Population and individual dynamics of *Clathrina aurea* (Calcarea)

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The species

Clathrina aurea Solé-Cava *et al.*, 1991 (Figure 1) is a calcareous sponge endemic and abundant in the Brazilian coast. It has an amorphous body with loosely anastomosed tubes and is found in a patchy distribution on sciaphilous environments. The reproduction of the species was already studied for 18 months, but no embryos or larvae were found.

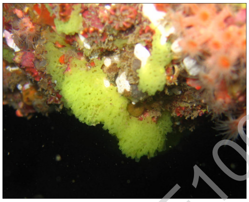

Figure 1: *Clathrina aurea* Solé-Cava *et al.*, 1991.

Why?

Sponges can assexually fragment their bodies and this capacity may be influenced by, for example, the species growth form (Wulff, 1991) . Fragmentation and fusion cycles are common in *Clathrina* species (Johnson, 1978; Gaino *et al.*, 1991; 1996), but there is no information about the importance of these events in the shape of the population and the fate of the results of each event. Also, very few is known about the individual dynamics of calcareous sponges, such as: growth rates, age and their annual cycles. The species is also able to maintain the connectivity between distant populations (Padua, 2011), although larvae has never been found (Lanna, 2010).

In the present work, we aimed to study the influence of asexual events in shaping the population of this species. We also follow the population dynamics (abundance, age of individuals, recruitment and mortality rates).

Where?

The present work was undertaken at the entrance of a small cave on the rocky shore of Papagaios Island, Cabo Frio (22º52'46''S, 42º01'07''W), Rio de Janeiro state, Southeastern Brazil (Figure 2).

How?

An area of 400cm2 was photographed and sampled for DNA analysis monthly for 16 months (from May 2012 to August 2013). We analysed the abundance of individuals, recruitment and mortality rates, age, growth rates and fragmentation and fusion events.

Fragments taken from the individuals were genotyped for six microsatellite *loci* previously described for this species (Padua *et al.,* 2013a). With the genotypes it was possible to verify if fusion events occured only between clones, how was the contribution of assexual reproduction and if individuals that seemed to disappear could appear again at the same place.

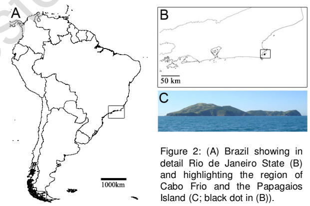

Figure 2: (A) Brazil showing in detail Rio de Janeiro State (B) and highlighting the region of Cabo Frio and the Papagaios Island (C; black dot in (B)).

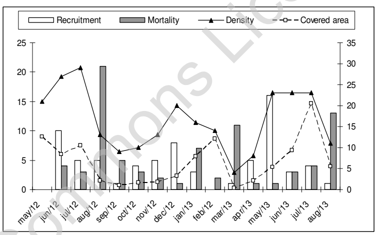

Figure 4: Recruitment, mortality,density and covered area of *C. aurea* in each of the 16 months of the present study.

And...

During the 16 months of the study, the fate of 92 individuals was followed (Figure 3). Density was significantly correlated with recruitment ($p=0.0001$) and covered area ($p=0.0002$) (Figure 4). Individuals lived 2.7 (±1.9) months in average, varying between one and 11 months. With frequent events of body expansion and retraction, size varied considerably. While some individuals decreased up to 92% (-0.11 cm2/month), others increased up to 2500% (0.51cm2/month).

Few events of fusion (4) and fragmentation (4) were observed. Only individuals with the same genotype fused. When individuals of different genotypes touched, they did not fuse (1). This rejection took around two months. The genotype of some individuals was followed up to eight months, and did not change over time. Only few clones were observed (around 10% of the individuals) and they were always very near (around 1cm from each other). With the genotyping, we confirmed that individuals can retract until only some cells are left, and after appear again in the same place. A total of 31 individuals was genotyped and 43.8% (32 of 73) of the alleles detected have already been found in Cabo Frio (Padua *et al.*, 2013a). Only six alleles (five in loci Cau_A7 and one in Cau_D8) were never seen before in the population.

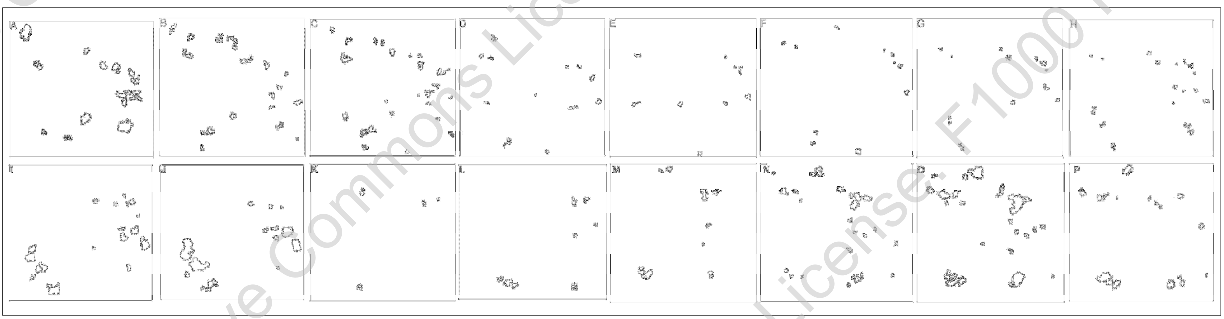

Figure 3: Individual dynamics over the studied period (400 cm2). (A) may/2012; (B) june/2012; (C) july/2012; (D) august/2012; (E) september/2012; (F) october/2012; (G) november/2012; (H) december/2012; (I) january/2013; (J) february/2013; (K) march/2013; (L) april/2013, (M) may/2013; (N) june/2013; (O) july/2013; (P) august/2013.

So what?

Clathrina aurea was more abundant between May and July, while in August and March it suffered a great mortality (Figure 4). Like another calcareous sponge in Rio de Janeiro, *Paraleucilla magna,* (Padua *et al.*, 2013b), *C. aurea* recruited continuously and presented events of body size increase and reduction and high mortality (Cavalcanti *et al.*, 2013). Differently of demosponge species that have long lives (*e.g. Xestospongia muta;* up to 2,300 years; McMurray *et al.*, 2008), *C. aurea* lived only 2.7 months in average. Clonality, fusion and fragmentation events were rare. The positive correlation of densitty and recruitment and the appearance of new alleles in the population, suggest that the main proccess shapping the population is sexual reproduction, eventhough we have never found individuals with gametes and larvae.

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