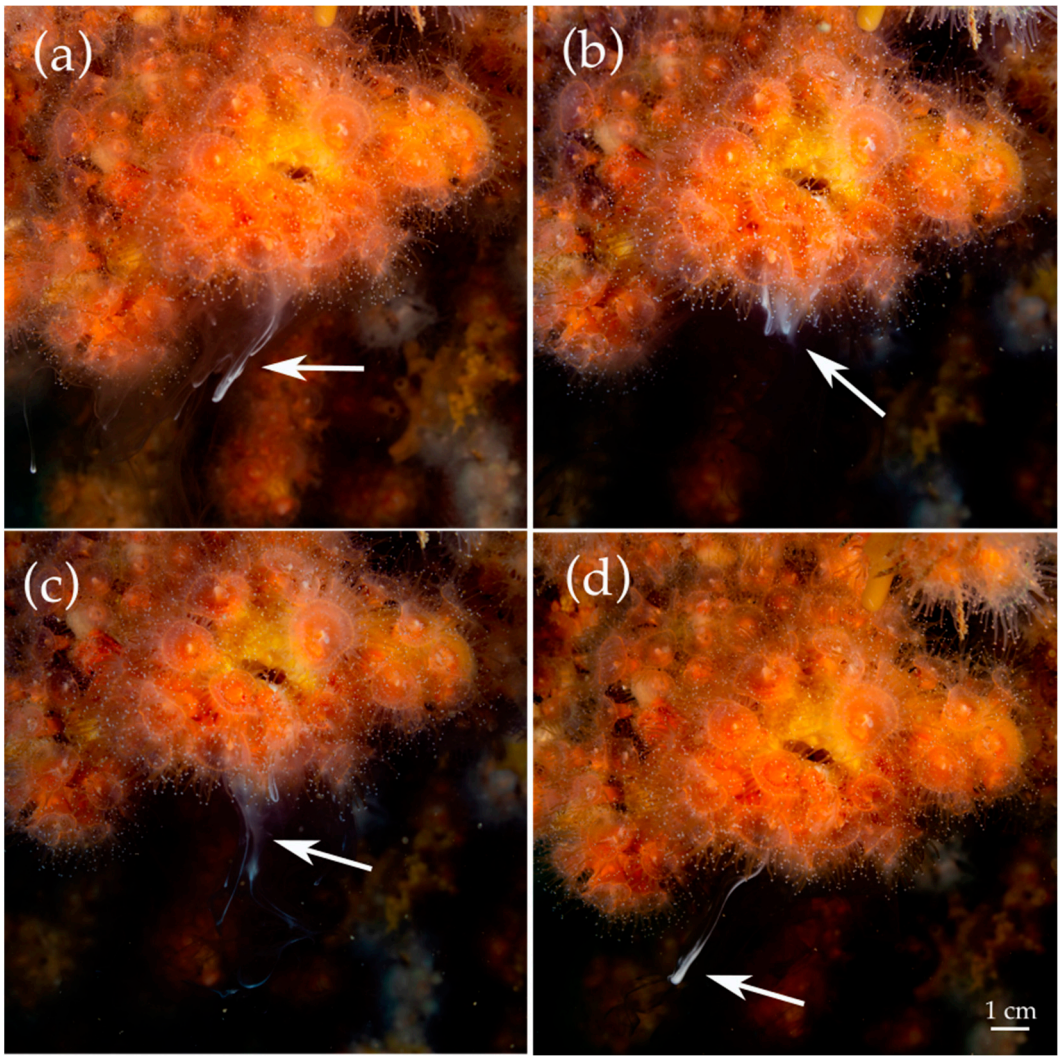

Figure 1. Sperm release by *Corynactis carnea*. The sequence (**a**–**d**) shows a group of specimens with at least one male releasing a dense cloud of sperm into the water. The arrow points to the cloud of sperm in each image.

On 5 February 2021 at 09:21 a.m., a SCUBA diving survey in a rocky reef located in the Natural Protected Area Península Valdés (at 20 m depth) in Punta Pardelas, Chubut, Atlantic Patagonia (42°38′27.3715″ S; 64°14′43.927″ W) was performed. The sampling site was inside the semi protected Nuevo gulf where water currents are likely to be associated with tidal influence and are around 10–20 cm/s [14] (mean tidal amplitude of 3.8 m and spring tides of up to 5.73 m). Average surface seawater temperatures range from 8 °C to

22 °C [15]. The specimens were observed, photographed and filmed with a Canon 100D (Canon, Taiwan, China) and two Ikelite DS-161 external flashes in situ. No specimens were collected, but D.L. has previously identified *C. carnea* specimens from the area based on the general morphology of the polyps, internal features and cnidae (see [1]).

During the survey, several groups of uniformly colored *C. carnea* were detected. One of the groups was found to be releasing sperm into the water. On close inspection of the group, at least two specimens were detected releasing the sperm (Figure 1, Video Footage S1). None of the other specimens in the nearby group were observed releasing gametes. This occurred during austral summer (water temperature 16 °C), eight days after the full moon.

Spawning has been previously observed in at least three species of *Corynactis*, but all were recorded as occurring in winter. In Pacific Patagonia (Chile) at a similar latitude, *Corynactis* sp. broadcast female and male gametes, exactly eight days after the full moon, coinciding with our observations [16] but in the winter season. *Corynactis californica* (USA) and *C. australis* (New Zealand) also reproduce sexually during winter time [16,17]. This is the first report of broadcast spawning for a *Corynactis* species during the summer time for the South Atlantic. These observations raise questions and new hypotheses to explain the differences in the gametogenic cycles of *Corynactis* spp. on both sides of the American continent within an evolutionary context.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/d15020287/s1, Video S1: Sperm release by *Corynactis carnea*.

Author Contributions: G.B. (Gonzalo Bravo) observed, filmed and photographed the specimens in situ. D.L., G.B. (Gonzalo Bravo), P.P. and G.B. (Gregorio Bigatti) analyzed the data and wrote the manuscript. D.L. prepared the figures. All authors have read and agreed to the published version of the manuscript.

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