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OFF-REEF EMIGRATION OF YOUNG ADULTS OF THE LABRID FISH *EPIBULUS INSIDIATOR*.—The immigration of planktonic larvae of fishes to coral reefs is a continuing process of major biological significance. It is the predominant mechanism of recruitment for most sedentary reef fishes (Sale, 1977). Migration of postlarval individuals of such fishes is a process about which much less is known. Recruitment of subadults and small adults onto isolated natural and artificial patch-reefs has been observed for only a few species of sedentary fishes (Randall, 1963; Robertson, 1974; Gundermann and Popper, 1975; Talbot et al., 1978). Losey (1974) described an unnatural emigration incident in which a small (adult?) blenny moved to the surface of the water and drifted off a reef after he had harassed it.

Here we describe off-reef emigration by small adults and subadults of *E. insidiator*. We observed this behavior at Palau in the western Pacific (lat. 7°30'N, long. 134°30'E). Palau Atoll is an elongate reef system that spans over 125 km in its long (northeast-southwest) axis. A group of heavily wooded islands is situated along the eastern side of the atoll. Observations were made at the outer edge of the barrier reef approximately 1 km southwest of the lighthouse that marks the eastern shipping entrance to Malakal harbor, Koror. There are no other reefs to seaward of the study reef.

We observed emigration on seven days between 25 Feb. and 26 April 1980. All instances occurred on the ebb tide, 0.5–5.5 hr after the tide had turned, when water was moving off the reef and out to sea. These emigrations occurred at various times between 0650 and 1750 hours, on days when the sea was very calm and there was either no wind or a northwest breeze of less than five knots. Emigration was noted only on days when floating leaves of trees, fern and seagrasses were being carried out to sea by the tidal current. This exit of plant debris was a common event, as we saw it on 17 of 20 ebb tides in the study area.

As the tide began to ebb, single fish or loose groups of up to 10 individuals could be seen moving along the outer edges of spurs of reef that protruded into deep water. These fish were completely brown, except for their transparent pectoral fins, and were 5–10 cm in total length. The larger of these individuals were probably mature, as fish of the same size often were seen spawning. Emigration was preceded by slow movement of the fish along the bottom in 3–4 m of water, movement that was perpendicular to the general direction of the reef face. During these movements the fish repeatedly peered towards the surface. When plant debris floated overhead, the fish folded its median fins and tail and slowly rose to the surface, propelling itself with its pectoral fins, and maneuvering with those fins and slow lateral flexings of the posterior part of its body as it did so. At the surface, the fish curled its tail toward its body, tipped over on one side and drifted along immediately adjacent to the plant material, maintaining its position with pectoral fin movements. The drifting tree leaves varied from brown to yellow, and fish that associated with yellowish leaves changed color and took on a yellowish cast as they joined them. The drifting fish remained with the debris as it floated off

the reef and out of sight. Four drifting fish were followed until they were 50–75 m to seaward of the edge of the reef, where the water depth was over 25 m and the observer at the surface could not see the bottom. They were still floating away with the plant debris when the observer left them.

We saw a total of 31 *E. insidiator* leave the reef in this manner, either singly or in groups of up to four fish. They and another 91 fish were seen rising and peering at the surface at six different sites scattered along about 200 m of the outer edge of the reef. Not all movements to the surface resulted in fish leaving, as some returned to the bottom after drifting for a few seconds. Also, on three different occasions, fish rose to and remained next to the floating observer for a minute or two before returning to the bottom or drifting off. Several of those that drifted off were not near leaves when they did so.

Thus drift emigration is regularly performed by *E. insidiator* in the study area. For such behavior to benefit the individual emigrant there must be a reasonable chance that a drifting fish will be redeposited on a reef. This may well be the case. First, we repeatedly saw fresh leaves of trees and seagrass being carried in from the sea over the study reef on flooding tides. Because of the isolation of this island group, the leaves undoubtedly originated on Palau. Second, the northeast winds that prevail at the time of the year we made our observations would tend to counter the effects of currents that might move floating material away from the east side of Palau. Third, according to Johannes (1978), the annual peak of spawning by Palauan fishes that produce planktonic larvae occurs during the period in which we made our observations. The larvae return to reefs to complete their life cycles, and Johannes has suggested that their chances of doing so at Palau are best during that season because oceanic currents that might tend to remove them are weakest then. Such a reduction in currents could also increase the chance that drifting *E. insidiator* will remain nearby and return to Palauan reefs. Finally, locally generated current eddies (Emery, 1972) might also help to return the floating *Epibulus* to Palauan reefs. This leads us to suggest that drift emigration represents a means by which subadults and young adults of *E. insidiator* regularly move from one area of a reef to another, although they may not move very far. Alternatively, there may be specific benefits

to be gained from drifting with plant material. For example, the drifting *E. insidiator* might gain access to otherwise inaccessible food, such as other smaller fishes that also associate with drifting plants. Similar drifting behavior may also occur in certain reef fishes in other areas: Randall and Randall (1960) described a few observations of juvenile wrasses and other fishes that resembled and floated with plant debris at several Caribbean and Pacific sites.

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LITERATURE CITED

- EMERY, A. R. 1972. Eddy formation from an oceanic island: ecological effects. *Carib. J. Sci.* 12:121–128.
- GUNDERMANN, N., AND D. POPPER. 1975. Some aspects of recolonization of coral rocks in Eilat (Gulf of Agaba) by fish populations after poisoning. *Mar. Biol.* 33:109–117.
- JOHANNES, R. E. 1978. Reproductive strategies of coastal marine fishes in the tropics. *Env. Biol. Fish.* 3:65–84.
- LOSEY, G. S., JR. 1974. *Aspidontus taeniatus*: effects of increased abundance on cleaning symbiosis, with notes on pelagic dispersion and *A. filamentosus* (Pisces, Blenniidae). *Zeits. Tierpsychol.* 34:430–435.
- RANDALL, J. E. 1963. An analysis of the fish populations of artificial and natural reefs in the Virgin Islands. *Carib. J. Sci.* 3:31–47.
- , AND H. A. RANDALL. 1960. Examples of mimicry and protective resemblance in tropical marine fishes. *Bull. Mar. Sci.*, 10:444–480.
- ROBERTSON, D. R. 1974. A study of the ethology and reproductive biology of the labrid fish, *Labroides dimidiatus* at Heron Island, Great Barrier Reef. Unpubl. PhD Thesis, University of Queensland.
- SALE, P. F. 1977. Maintenance of high diversity in coral reef fish communities. *Amer. Natur.* 111:337–359.
- TALBOT, F. H., B. C. RUSSELL AND G. R. V. ANDERSON. 1978. Coral reef fish communities: unstable, high-diversity systems? *Ecol. Monogr.* 48:425–440.
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