

Short note/ Kurze Mitteilung

A feeding partnership between *Octopus cyanea* and fish predators in the Red Sea

Eine Fressgemeinschaft zwischen *Octopus cyanea* und Fischräubern im Roten Meer

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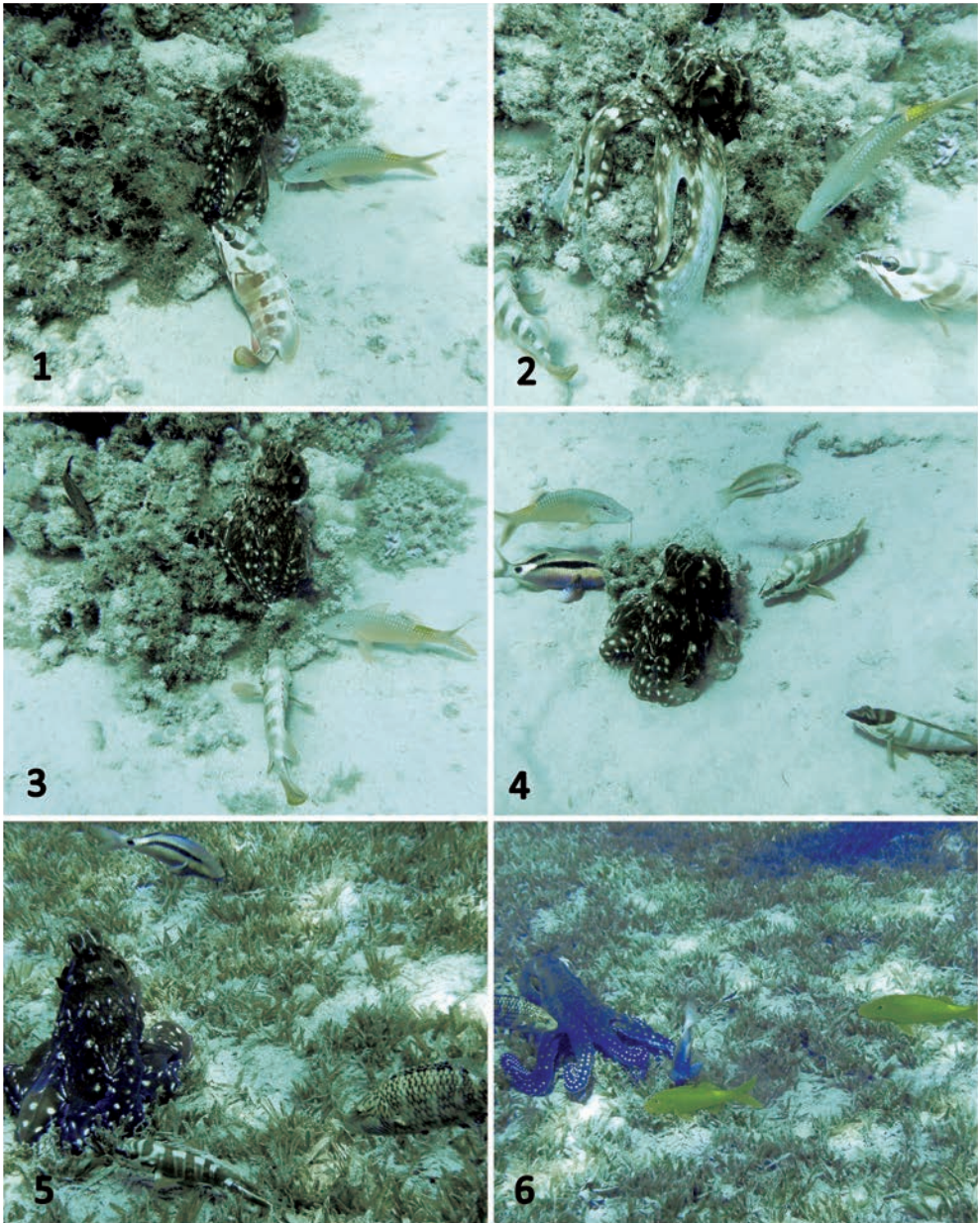
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Zusammenfassung: *Octopus cyanea* ist der einzige tagaktive Vertreter seiner Gattung. In Dahab (Sinai, Ägypten) wurden Fressgemeinschaften zwischen *O. cyanea* und verschiedenen räuberischen Fischarten beobachtet. Dabei wühlt der Krake den Sandboden derart tief auf, dass auch größere Objekte wie Garnelen, Krabben und Fische freigelegt werden, die nicht nur vom Oktopus, sondern auch von räuberischen Fischen erbeutet werden können. Bei diesem Akt sammeln sich schnell die Sägebarsche *Cephalopholis argus* und *Epinephelus fasciatus* sowie die Meerbarbe *Parupeneus cyclostoma*, dazu verschiedene Kleintierfresser wie Lippfische und andere *Parupeneus*-Arten. Der Auslöser für das Verhalten der Begleitfische ist offensichtlich das Erscheinen des Kraken aus seinem Versteck und nicht erst die Wühltätigkeit, wie bei anderen solchen Partnerschaften.

Octopus cyanea Gray, 1849, called Big Blue or Day Octopus, is unique because it represents the only day active species within the genus. Its distribution comprises the tropical Indo-Pacific, including the Red Sea. As consequence of the Lessepien migration it was found also at the Mediterranean coast of Israel (MIENIS 2003). It forages and hunts for mollusks, shrimps, crabs and fish (BOLETZKY & HANLON 1983). Also cannibalism was found among the genus *Octopus* (AMBROSE 1967). Other predators of cephalopods are especially sea mammals like walruses, sea lions and sea bears (KLAGES 1996).

In the scope of investigations of feeding partnerships in tropical reefs the behavior of *O. cyanea* in the reefs of Dahab (Sinai, Egypt) became obvious. Three observations of interspecific feeding assemblages could be made in October 2016 in depths of 5-10 m which were documented by photos (figs 1-6). *O. cyanea* proved to be a sand burrower like goatfish (Mullidae), rays (Rajidae, Trygonidae), and starfish (*Astropecten* spp.) (FRICKE 1970, 1975; JAERISCH et al. 2010; MOOSLEITNER 1982, 2008; VELTE 2006; ZANDER 2013, 2016).

When *O. cyanea* starts hunting, it leaves its hiding hole in the reef and creeps to the sand bottom (figs 1-2). Immediately, before the octopus reaches the ecotone of reef and sand bottom, several of the potential follower fish species appear, e.g. *Parupeneus cyclostoma* (Mullidae) or *Epinephelus fasciatus* (Serranidae). Within only four minutes a further *E. fasciatus*, a *Cephalopholis argus* (Serranidae), a *Thalassoma rueppellii* (Labridae) and a *Parupeneus macronema* (Mullidae) joined this assemblage (figs 3-4). *Cheilinus abudjubbe* (Labridae), *Parupeneus forskali*, and *Epinephelus fasciatus* were also found in an eelgrass habitat as followers of the day octopus and, additionally, *Chaetodon paucifasciatus* (Chaetodontidae) (fig. 5). It is remarkable that in this place also two yellow colored *Parupeneus cyclostoma* appeared (fig. 6). In another sand habitat *P. cyclostoma*, *C. argus* and *T. rueppellii* were present again. The status of *P. cyclostoma* as predator was directly observed by the specimen of figures 1-4 which swallowed a larger object, probably a great shrimp. Because *O. cyanea* with its strong arms is able to burrow in deeper layers of the bottom than goatfish, also larger macrofauna can be attained.



Figs 1-6: Feeding partnerships of *Octopus cyanea*. **1-4** Photo sequence of a feeding partnership between *O. cyanea* and fish species which forage for crayfish and fish in sand bottoms. *O. cyanea* leaves its hiding place in the reef (**1**), moves onto the ecotone of reef and sand bottom (**2, 3**) and begins to burrow in the sand bottom; during this time several participating fish species join like *Thalassoma rueppelli*, *Parupeneus macronema* and also the fish predators *Epinephelus fasciatus*, *Cephalopholis argus* and *Parupeneus cyclostoma* (**2-4**). **5-6** Feeding partnership of *O. cyanea* on the sand bottoms of eelgrass habitats. The first followers were *E. fasciatus*, *Parupeneus forsskali* and *Oxycheilinus abudubje* (**5**); later also specimens of *P. cyclostoma* (here the yellow variety) joined the assemblage (**6**).

The feeding partnership of *O. cyanea* means that even fish predators can gain prey by an efficient way of foraging. The compilation of the follower assemblage of *Octopus cyanea* is a very special one and differs from those of goatfish followers. Whereas representatives of Labridae are characteristic associates of burrowing goatfish (MOOSLEITNER 1982, 2008; ZANDER 2016), here also fish predators like serranids and *P. cyclostoma* were regularly attracted. The releaser for this behavior may be not only the disturbance of the sediment but also the mere appearance of the octopus. This behavior should be learned by activation of special inherited patterns in the brain by improving the memory after repeated special environmental impressions (MAUSFELD 2001). The observed partnership is advantageous for the followers, because these can economize the pursuing energy for prey which is supplied by the octopus. This may be a mechanism in all interspecific feeding partnerships (ZANDER 2013).

Literature

- AMBROSE, R. F. 1984. Food preferences, prey availability, and the diet of *Octopus bimaculatus* Verrill. *Journal of Experimental Marine Biology and Ecology* 77, 29-44.
- BOLETZKY, S. VON, & R.T. HANLON 1983. A review of the laboratory maintenance, rearing and culture of cephalopod molluscs. *Memoirs of the National Museum of Victoria (Melbourne)* 44, 147-187.
- FRICKE, H. W. 1970. Zwischenartliche Beziehungen der tropischen Meerbarben *Pseudupeneus barberinus* und *Pseudupeneus macronema* mit einigen anderen marinen Fischen. *Natur und Museum* 100, 71-80.
- FRICKE, H. W. 1975. The role of behaviour in marine symbiotic animals. *Symposia of the Society for Experimental Biology* 29, 581-593.
- JAERISCH, J., C.D. ZANDER, & O. GIERE. 2010. Feeding behaviour and feeding ecology of two substrate burrowing teleosts, *Mullus surmuletus* (Mullidae) and *Litbognathus mormyrus* (Sparidae), in the Mediterranean Sea. *Bulletin of Fish Biology* 12, 27-39.
- GOODMAN-LOWE, G.D. 1998. Diet of the Hawaiian monk seal (*Monachus schauinslandi*) from the northwestern islands during 1991 and 1994. *Marine Biology* 132, 535-546.
- KLAGES, N.T.W. 1996. Cephalopods as prey II. Seals. *Philosophical Transactions of the Royal Society, London, Biological Sciences B* 35, 1045-1052.
- MAUSFELD, R. 2001. What's within? Can the internal structure of perception be derived from regularities of the external world? *Behavioral and Brain Sciences* 24, 689-690.
- MIENIS, H.K. 2003. Marine mollusks from the eastern Mediterranean. 14. The first finds of *Octopus cyanea*. *Spirula* 333, 88-89.
- MOOSLEITNER, H. 1982. Freßgemeinschaften auf Sandböden im Mittelmeer. *Zoologischer Anzeiger* 209, 269-282.
- MOOSLEITNER, H. 2008. Freßgemeinschaften mit Meerbarben (Mullidae) im tropischen Indopazifik. *Bulletin of Fish Biology* 10, 55-67.
- RANDALL, J.E. 1967. Food habit of reef fishes of the West Indies. *Proceedings of the International Conference on Tropical Oceanography, Miami Beach, Florida* 5, 655-847.
- VELTE, F. 2006. Freiwasserbeobachtungen bei Kreta zur Freßgemeinschaft zwischen der Streifenmeerbarbe und anderen Fischen. *Verhandlungen der Gesellschaft für Ichthyologie* 5, 117-127.
- ZANDER, C.D. 2013. Partnerschaften versus Parasitismus bei Fischen. *Bulletin of Fish Biology* 14, 89-96.
- ZANDER, C.D. 2015. Predatory attack on spawn of damselfish by parrotfish in the Caribbean. *Bulletin of Fish Biology* 15, 137-139.
- ZANDER, C.D., 2016. Quantitative analysis of five symbiotic relationships of fishes from Dahab (Egypt, Red Sea). *Bulletin of Fish Biology* 16, 47-60.

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Abb. 1-6: Freßgemeinschaften von *Octopus cyanea*. **1-4** Fotoabfolge einer Freßgemeinschaft auf Sandböden von *O. cyanea* und Fischarten, die sich von Krebsen und anderen Fischen ernähren. *O. cyanea* verlässt sein Versteck im Riff (1), bewegt sich zur Grenze von Riff und Sandboden (2-3) und beginnt den Boden aufzuwühlen; während dieser Tätigkeit erscheinen die ersten teilhabenden Fischarten wie *Thalassoma rueppelli* und *Parupeneus macronema* sowie auch die Fischprädatoren *Epinephelus fasciatus*, *Cephalopholis argus* und *Parupeneus cyclostoma* (2-4). **5-6** Freßgemeinschaft von *O. cyanea* auf den Sandböden von Seegraswiesen. Die ersten Folger waren *Epinephelus fasciatus*, *Parupeneus forsskali* und *Oxycheilinus abudubhe* (5), etwas später schwammen auch Exemplare der gelben Variante von *P. cyclostoma* heran (6).