

REEF CHECK SPOTLIGHT: MYSTERY IN THE RED SEA - CIRCULAR FEEDING SCARS OBSERVED ON FIRE CORAL

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During our Reef Check (RC) surveys in February 2012 at Marsa Shagra, Red Sea, Egypt, we observed some strange circular blotches on a fire coral *Millepora dichotoma*. We sent these pictures to RC and made an inquiry to several experts with no conclusive outcome.

Initially we took the following explanations into consideration:

- Feeding scars by *Coralliophila* snails
- Feeding scars by juvenile Crown of Thorns seastars (COTS)
- Some kind of coral disease
- Anomaly of *Millepora*

Coralliophila is frequently observed on *Porites* corals, where it produces slight feeding scars, whereas the tissue remains mainly alive and intact. These feeding scars are quite different from the feeding scars caused by *Drupella* snails that completely remove the living tissue, leaving behind bare white skeleton. So, the impact of *Coralliophila* on *Porites* is better characterized as a parasite than as a predator. But *Coralliophila* feeds exclusively on *Porites* and is most unlikely to feed on any other corals, including *Millepora*. Another point against *Coralliophila* is that they were obviously absent on *Millepora*, whereas they are usually observed in close vicinity due to their small feeding territory.

Juvenile COTS are ruled out, because COTS tend to create paths instead of single blotches. We actually have observed a young COTS feeding scar on a *Favia* coral during our surveys; the tissue was completely removed – in contrast to those circular blotches on *Millepora* that appeared a bit bleached but not grazed down to the bare skeleton. Later, we found out from Prof. Rupert Ormond that COTS actively avoid *Millepora* because they are stung by it!

Some kind of coral disease might also have been the cause, but an infection with ciliates or bacteria tends to spread over the whole colony and does not form such equal sized and sharp edged blotches.

At that time, we preferred the explanation of an anomaly of *Millepora*. I observed in my aquarium that *Millepora* often forms "tissue bubbles" at branches as well as "bleached" small areas. But not such perfectly round patches.

So we uploaded the pictures to [RC Europe's homepage](#) and posted an inquiry through the "NOAA Coral List Server," from which we received more than 20 emails with possible explanations. These ranged from feeding scars by COTS, *Coralliophila*, *Drupella*, parrotfish, damselfish, butterflyfish, filefish, blennies (*Exallias brevis*), corallivorous flatworms, White Pox disease, a secondary infection of a feeding scar and a special form of bleaching.

Zvuloni *et al.* (2011), described exactly the same phenomenon in *Millepora* as "Multifocal Bleaching", but they didn't determine the reason for these patches. They suggested a form of bleaching, a "new syndrome in *Millepora*", possibly caused by a microbial infection.

Finally, Dr. Bruce Carlson in Hawaii solved this mystery by uploading a [video](#) showing the feeding behaviour of the leopard blenny, *Exallias brevis*, and describing the exact mechanism how it forms these remarkable feeding scars:

Exallias brevis is an obligate corallivore that scrapes off the tissue with its upper jaw while anchoring the mouth with its lower jaw, producing sharp edged, circular feeding scars! Indeed, all of those blotches, even those published in Zvuloni's paper showed a faint white line under the circular feeding bite! "*That line represents the lower jaw that anchors the mouth while the upper jaw sweeps over the coral and removes the tissue.*" Carlson stated. He also mentioned that on the picture "*some of the older scars have regenerated a bit and a newer scar overlaps the older scar. That can only be produced by feeding, i.e., it rules out bleaching or disease.*" Carlson is submitting a paper to Marine Ecology Progress Series with a complete description of the feeding behavior of *Exallias brevis*.

Carlson (1992) found out that only the superficial coenosarc tissue was removed while the polyps remained mostly intact within calyces and that these marks regenerated within 50 days. He observed *E. brevis* feeding exclusively on living corals, at rates of 13.9 and 28.4 bites per hour for males and females, respectively. He sized the circular feeding bites on *Porites lobata* to $2.04 \pm 0.42 \text{ cm}^2$.

Dr. Carlson has observed *E. brevis* feeding on *Millepora* as well at Enewetak Atoll in the Pacific. Dr. Jürgen Herler stated, that *E. brevis* removes coral tissue, at least for breeding, and he sent a photo with the fish and its egg patches on a *Millepora* in the Red Sea. Finally, Christian von Mach confirmed that he observed *E. brevis* feeding on *Millepora* in the Gulf of Aqaba / northern Red Sea.

In the following days we had a lively discussion upon this matter....

Why have these circular patches not been reported until now?

Why has it been such a problem (for many experts) to determine these patches as Exallias brevis feeding scars?

We have conducted Reef Check surveys in that area for four years, but this was the first year we observed these circular patches. If *Exallias brevis* is not very abundant, divers would have seen just a minor density of feeding scars. Thus, this phenomenon may not have been obvious, being perceived only by a watchful observer, who knows about coral diseases, coral bleaching and feeding scars. Additionally, *E. brevis* hides deep within *Millepora* thickets, so any observer would have to come really close and rest for a while to watch *E. brevis* feeding. Such an observer would have to be quite persistent to get an answer about whatever is responsible for these blotches. So we think that this phenomenon has simply not been recognized and / or been acknowledged to be published so far.

Furthermore, most divers and snorkelers may avoid coming too close to *Millepora*, because it's also called "fire coral". Also, the preferred habitat of *Millepora* and *E. brevis* is around the reef crest at shallow depth, whereas most divers are going to 10-30m depth.

E. brevis may show some ecological differences within it's range from the Red Sea, Madagascar and India to Australia, and Hawaii. In the Egyptian Red Sea we've observed *E. brevis* always within the *Millepora* thickets at shallow depth around the reef crest. We didn't observe it on any other corals, e.g. *Porites*, where it was mainly observed by Dr. Carlson in Hawaii.

It's quite possible that in some cases, disease may in fact simply be some kind of feeding scar.

Stories like this one happen when thousands of Reef Checkers put their eyes on the reef, with a focus on all kinds of human impacts, coral damage, recently killed corals, bleaching, coral diseases, and COTS feeding scars.

But one part on this mystery remains: similar scars on *Millepora complanata* have been observed by scientists from Bermuda, the Florida Keys, the Mexican Caribbean and Pernambuco, Brazil. So far, no one has identified the fish that creates these spots.

Exallias brevis does not occur in the Caribbean but it has close relatives there. Charles Delbeek mentioned that *Ophioblennius atlanticus* has a very similar mouth structure to *E. brevis* and lives in close proximity to stands of Caribbean fire coral.

There are many secrets on the reef waiting to be uncovered and we are still searching for a corallivore equivalent of *E. brevis* in the Caribbean.

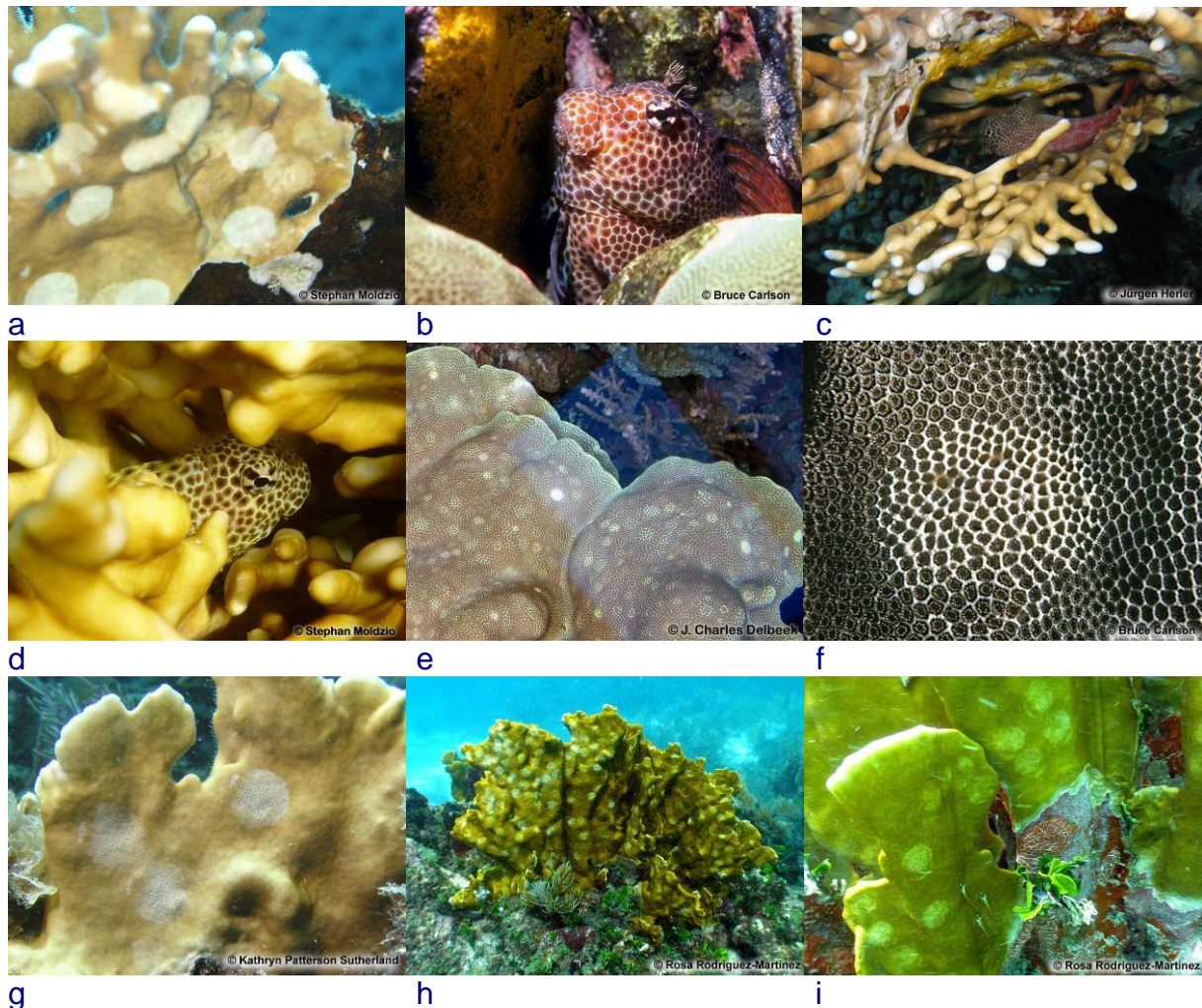


Figure 1: (a) feeding scars on *Millepora dichotoma* at Marsa Shagra, Egypt, Red Sea ; (b) leopard blenny *Exallias brevis* guards his nest, Hawaii, Central Pacific ; (c) *E. brevis* with nest inside *M. dichotoma*, Red Sea ; (d) *E. brevis* deep inside the *Millepora* thicket at Marsa Shagra, Egypt, Red Sea ; (e) feeding scars on *Porites* caused by singular bannerfish *Heniochus singularis* ; (f) feeding scar on *Porites* caused by *E. brevis* ; (g) unID feeding scars on *Millepora complanata* at Conch Reef, Florida Keys; (h; i) unID feeding scars on *M. complanata* at Puerto Morelos reef, Mexico, Caribbean Sea