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James F. McElman, *Department of Fisheries and Oceans, Biological Station, St. Andrews, New Brunswick E0G 2X0, Canada.* Accepted 14 Jan. 1982.

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OBSERVATIONS ON THE COMMENSAL RELATIONSHIP OF *NOMEUS GRONOVII* WITH *PHYSALIA PHYSALIS*.—The Portugese man-of-war, *Physalia physalis*, is a common siphonophore in the Gulf Stream along the east coast of Florida. *Nomeus gronovii* has been long accepted as a commensal of *Physalia* (Gudger, 1942). The nature of the ability of *Nomeus* to live among the venomous tentacles of *Physalia* has been the subject of some debate and much speculation (Mansueti, 1963), and this association has been likened to that described for the relationship between sea anemones and the anemonefishes. Observations of *Nomeus* and *Physalia* together under captive conditions may lend a clue as to the actual nature of this "immunity."

Materials and methods.—Both *Physalia* and *Nomeus* were obtained from Florida waters during the summer of 1977. The *Nomeus* were maintained separately from any *Physalia* for nearly 15 days in natural seawater and fed daily. Freshly caught *Physalia* were then placed in a large, 1,798 L, 1.2 M deep filming tank. After preliminary filming, a single 7 cm *Nomeus* was acclimated to the system in a solid opaque container.

Upon introduction, the *Nomeus* initially swam near the surface and around the *Physalia* in a large circular pattern in both clockwise and counterclockwise directions. The fish remained approximately 10 to 20 cm from the main body of tentacles. About 15 min after the release, the *Nomeus* swam closer to the *Physalia*, paused as if inspecting it, and then began to nip the edges of the gonozooids. The fish avoided the larger dactylozooids and remained near the surface feeding on the tentacles that lie just under the float of the *Physalia*. During one of these nipping sorties, the fish was stung and held on the tip of its mouth by several of the smaller dactylozooids, but easily disengaged itself. Feeding behavior consisted of tearing off and ingesting small tentacles, around ten mm in length, at approximately two min intervals. Several times during this period of feeding, the *Physalia* would contract several of the larger dactylozooids. The *Nomeus* would then veer away, resume the above circular pattern of swimming for several minutes, and then return to feed after the tentacle contraction had stopped.

Approximately an hour after introduction, the *Nomeus* seized one of the larger dactylozooids and tore it loose, shaking the entire *Physalia* in the process. This was the first direct contact noted between the fish and any of these large stinging tentacles. Less than two hours following introduction, the fish started to swim in and around the larger tentacles. During this period, the fish's head brushed several of the smaller stinging tentacles, but was apparently not stung strongly enough to be held by the *Physalia*. A larger dactylozooid did sting and hold the fish by its caudal fin; however, the fish shook free easily.

A freshly expired *Nomeus* was then offered to the *Physalia*. The carcass was immediately stung, held by a dactylozooid and brought up to the gastrozooids. The live *Nomeus* began to swim more erratically and moved in towards the carcass as the gastrozooids formed their characteristic 'bag' and began to digest the fish. The live *Nomeus* was then caught on its left side just caudal to the primary dorsal fin by one of the largest dactylozooids. Intervention by the observer was necessary at this point to save the fish. After separation, the fish swam erratically at some distance from the *Physalia*, particularly favoring its left side. The erratic behavior of the *Nomeus* was identical to that seen by previous observers (Mansueti, 1963). Some 40 min after receiving this major sting, the *Nomeus* resumed its previous swimming pattern among the tentacles. It again fed on the tentacles, but only in those areas away from where the carcass was being digested. Feeding continued over the next hour in episodes ranging from five to ten min in length.

With the *Physalia* stationary, the *Nomeus* would swim around the periphery of the drift net and to a lesser extent among the tentacles of the net. However, when the *Physalia* was moved about the tank in random directions, the fish would immediately dart into the central mass of large dactylozooids and remain close in among them. The fish was not observed to come into direct contact with any of these tentacles during the periods of movement, nor was it stung. In fact, the fish displayed relative ease in maintaining a safe distance from the dactylozooids even with abrupt, sharp changes in direction, or increases in the speed of movement. *Nomeus* specimens use the pectoral fins for propulsion, much like labrids, while the pelvic fins are spread like a fan. The caudal fin is apparently used for only short fast darts. This swimming behavior appears to be well suited for existence with *Physalia*, as the fish was not stung no matter how fast or erratic the movement of the *Physalia* was.

Discussion.—Although *Physalia* are quite venomous, juvenile fishes are recorded as living commensally with them. Among these are the yellow jack, *Caranx bartholomaei* Cuvier; the pilot fish, *Naucrates ductor* (Linnaeus); the spotted ruff, *Mupus maculatus* (Günther); and the longspine snipefish, *Macrorhamphosus scolopax* (Linnaeus) (Mansueti, 1963; Maul, 1964). These fishes are normally found only in association with the gastrozooid/goonozooid tentacle bunch just under the float, and not with the drift net of dactylozooids where they can be stung (Maul, 1964). *Nomeus* differ from the above fishes as they not only inhabit the area just under the pneumatophore, but also swim among the dactylozooids with reportedly little or no harm (Gudger, 1942; Böhlke and Chaplin, 1968). Pieces of *Nomeus* have been isolated, however, from the gastrozooids of *Physalia* (Garman, 1896; Kato, 1933; Lane, 1960; Marshall, 1965), and it has been recorded that *Nomeus* can be stung by *Physalia* in the wild (Mansueti, 1963; Zahl, 1952). Furthermore, captive studies have shown that *Physalia* tentacles will adhere to *Nomeus* as in seven other species of fishes known to be susceptible to *Physalia* stings (Mayo, 1968). *Nomeus* have also been observed (as in this study) to feed on the dactylozooids and other tentacles of *Physalia*, with tissues and discharged *Physalia* nematocysts later being found in the gastro-intestinal tract (Garman, 1896; Kato, 1933; Lane, 1960; Marshall, 1965). In spite of these reports, *Nomeus/Physalia* commensalism has been considered similar to that of the anemonefishes and anemone, in which the fish typically exhibits a direct immunity to the anemone's sting through the inhibition of nematocyst firing (Maul, 1964; Lane, 1960; Mansueti, 1963; Dales, 1957). The immunity of the anemonefish is also renewable, even after lengthly separation (Spotte, 1972; Terceira, 1976; Mariscal, 1972). The behavior employed by anemonefishes in establishing and maintaining this immunity has been described (Mariscal, 1972; Spotte, 1972).

Although *Nomeus* are capable of withstanding injections of *Physalia* venom ten times the normal strength of that which kills other fishes (Lane, 1960; Maul, 1964), and while there are indications that *Nomeus* have at least one antibody that is reactive with *Physalia* toxin (Mayo, 1968), it apparently does not adapt to *Physalia* in the same manner as reported for the anemonefishes/anemone symbiosis. At not time during the period of observations was the *Nomeus* specimen seen to engage in any acclimating behavior similar to that of anemonefishes, nor was it observed to come into contact with the large dactylozooids without being stung. As described above, the *Nomeus* was quite capable of swimming among the dactylozooids early in the observations and could do so with ease whether the *Physalia* was stationary or mobile. This ability has also been described in observations of *Nomeus* with *Physalia* in the wild (Zahl, 1952). It therefore is apparent that, rather than developing an ability to inhibit the discharge of *Physalia* nematocysts or prevent them from stinging, *Nomeus* uses its swimming abilities as its primary means of defense while living in the venomous drift net of *Physalia*.

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Robert L. Jenkins, *Marineland Research Laboratory, Rt. 1, Box 122, St. Augustine, Florida 32084. Present Address: National Aquarium in Baltimore, Pier 3, 501 E. Pratt St., Baltimore, Maryland 21202.* Accepted 13 Nov. 1981.

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HEMANTHIAS PERUANUS, ANOTHER HERMAPHRODITIC ANTHIINE SERRANID.—Hermaphroditism in serranids is a well-documented phenomenon and may be either synchronous (functioning as male and female at the same time) or protogynous (undergoing sexual transformation from female to male). To date, all anthiines for which sexuality is known have proved protogynous hermaphrodites (Reinboth, 1963, 1964; Fishelson, 1970; Suzuki et al., 1978; Hastings, 1981; Coleman, 1981). Protogyny is indicated by the presence of developing testicular tissue in the posteroventral portion of the gonad concomitant with regressing eggs. Proliferation of testicular tissue progresses anteriorly and eventually invests the entire gonad. Protogyny is also evidenced by: 1) the occurrence of males only in the larger size groups; 2) the presence of atretic eggs (brown bodies) in testicular tissue (Smith, 1959); and 3) testes with well-developed lumina, indicative of their having transformed from ovaries (Smith, 1971; Heemstra, 1973).

Hemanthias peruanus Steindachner, the splittail barbier, is an anthiine serranid found in tropical and subtropical waters of the eastern Pacific at depths ranging from 80 to 120 m. During the dissection of several specimens, it became apparent that the species was hermaphroditic and, undoubtedly, protogynous. Gonads from five specimens (92 to 181 mm SL) were examined macroscopically, a method usu-