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Fishes other than anemonefishes that associate with sea anemones

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Introduction

The obligatory relationship of sea anemones and anemonefishes (*Amphiprion* spp. and *Premnas biaculeatus*) and damselfishes of the genus *Dascyllus* is well known. We summarize the literature and add personal observation of facultative associations with sea anemones by cardinalfishes (Apogonidae), wrasses (Labridae), hawkfishes (Cirrhitidae), butterflyfishes (Chaetodontidae), a scaled blenny (Clinidae), and even a temperate greenling (Hexagrammidae). Although most of these fishes appear to avoid the tentacles, some make contact. The behavioral and physiological facets of these relationships remain to be studied.

The 27 species of the Indo-Pacific anemonefish genus *Amphiprion* and the monotypic anemonefish genus *Premnas* are well known for their obligate association with sea anemones. At least two other species of Indo-Pacific damselfishes of the genus *Dascyllus* also associate with anemones as juveniles (Fautin and Allen 1992). These pomacentrid fishes live among the tentacles of the anemones which bear nematocysts – microscopic stinging capsules – that provide for the defense of the anemone and capture prey, including small fishes, that come in contact with the tentacles. Because sea anemones, like other cnidarians, can be deadly to fishes, early reports of associations between them were subject to skepticism.

Collingwood (1868a, 1868b) first described the relationship more than a century after some of the anemonefishes and their hosts were individually described.

Less well known are other fishes that shelter at times among the stinging tentacles of large sea anemones. Colin and Heiser (1973) reported two West Indian cardinalfishes (Apogonidae), *Apogon quadrisquamatus* and *A. aurolineatus*, that occasionally associate with the sea anemones *Bartholomea annulata* and *Condylactis gigantea*. They added that the fishes were not immune to the nematocysts, and many had white spots and lesions that they believed were caused by contact with the tentacles. Hanlon et al. (1983) reported more than 30 species of West Indian reef fishes that occasionally dwell within the sphere of the tentacles of sea anemones, principally as juveniles. Of seven species discussed in detail by Hanlon et al., all but one avoided touching the tentacles. The exception was the labrisomid *Starksia hassi* which made full contact with the tentacles with no apparent harm.

J.E.R. took several photographs of a group of the West Indian cardinalfish *Apogon quadrisquamatus* sheltering among the tentacles of a *Condylactis gigantea* at Bonaire in the southern Caribbean Sea, one of which was published (Randall 1996: Fig. 149). These fish were using the anemone during the day for shelter and not just retreating to it for temporary asylum, and it seemed that at least occasional tentacle contact was made.

Cardinalfishes associate with sea anemones in the tropical Indo-Pacific as well the West Indian region. Some hover near an anemone for the protection it provides but appear to avoid the tentacles. An example is *Apogon nanus* with a tube anemone (order Ceriantharia) at Flores, Indonesia (Fig. 1). Another is *Pterapogon kauderni* from Sulawesi (Fig. 2) with what is probably the anemone *Heteractis crispa* which also hosts “true” anemonefishes. D.G.F. has seen apogonid fishes in eastern Indonesia around members of the anemone family Actinodendronidae, termed Hell’s Fire Anemones because of their powerful sting.

The cardinalfish *Apogon moluccensis* (*A. ventrifasciatus* is a synonym) definitely makes contact with the

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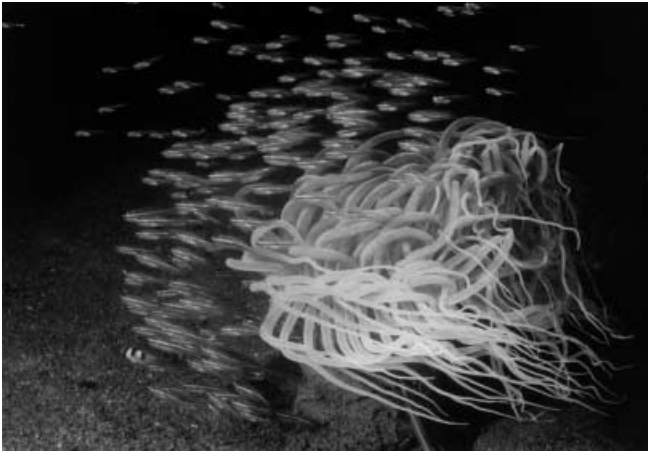


Fig. 1. The cardinalfish *Apogon nanus* with a tube anemone (order Ceriantharia) at Flores, Indonesia

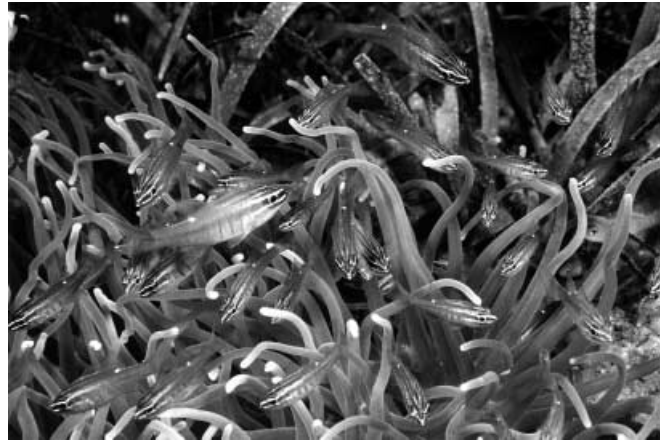


Fig. 3. The cardinalfish *Apogon moluccensis* and sea anemone (probably *Heteractis crispa*) at the D'Entrecasteaux Islands, Papua New Guinea



Fig. 2. The cardinalfish *Pterapogon kauderni* and a sea anemone (probably *Heteractis crispa*) at Sulawesi, Indonesia (Max Gibbs)

tentacles of an anemone (probably *Heteractis crispa*), as shown in Fig. 3 taken at the D'Entrecasteaux Islands of Papua New Guinea.

Wrasses (Labridae) of the genus *Thalassoma* also occasionally associate with anemones. Fautin and Allen (1992: Fig. on p. 5) published a photograph taken by R. Eisenhart near Madang, Papua New Guinea, of three juveniles of *T. amblycephalum* above the tentacles of the anemone *Heteractis magnifica*. They noted that infrequent contact was made with the tentacles by species of *Thalassoma*.

Lisa Crosby (personal communication), a divemaster out of Bali, observed *Thalassoma amblycephalum* and *T. lunare*, another wrasse (*Halichoeres hortulatus*), two damselfishes (Pomacentridae), and two hawkfishes (Cirrhitidae) of the genus *Cirrhitichthys* that "actually live in an anemone" at the island of Rinca in the Komodo Group, Indonesia. J.E.R. went to the site at Rinca; his Fig. 4 shows the anemone *Heteractis magnifica* with three juveniles of *T. amblycephalum* and one of *T. lunare*, and Fig. 5 an individual of *T. amblycephalum*

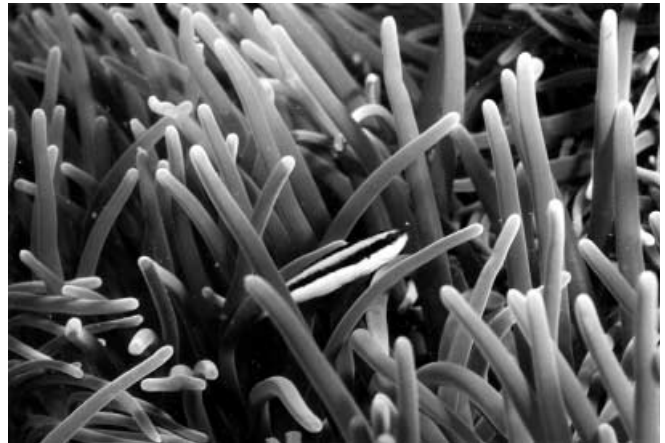


Fig. 4. Juveniles of the wrasse *Thalassoma amblycephalum* with the sea anemone *Heteractis magnifica* at Rinca, Komodo Group, Indonesia

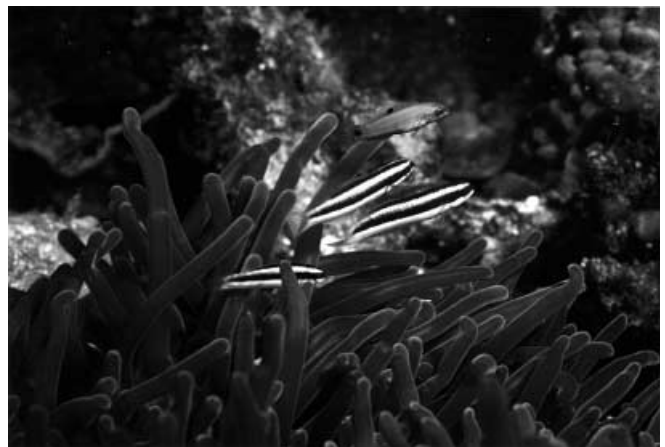


Fig. 5. Juvenile wrasses *Thalassoma amblycephalum* and *T. lunare* with the sea anemone *Heteractis magnifica* at Rinca, Komodo Group, Indonesia

in contact with the tentacles of *H. magnifica*. A video taken by Kwok Yin Lam at the request of J.E.R. also demonstrates that individuals of these two species of *Thalassoma* are often touched by the tentacles of *H. magnifica*. Although J.E.R. did not see the other fishes mentioned by Crosby in association with anemones, he watched a television program of undersea life in Indonesia that showed the hawkfish *Cirrhitichthys aprinus* among the tentacles of a large sea anemone, thus confirming Crosby's observation for this family.

A juvenile *Chaetodon kleinii* of the butterflyfish family Chaetodontidae was observed by J.E.R. at Rinca sheltering among the tentacles of a sea anemone. This is not surprising since it is known that some butterflyfishes of the genus *Chaetodon* prey on sea anemones (Fricke 1975; Fautin and Allen 1992; Godwin and Fautin 1992).

The fish-anemone phenomenon is not confined to the tropics. In the temperate northeastern Pacific, the painted greenling (*Oxylebius pictus*, family Hexagrammidae) associates as a juvenile with the sea anemone *Urticina lofotensis*. The fish sleeps on the oral disc, leaving the anemone by day but returning every night (Elliott 1992).

The relationship of anemonefishes of the genera *Amphiprion* and *Premnas* with sea anemones is mutualistic. The anemonefishes avoid predation by sheltering within the anemones, and individuals of some species vigorously protect the anemone from predators such as fishes of the families Chaetodontidae and Tetraodontidae and sea turtles (Godwin and Fautin 1992). Also from our own experience we know that they may be very aggressive toward divers that venture too near their anemone.

Anemonefishes are never found in nature without an anemone, so it is clear that the association is obligatory. Fautin (1991) has reviewed the literature explaining how anemonefishes are protected from anemone nematocysts. These fishes do not have a thicker coat of mucus than other species, and they are not immune to nematocyst toxin. Rather, a fish's mucous coating inhibits the firing of the nematocysts. In the absence of the protective mucus (as when a fish is removed for a while from its anemone, or the mucus is rubbed off), the fish can be stung. The source of the protection provided by the mucus is debatable. There is evidence that a fish coats itself with the mucus of the host anemone, and

there is also evidence that the fish's own mucus prevents the firing of the anemone nematocysts.

The relationship of other fishes that have been observed as occasionally associated with anemones is facultative and ephemeral. The question arises whether these fishes that have been observed to make contact with the anemone tentacles have acquired some measure of protection to prevent the discharge of the nematocysts or whether they accept an occasional sting as the price to pay for the protection provided by the anemone. If there is actual protection from nematocyst stings, a study of its mechanism would provide for comparison with that of anemonefishes.

Acknowledgements We thank Lisa Crosby for her observations on the association of anemones with fishes other than anemonefishes; Max Gibbs for his photograph of *Pterapogon kauderni* with an anemone; Kwok Yin Lam for his video of species of *Thalassoma* with *Heteractis magnifica*; and Mike Neumann for the opportunity for J.E.R. to make the cruise on *Pelagian* to the islands of the Komodo Group, Indonesia. D.F.G. was supported by U.S. National Science Foundation Grant DEB 9978106.

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