



**Distribution of the anemone shrimp
Periclimenes sagittifer in Maseline
Harbour, Sark**

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Background

Shrimps of the genus *Periclimenes* are familiar to many divers from tropical waters, often living associated with anemones, corals, holothurians, nudibranchs and other invertebrates. However, some species are found in more temperate waters, such as *Periclimenes sagittifer*, whose range extends from the Straits of Gibraltar through to the English Channel. Until recently this species had only been recorded on the French coast of the Channel and in the Channel Islands, although a small population was discovered in 2007 at Swanage Pier in Dorset by Seasearch divers and was surveyed by volunteers in 2008 [Whyte and Doggett, 2009]. A population is also known to be present on Sark.

P. sagittifer is found associated with the snakelocks anemone, *Anemonia viridis*. This anemone is usually bright green with purple tips to the tentacles when found in shallow, brightly lit waters, although can also be a more dull grey colour in darker and more turbid waters. The anemone plays host to unicellular green algae that live within its tissues. These algae (dinoflagellates from the genus *Symbiodinium*) provide the anemone with a carbon source as a result of their photosynthetic activity, and in return the anemone provides the algae with a source of nitrogen, phosphate and protection. The green coloration of the anemone can be lost if an individual is removed to the lower-light conditions of an aquarium, due to loss of the symbiont or reduced photosynthetic pigment. *A. viridis* has a strong muscular foot and is capable of movement, albeit slow. It reproduces largely by binary fission, and based on data for other anemone species is likely to be a long-lived species (there are records of aquarium anemones living for several decades). It is found throughout the United Kingdom, predominantly on the western coast, as far north as Scotland.

P. sagittifer is presumed to benefit from protection from predation within the tentacles of the anemone. However, it is unclear whether *A. viridis* derives any benefit in return, such as being cleaned by the shrimp. In fact, in addition to feeding upon food caught by the anemone, *P. sagittifer* has been reported to feed on the tips of the

anemone. The relationship thus appears to be of a more parasitic nature (see discussion in Caldo *et al.* 2007).

A. viridis has sticky tentacles with a powerful sting that it can use to catch small fish, which raises the interesting question as to why *P. sagittifer* is not stung and caught by the anemone. Some insight has been gained by studies of the interaction between *A. viridis* and crabs of the genus *Inachus*, to which it also plays host (Melzer and Meyer, 2010). *Inachus* can be found not associated with anemones, which has enabled studies where individual crabs that have not been associated with an anemone are presented to *A. viridis*. Such anemone-naïve crabs were stung, whereas the anemone did not react to crabs that had been taken from another anemone. This indicates that prior exposure to the anemone results in some form of habituation, leading to the anemone no longer recognizing the crab. The exact mechanism of this habituation is unclear, but may involve transfer of mucus to the surface of the crab (based on the familiar clown anemone fish example), and the protection from stinging can be removed by wiping the surface of the crab with an organic solvent (Weinbauer *et al.*, 1982). Similar experiments have not been reported for *P. sagittifer* due to the difficulty in obtaining anemone-naïve individuals.

In other surveys of *P. sagittifer* they have been reported singly, or in heterosexual pairs (Caldo *et al.*, 2007). There are no records of same-sex pairs, or greater than two shrimps per anemone, although there are records of *P. sagittifer* sharing anemones with other species (eg *Inachus* sp.). This suggests that *P. sagittifer* actively fights off same-sex individuals, but is tolerant of other species (Caldo *et al.*, 2007).

Survey methodology and results

Seasearch divers undertook a survey of a known population of *P. sagittifer* in Maseline Harbour on 20th August 2010. This site is composed mainly of artificial substrata and discarded materials (see below), corresponding to JNCC Biotope IR.FIR.IFou (infralittoral fouling seaweed communities). The majority of the anemones were known to be associated with the harbour wall and adjacent seabed, and thus it was not feasible to give each pair of divers a different transect to survey. Instead, each pair undertook a survey stretching from the inner harbor wall to around the first corner. A variety of data was recorded for each anemone (Table 1).

Depth of anemone
Colour of anemone
Grey
Green with purple tips
Substratum
Rock
Kelp
Other
Number of *P. sagittifer* present
Number of *Inachus* sp. present

Table 1. Data recorded for each surveyed anemone

Due to the survey methodology some anemones will have been surveyed by more than one dive pair, and thus the data should be viewed as a population sampled with replacement, and proportional data are reported below. A total of 62 anemone records were produced, of which 8 contained one or more *P. sagittifer*.

Three major anemone habitats were recorded. Rock (including the harbour wall; 26% of the anemone records), kelp (typically on the upper surface of the algae so that the anemone is in a position to receive both sunlight and to catch prey; 61% of the records), and a discarded Avenue Bicycles bicycle, whose basket was home to three anemones including one occupied by a shrimp. Shrimps were found in anemones in all three habitats, at similar frequencies in anemones from each habitat. More extensive recording will be required to determine whether *P. sagittifer* has a preference for anemones attached to a particular substratum in this locale. Anemones were recorded between 7.6m and 11.2m depth, with shrimps recorded in anemones between 7.7m and 10.8m depth.

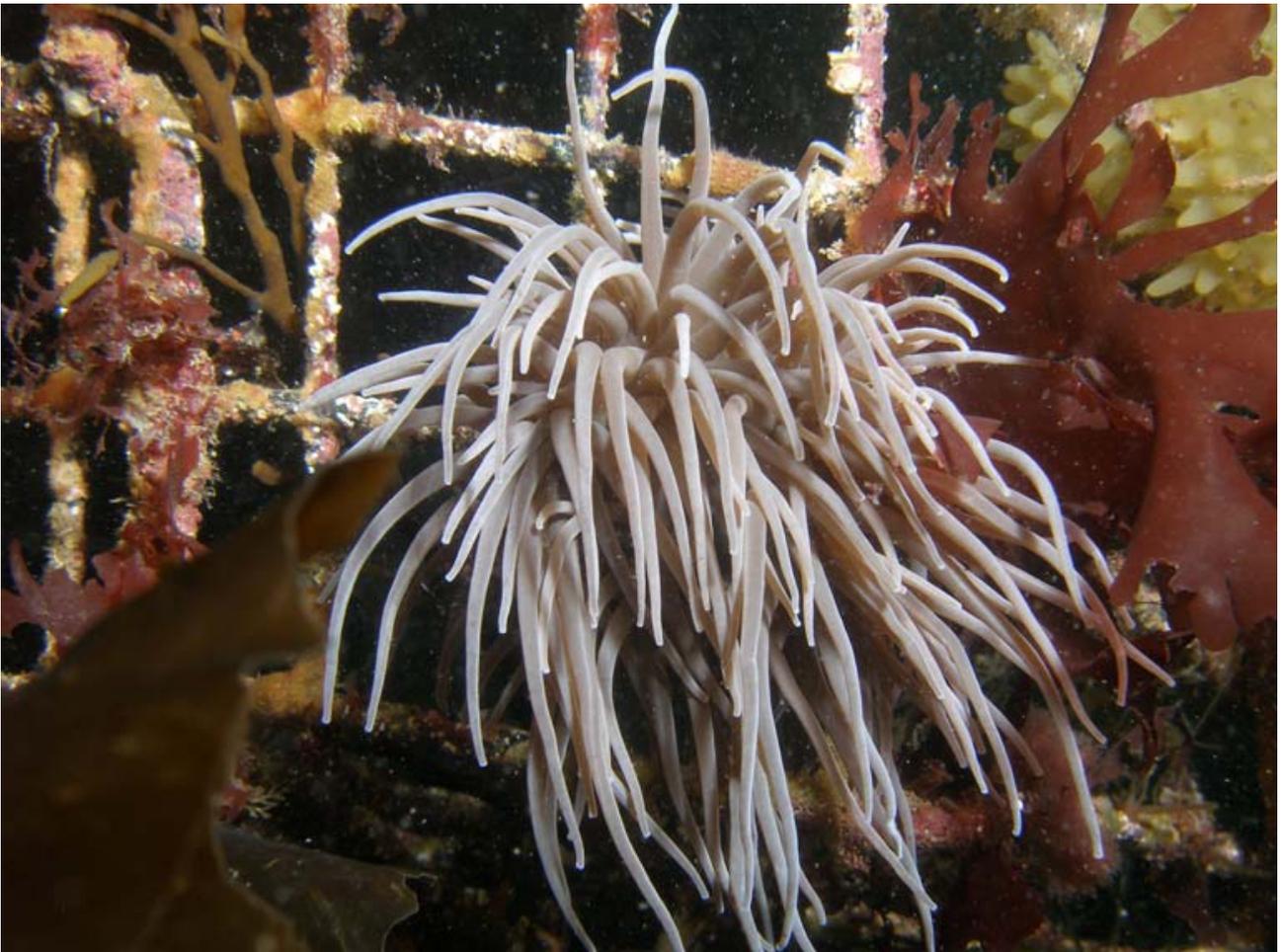


Figure. Grey anemone on bicycle basket

At this location the majority (89%) of the anemones were grey in coloration, reflecting light conditions at this locale (see above). 13% of the anemones were host to at least one *P. sagittifer*, and 32% of the anemones were host to one or more *Inachus* individuals. 5% of the anemones had two *Inachus* crabs present, but no attempt was made to determine if they were mated pairs. No examples of shrimp pairs were recorded in those anemones surveyed. Shrimps were found in both grey and green anemones, at frequencies similar to the relative proportions of the two anemone colour varieties.



Figure. *Green anemone on kelp*

Consistent with surveys of populations in Portugal (Caldo et al., 2007) and Swanage (Whyte and Doggett, 2009) examples were recorded of anemones that contained both *Inachus* and *P. sagittifer*. More extensive surveying will be required to determine whether there is any competition between these two species for hosts, but our data do indicate that the presence of *Inachus* does not prevent the co-occurrence of *P. sagittifer* in the same anemone.

Conclusions and discussion

The data collected from this survey are in broad agreement with studies on other populations with regard to anemone colour preference (Whyte and Doggett, 2009) and interaction with other decapods (Caldo et al., 2007; Whyte and Doggett, 2009). The Sark population of *P. sagittifer* in Maseline Harbour is present at much greater depth than that reported for Swanage Pier, where all the shrimp-occupied anemones were found between 3.0m and 3.4m depth (Whyte and Doggett, 2009). Although the shrimps do not show an absolute preference for anemones of a particular colour, habitat location or decapod occupancy, it is possible that these factors may play a quantitative effect on choice of anemone by the shrimp and thus influence the local population.

P. sagittifer is a highly photogenic species, and is found at only one site on the UK mainland. It is a unique and interesting species that attracts divers to Sark, and is used as an example of the rich and healthy marine life around Sark, which in turn is a major attraction of the island to tourists. Thus although too small to be of direct commercial value, *P. sagittifer* does provide economic benefit to Sark. Further study of this population of *P. sagittifer* would help produce a local action plan for the management and conservation of this important species.

More broadly, the population of *P. sagittifer* in Sark is of particular interest because it is at the extreme northern limit of its range, and thus would be expected to be particularly sensitive to long-term changes in ocean conditions (such as temperature). Its distribution is most likely restricted by water temperature, since its host anemone is found in abundance as far north as Scotland. As such, it could act as a 'sentinel' species with regard to climate-induced changes in species distribution. *P. sagittifer* is a striking and photogenic species, found in a familiar host anemone, and thus would make an attractive target for further Seasearch surveying and monitoring, particularly in the southwest. The population in Sark provides an opportunity to study the behaviour and ecology of this species when at the extreme limits of its geographical range.

Acknowledgements

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[http://www.seasearch.co.uk/downloads/Shrimp Survey Report Oct 08.pdf](http://www.seasearch.co.uk/downloads/Shrimp%20Survey%20Report%20Oct%2008.pdf)