Vol. 463: 297–299, 2012
doi: 10.3354/meps10002

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published August 30

COMMENT

Feeding activity by the blenny *Exallias brevis* causes multifocal bleaching in corals: Comment on Zvuloni et al. (2011)

Bruce A. Carlson*

Georgia Aquarium, 225 Baker Street, Atlanta, Georgia 30313, USA

ABSTRACT: The shortbodied blenny *Exallias brevis* is an obligate corallivore. Studies on Hawaiian reefs and casual observations on other Pacific reefs reveal that *E. brevis* feeds on a wide variety of scleractinian corals, including the hydrocoral *Millepora* spp. This blenny produces distinctive circular feeding marks of ca. 2 cm^2 on corals; the marks can persist for 50 d or more. *E. brevis* is indigenous to the Red Sea and may be responsible for the multifocal bleaching syndrome in Red Sea *Millepora dichotoma* described by Zvuloni et al. (2011; Mar Ecol Prog Ser 441:25–32).

KEY WORDS: *Exallias brevis* · Shortbodied blenny · Corallivore · *Millepora* spp. · Multifocal bleaching · Red Sea

INTRODUCTION

The shortbodied blenny *Exallias brevis* (Kner) is a combtooth blenny in the tribe Salariini (Hastings & Springer 2009). Combtooth blennies are characterized by a single row of elongate incisiform teeth in each jaw that are used like brushes while grazing on rocky surfaces. The majority of these blennies feed on algae and detritus, but a few species such as *Ecsenius* sp. have been observed feeding on coral tissue (Randall et al. 1997, Carlson & Awai 2008).

Hiatt & Strasburg (1960) reported that *Exallias brevis* at Enewetak Atoll is an herbivore, but Hobson (1974) stated that in the Hawaiian Islands it feeds on coral polyps. Carlson (1978) and Sano et al. (1984) confirmed Hobson's conclusions that *E. brevis* is a corallivore. Carlson (1992) obtained quantitative data on the diet and feeding behavior of *E. brevis*, and these previously unpublished data form the basis of this Comment.

Zvuloni et al. (2011) described an apparently new 'multifocal bleaching' (MFB) syndrome in hydrocorals *Millepora dicotoma* and *M. platyphyllia* in shallow waters off Eilat in the Gulf of Aqaba, Red Sea. Photographs and descriptions published by Zvuloni et al. (2011, their Fig. 1c) bear a remarkable resemblance to the spots on Hawaiian corals resulting from the feeding activity of *E. brevis*.

OBSERVATIONS AT THE HAWAIIAN ISLANDS

Feeding was recorded over 63 h for 15 tagged male and 5 tagged female *Exallias brevis* on Hawaiian coral reefs at Hanauma Bay and Kahe Point on the island of Oa'hu, from October 21, 1980 through May 9, 1982 (Table 1). Feeding was exclusively on living corals, at rates of 13.9 and 28.4 bites h^{-1} for males and females, respectively. A total of 10 feeding marks were photographed and measured. Feeding bites on *Porites lobata* produced circular marks 2.04 ± 0.42 cm^2 (mean ± SD) in area (ca. 1.6 cm diameter) (Fig. 1a,b). Macro-photographs revealed that superficial coenosarc tissue was removed while the polyps remained

*Email: bcarlson@georgiaaquarium.org

Table 1. *Exallias brevis.* Feeding bites (mean h^{-1} $blenny^{-1}$) on corals at Hanauma Bay and Kahe Point, Oa'hu, Hawaii. Observations totaled 48 h for males (n = 15), and 15 h for females (n = 5)

Coral species	Males			Females		
	Bites (n)	Rate (h^{-1})	Fraction (%)	Bites (n)	Rate (h^{-1})	Fraction (%)
Porites lobata	589	12.27	88.0	229	15.27	53.8
Pocillopora meandrina	65	1.35	9.7	76	5.06	17.8
Montipora spp.	10	0.21	1.5	42	2.80	9.9
Leptastrea purpurea	4	0.08	0.6	16	1.07	3.7
Cyphastrea ocellina	1	0.02	0.1	0	–	–
Pavona varians	0	–	–	63	4.20	14.8
Total	669	13.94	99.9	426	28.40	100.0

mostly intact within calyces. A total of 6 feeding marks were tracked over time and remained visible (pale or white) for as long as 50 d before the coral regenerated. Thus, over a 50 d period, a single *E. brevis* could produce white marks on *P. lobata* covering an aggregate area up to 1.57 m^2 before the oldest marks disappear.

A video of *Exallias brevis* (www.youtube.com/watch?v=Ymk8e_1YJGI) reveals that the mouth is wide open when feeding, and has the appearance of a small suction cup. During a feeding bite, the less flexible lower jaw with rigid teeth remains anchored in the coral, while the highly extensible upper jaw, with flexible teeth, sweeps across the surface of the coral removing coral tissue. The lower jaw creates a small crescent-shaped mark while the upper jaw produces a larger, nearly circular mark (Fig. 1a).

Males with nests defended areas of 9.0 ± 2.7 m^2 (mean ± SD; n = 8); territories of males without nests and of females averaged 20.3 ± 12.0 m^2 (n = 5) and 24.6 ± 8.2 m^2 (n = 6), respectively. Males caring for eggs fed in a smaller area, and thus feeding marks were more concentrated in those areas (Fig. 1b).

My observations of *Exallias brevis* on other Pacific island reefs were consistent with the corallivorous diet reported for the Hawaiian Island blennies, except that a wider variety of corals were included in the diet. One male *E. brevis* observed for 1 h near Motupore Island, Papua New Guinea, fed upon *Acropora* sp., *Porites* sp., *Montipora* sp., *Pocillopora eydouxi*, and *Goniastrea* sp. At Enewetak Atoll in the Marshall Islands, I observed a female *E. brevis* perched among the branches of fire coral *Millepora* sp., and after 5 min of observation, it fed on the coral (Fig. 1c,d).

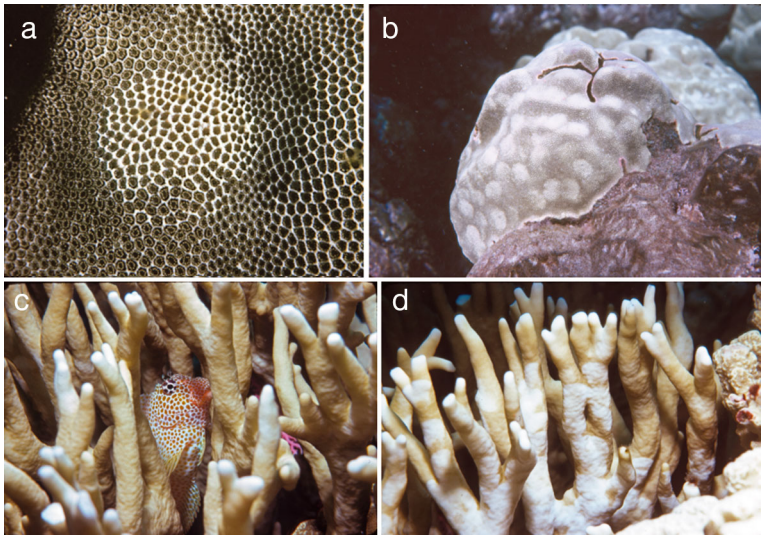

Fig. 1. Feeding marks on coral produced by *Exallias brevis.* (a) Single feeding mark (pale circular area) on *Porites lobata*, showing diagnostic pattern (Oa'hu). (b) Multiple feeding marks within a nesting male's territory (Oa'hu). (c) *E. brevis* in *Millepora* sp. colony (Enewetak). (d) Feeding marks made by blenny in (c) (Enewetak)

DISCUSSION

Exallias brevis is widespread on coral reefs throughout the Indo-Pacific region, from the Hawaiian Islands in the east to the Red Sea in the west, but it is infrequently observed due to its cryptic coloration and sedentary behavior. Biologists surveying reefs may observe *E. brevis* feeding marks on corals without knowing what produced them.

The marks produced by Hawaiian *Exallias brevis* are identical to the MFB spots illustrated by Zvuloni et al. (2011, their Fig. 1c): many of the latter spots show the diagnostic crescent on the lower edge. Furthermore, the concentrated pattern of the MFB spots is consistent with the territorial feeding and nesting activity of *E. brevis*. Zvuloni et al. (2011) considered MFB as a bleach-

ing event, partly because they observed intact zooids within the bleached areas. However, this too is consistent with *E. brevis* feeding, which removes mostly coenosarc tissue and misses many of the polyps in their calices.

Randall (1983) listed *Exallias brevis* as indigenous to the Red Sea and noted that it is smaller in size there compared to other locations. This would explain the slightly smaller size of the MFB spots reported by Zvuloni et al., compared to the marks produced by larger *E. brevis* in the Hawaiian Islands. Feeding activity of this blenny appears to have gone unnoticed in the Red Sea until recently, but Christian Alter (Red Sea Environmental Centre, Dahab, Egypt) has confirmed that Red Sea *E. brevis* feeds on *Millepora dichotoma* (pers. comm.).

Zvuloni et al. (2011, p 30) correctly noted that 'pattern analysis does not usually suffice to determine the pattern-generating processes, and in the absence of microbiological data we cannot explicitly state that MFB is a syndrome caused by an infectious disease.' MFB in Red Sea *Millepora dichotoma* is more parsimoniously explained by the feeding activity of *Exallias brevis*.

Acknowledgements. I thank Stephan Moldzio, who was curious about white spots which he photographed on *Millepora* in the Red Sea and posted a query on the Coral-List (www.coralreef.noaa.gov) to which I responded. Gal Eyal connected Stephan's photos with MFB, and both of these researchers corresponded with me to resolve the issue of MFB on *Millepora* sp. in the Red Sea. I also thank Charles Birkeland, John E. Randall and Victor G. Springer, who reviewed the manuscript and offered editorial suggestions.

LITERATURE CITED

Carlson BA (1978) A contribution to the biology of the spotted blenny, *Exallias brevis* (Pisces: Blenniidae). Pac Sci 32:96

Carlson BA (1992) The life history and reproductive success of the coral blenny, *Exallias brevis* (Kner, 1868). PhD thesis, University of Hawaii, Honolulu, HI

Carlson BA, Awai ML (2008) Know the blennies. Coral — The Marine Aquarium Magazine, April-May 5:25–39

Hastings PA, Springer VG (2009) Systematics of the Blenniidae (combtooth blennies). In: Patzner RA, Goncalves EJ, Hastings PA, Kapoor BG (eds) The biology of blennies. Science Publishers, Enfield, p 3–30

Hiatt RW, Strasburg DW (1960) Ecological relationships of the fish fauna on coral reefs of the Marshall Islands. Ecol Monogr 30:65–127

Hobson ES (1974) Feeding relationships of teleostean fishes on coral reefs in Kona, Hawaii. Fish Bull 72:915–1031

Randall JE (1983) Red Sea fishes. IMMEL Publishing, London

Randall JE, Allen GR, Steene RC (1997) Fishes of the Great Barrier Reef and Coral Sea. University of Hawaii Press, Honolulu

Sano M, Shimizu M, Nose Y (1984) Food habits of teleostean reef fishes in Okinawa Island, Southern Japan. University Tokyo Bull 25:1–128

Zvuloni A, Armoza-Zvuloni R, Shaked Y (2011) Multifocal bleaching of *Millepora dichotoma* in the Gulf of Aqaba (Eilat), Red Sea. Mar Ecol Prog Ser 441:25–32

Editorial responsibility: Charles Birkeland, Honolulu, Hawaii, USA; Matthias Seaman, Oldendorf/Luhe, Germany

Submitted: June 15, 2012; Accepted: August 14, 2012
Proofs received from author(s): August 21, 2012