BASTERIA, 50: 87-92, 1986

The Queen Scallop, Chlamys opercularis (L., 1758) (Bivalvia, Pectinidae), as a food item of the sea anemone Urticina eques (Gosse, 1860) (Actiniaria, Actiniidae)

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Scantly detailed knowledge is available about the food of sea anemones, but we do know that many species, especially intertidal forms, are opportunistic feeders on sizeable prey, such as other Coelenterata, Crustacea, Echinodermata and Mollusca, notably gastropods.

Representatives of the genus *Urticina* Ehrenberg, 1834 (= *Tealia* Gosse, 1858) occurring both intertidally and in moderate depths, are well-known as large prey predators (Slinn, 1961; Den Hartog, 1963; Sebens & Laakso, 1977; Shimek, 1981; Thomas, 1981). Slinn (loc. cit.) reported an incidental record of two actinians brought in by Port Erin scallop fishermen, identified as *Tealia felina* (L., 1761), but more likely to represent *Urticina eques* (Gosse, 1860), each of which had ingested an individual of the sea urchin *Echinus esculentus* L., 1758. Den Hartog (loc. cit.: 77-78) referring to the Dutch coast reported the starfish *Asterias rubens* L., 1758, to be the main food item of the shore-form of *Urticina felina* (L., 1761) [often referred to in the older literature as *Tealia coriacea* (Cuvier) or the var. *coriacea*; cf. Stephenson, 1935], including specimens considerably exceeding the basal diameter of the anemones. Second-common was the crab *Carcinus maenas* (L. 1758) (carapax width up to 30 mm) and further noteworthy is a record of a specimen of the rather rigid scyphozoan *Rhizostoma octopus* (L., 1788) [as *R. pulmo* (Macri, 1778)] with an umbrella almost twice the basal diameter of its swallower. Thomas (loc. cit.) presented a photograph made in situ at Point Lobos, California, of an *Urticina lofotensis*[1] (Danielssen, 1890) engulfing a sizeable starfish,

[1] The name *Urticina lofotensis* (Danielssen, 1890) is generally used sensu Carlgren (1902: 42; 1921: 168), who established that Danielssen's type series of *Madoniactis lofotensis* consisted of no less than three species, viz.: *Hormathia digitata* (O.F. Müller) (on which Danielssen's anatomical description was based), *Metridium senile* (L., 1761) and an *Urticina* species. Danielssen's morphological description was mainly based on the largest *Urticina* specimen, which was also depicted (cf. Danielssen, 1890: pl. 1 fig. 5), and Carlgren (loc. cit.: 42) therefore stated: "Ich sehe in dem grössten abgebildeten Exemplare den Typus der Art"; thus formally acting as the first reviser and designating this specimen as the lectotype of *Madoniactis lofotensis* Danielssen, 1890.

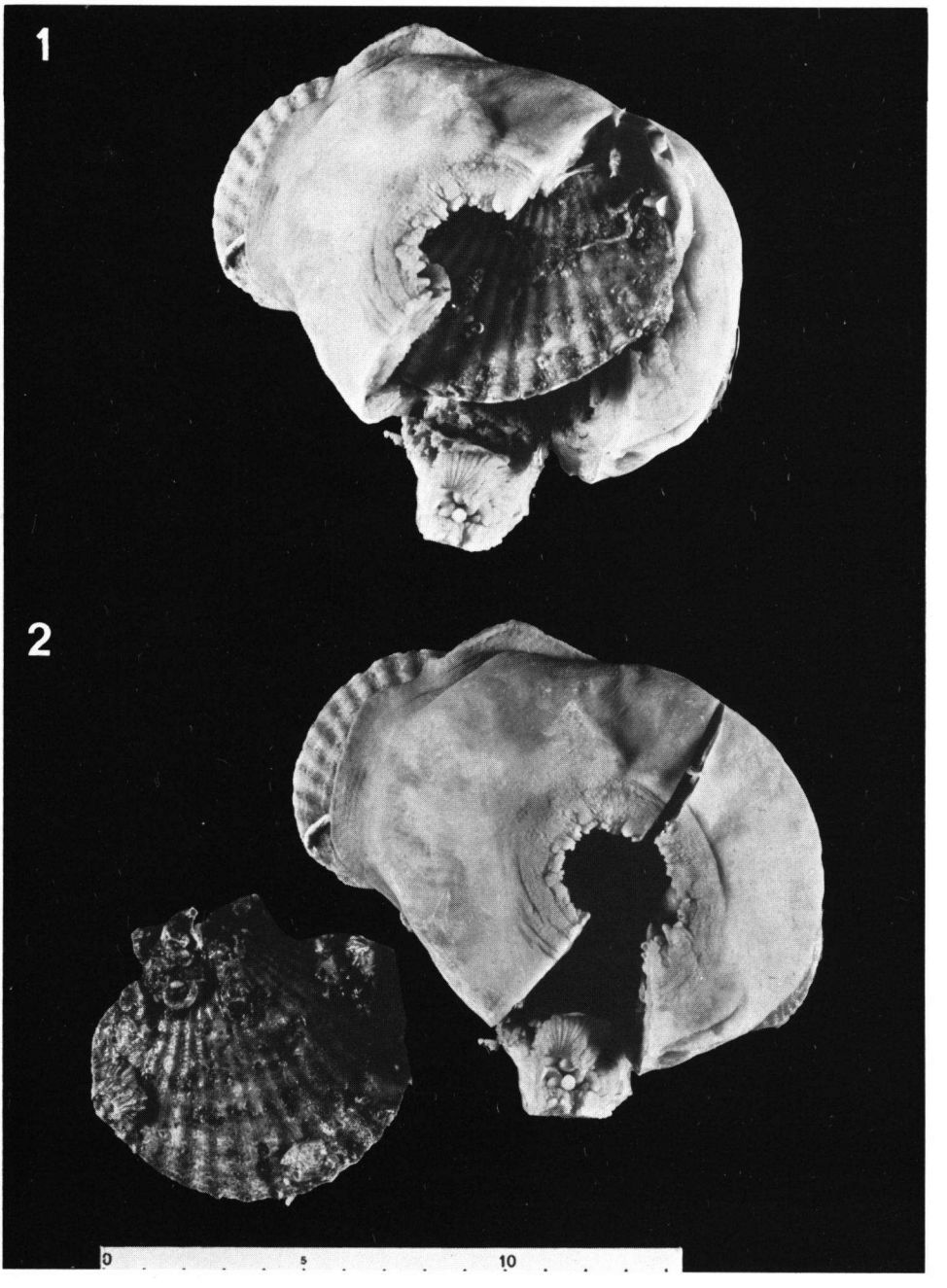
Hand (1955) in his study of the endomyarian and mesomyarian sea anemones from Central California, recognized three species of *Urticina* (as *Tealia*),which he identified with known North Atlantic species. In the present context it is relevant to note that the North Atlantic *Urticina eques* [= *U. lofotensis* (Danielssen, 1890)] is definitely not identical with the Californian *U. lofotensis* sensu Hand. Manuel & Williams (cf. Manuel, 1981: 110) found that the nematocyst measurements of both taxa do not "wholly" agree. My own studies on North Atlantic material show this to be an understatement, for the differences actually are quite significant, indicating separate species, so that a new name is required for the Californian species. The same applies to the Californian *Urticina coriacea* sensu Hand, 1955, which on similar grounds is not conspecific with the North Atlantic *Urticina felina*. It is, however, beyond the scope of the present paper to rename these two Californian species.

Patiria miniata (Brandt, 1835), remarkably itself a species reported as a predator of the sea anemone *Anthopleura elegantissima* (Brandt, 1835) (cf. Francis, 1973: 80) and belonging to the same family as the genus *Urticina* (!); one therefore wonders whether this record might not actually refer to the superficially similar *Dermasterias imbricata* (Grube, 1857) occurring in similar habitats and known to feed primarily on Coralli-morpharians and sea anemones (Lambert, 1981: 94; Annett & Pierotti, 1984), including *Anthopleura elegantissima* (cf. Mauzey et al., 1968: 610). The presence of sizeable starfish, viz., *Henricia leviuscula* (Stimpson, 1857) (diameter: 80-120 mm) in the gastric cavity of *Urticina lofotensis*, again from the U.S. west coast (San Juan Archipelago, Washington State), was also reported by Sebens & Laakso (1978: 161), and these same authors reported pholidid fish (up to 150 mm long) from a new *Urticina* species, which they appropriately named *Tealia piscivora*. Shimek (loc. cit.) mentioned the sea-urchin *Strongylocentrotrus droebachiensis* (O.F. Müller, 1776) to be the principal food item of *Urticina crassicornis* (O.F. Müller, 1776) in the vicinity of Homer, Alaska.

During a three-week visit (21 August-12 September, 1985) to the Faroe Islands, situated between the Shetlands, Iceland and the Norwegian coast (c. 62°N, 7°W), I had the opportunity to join a short trip (from 1-2 September) with the commercial scallop-fishing vessel "Nordheim" from Eidi, Eysturoy, to fish the *Chlamys opercularis* beds situated c. 10 miles east of Streymoy and Eysturoy (in the area between 62°03′-08′N and 6°14′-15′W). Fishing depth varied between 84 and 110 m. During this trip I collected four species of Actiniaria: *Urticina eques* [= *Tealia lofotensis* (Danielssen, 1890)], *Bolocera tudiae* (Johnston, 1832), *Stomphia coccinea* (O.F. Müller, 1776) and *Sagartiogeton laceratus* (Dalyell, 1848). *Urticina eques* proved by far the commonest species; hundreds of specimens, mostly firmly contracted, were caught in the scallop dredge. Due to the large size of this species I restricted myself in taking a sample of no more than ten specimens, varying in basal diameter from ca. 95 × 91 to 128 × 112 mm. These were preserved in 8-10% formalin-seawater.

A few months later, when studying this sample, I noticed that two specimens had engulfed a complete specimen of *Chlamys opercularis* (L., 1758) (basal diameter of the anemones ca. 128 × 112 and 127 × 87 mm; length and width of the scallops 78 × 72 and 72 × 67 mm respectively) (figs. 1-2). Although acquainted with the fact that species of *Urticina* may feed on large prey and although predation on juvenile *Pecten maximus* (L., 1758) by the sea anemone *Anthopleura ballii* (Cocks, 1850) was previously reported by Minchin (1983), the possibility of *Urticina* feeding on scallops unfortunately had not occurred to me when at sea, as otherwise I would have collected more material. However, even in the absence of quantitative data one will at once understand that the presence of a fully grown scallop in two out of ten specimens of *Urticina eques* is no coincidence. The question how these scallops are caught by the anemones is not difficult to answer. *Chlamys opercularis* and many other free living Pectinidae (and Limidae) are well-known for their ability to swim by jet propulsion. There is a rather extensive literature about this phenomenon (e.g. Buddenbrock & Möller-Racke, 1953;

Figs. 1-2. One of the collected specimens of *Urticina eques* (Gosse) which has engulfed a complete individual of *Chlamys opercularis* (L.) (1, view of right valve; 2, view of left valve). Note that *Chlamys opercularis* also serves as substrate; a right valve is just visible to the left. Of the sample of ten *Urticina eques*, six had used *Chlamys opercularis* as substrate, one had settled on a valve of *Cyprina islandica* (L.), and three were without (or had lost their) substrate.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Lecomte, 1952; Rees, 1957; Baird, 1957; Hartnoll, 1967; Moore & Trueman, 1971; Thomas & Gruffydd, 1971; Thorburn & Gruffydd, 1979). It must be this swimming behaviour which causes scallops to be caught. In particular the relatively violent reaction to avoid active predators, the so-called "escape reaction", somewhat paradoxally seems to implicate the risk for a scallop of ending up in the sticky tentacle crown of *Urticina*. Other ways in which a passive predator as *Urticina* may get hold of a scallop are less plausible, although it may be possible that scallops which lie or move within the action radius of this actinian are seized in an active way by bending down the column and the tentacle crown.

Considering the evidence that *Chlamys opercularis* certainly is accepted as a food item by *Urticina eques* (the two specimens ingested were in a progressed state of digestion), scallop beds offer potentially rich feeding grounds for this species of sea anemone and presumably, the more the scallops swim, the better for the anemones. Therefore the presence on *Urticina*-inhabited scallop-beds of other, more active predators, such as species of starfish and possibly some of the large carnivorous gastropods, able to trigger an "escape reaction", would probably benefit an *Urticina* population; and I cannot help thinking that this is likely to apply also to regular disturbances of the sea floor by trawlers, etc.

The larger gastropods commonly found in the catches of the "Nordheim" were: *Buccinum undatum* L., 1758 (more than one growth form), *Neptunea antiqua* (L., 1758), *N. despecta* (L., 1758), *Sipho gracilis* (Da Costa, 1778), *S. islandicus* (Gmelin, 1791), and *Volutopsius norvegicus* (Gmelin, 1790) (all Buccinidae). The commonest starfish were: *Astropecten irregularis* (Pennant, 1777), *Asterias rubens, Crossaster pappopus* (L., 1767), *Solaster endeca* (L., 1771) and *Hippasteria phrygiana* (Parelius, 1768). Of these, at least *Asterias rubens* is known to appreciate *Chlamys opercularis* as food and to elicit a strong "escape reaction" in Pectinidae (e.g. Mortensen, 1927: 140; Rees, 1957; Brun, 1968; Thomas & Gruffydd, 1971: 90). *Astropecten irregularis* has been reported also to elicit a strong "escape reaction" (Thomas & Gruffydd loc. cit.), but, although a voracious feeder on molluscs, there appears to be no explicit record of *Chlamys* or *Pecten* as a food item. *Crossaster papposus* on the other hand has occasionally been reported to eat scallops (Hunt, 1925: 584; Mauzey et al., 1968: 609) but elicits a weaker "escape reaction" (Thomas & Gruffydd, 1971, loc. cit.). In *Solaster endeca*, which has not been recorded to eat scallops, this reaction is negligible (Mauzey et al., loc. cit.). Data on *Hippasteria phrygiana* are not available.

Chlamys opercularis is a wide-spread boreal-lusitanian species occurring in the eastern North Atlantic from northern Norway and the Faroes, south to Morocco, the Canaries and the Azores and into the Mediterranean (Tebble, 1966: 61; Høpner Petersen, 1968: 12), whereas *Urticina eques* is a truly boreal species not found further south than the North and Irish Seas.

To get a better insight in the role of *Urticina eques* as a predator in a relatively northern scallop-bed life-community, further investigations are necessary and feasible if one can arrange to join a few trips with a scallop-fishing boat to make a quantitative study of the contents of the gastric cavity of this sea anemone species. Additional studies, partly under experimental conditions, may reveal how scallops are captured and which of the commonest Asteroidea, Gastropoda, etc., are the most important predators.

It would also be interesting to investigate whether any of the above named species of starfish and gastropods may act as a predator on *Urticina eques. Crossaster papposus*,

although mainly a predator of other starfish, molluscs, etc. (e.g. Mortensen, 1927: 114; Glomb, 1976; Lambert, 1981: 68) has been reported also to eat actinians (Milligan, 1916; Chadwick, 1916; Mortensen, 1927: 114; Hancock, 1958: 578; Mauzey et al., 1968: 609), though I have searched in vain for a specific record concerning *Urticina*. Another species which possibly appreciates actinians as food is *Hippasteria phrygiana*; its close north-east Pacific relative *H. spinosa* Verrill, 1909, which mainly feeds upon pennatulids, occasionally has been reported to eat *Metridium senile* (L., 1761) (Mauzey et al., 1968: 606; Lambert, 1981: 56). So far there is no evidence that any of the above-mentioned Buccinidae eat actinians. In southern Alaska, however, such a predator-prey relation has been established for *Beringius kennicotti* (Dall, 1871) (also Buccinidae) and *Urticina crassicornis* (O.F. Müller, 1776) (Shimek, 1980).

I thank skipper Ólavur Fløtt, Eidi, and Mr. Edmund Joensen, Oyrabakka, for allowing me to join a trip with the "Nordheim" and for hospitality and cooperation enjoyed on board the ship. Dr. Arne Nørrevang, Tórshavn, acted as an intermediary in this arrangement. He and Mrs. Elin Jacobsen, are also acknowledged for patiently accepting me as a house-mate during my three-week stay at the Faroes, and for many facilities and good advice.

My visit to the Faroes was financially supported by the Jan Joost ter Pelkwijk Fonds.

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