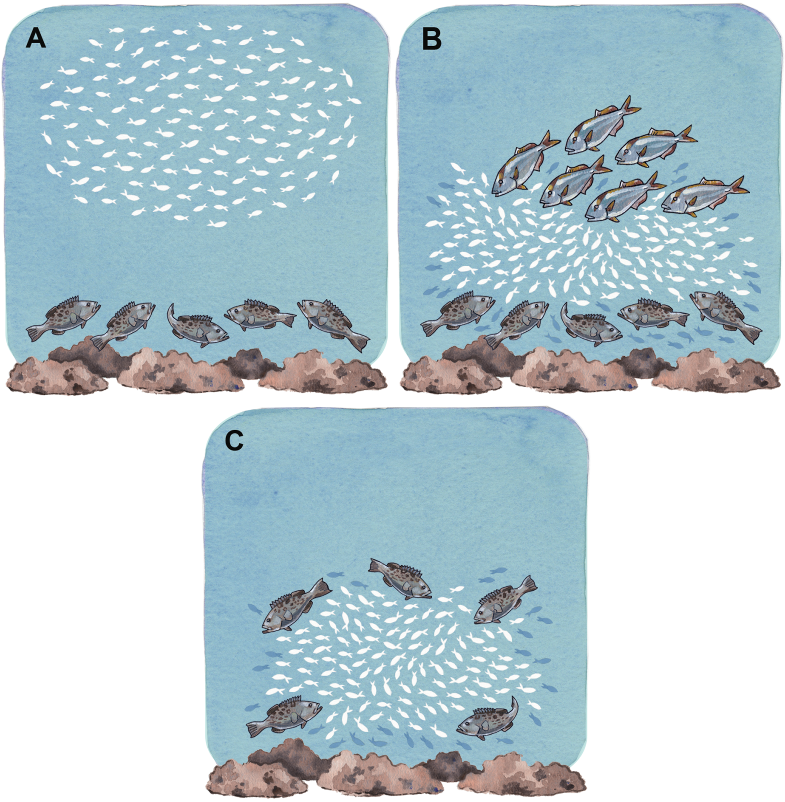
BULLETIN OF MARINE SCIENCE. 88(2):317–318. 2012
http://dx.doi.org/10.5343/bms.2012.1004

INTRASPECIFIC COOPERATION FACILITATES SYNERGISTIC PREDATION

Christopher D Stallings and Andrea L Dingeldein



The presence of multiple feeding behaviors can increase the vulnerability of prey beyond the additive effects of individual behaviors. Evidence for such synergistic effects has previously come from studies involving multiple species exhibiting distinct feeding tactics toward common prey (e.g., Hixon and Carr 1997) and direct observations have been limited (e.g., Bshary et al. 2006). We observed this multi-species interaction plus one that has not been previously described on May 13, 2011, while diving on a rocky reef located at 16 m depth in the Apalachee Bay region of the northeastern Gulf of Mexico. The cooperative interactions involved the benthic-oriented gag, *Mycteroperca microlepis* (Goode and Bean, 1879) (nine individuals 30–40 cm total length, TL), and midwater-oriented greater amberjack, *Seriola dumerili* (Risso, 1810) (eight individuals 50 cm TL), feeding on a school of planktivorous prey fishes (> 1000 individuals comprising engraulids and clupeids 3–5 cm TL). The school of prey fishes hovered ~2 m above the reef, just high enough to apparently reduce predation potential by the piscivorous *M. microlepis* (A). Both the prey fishes and *M. microlepis* were present for the entire duration of our observations while *S. dumerili* were present intermittently as they swam the expanse of the 20,750 m^2 reef. Each time the *S. dumerili* approached the prey fishes, they would rapidly swim in a downward motion in an apparent attempt to capture the prey from above. This action pushed the school of prey fishes toward the reef where *M. microlepis* were located. The presence of *M. microlepis* reduced prey refuge within the reef while that of *S. dumerili* reduced refuge in the water column, thus allowing increased feeding opportunities for both predatory fishes (B, interspecific cooperation). When the *S. dumerili* swam away, the prey resumed

© 2012 Rosenstiel School of Marine and Atmospheric Science of the University of Miami

their safe distance above the reef. However, several *M. microlepis* (2–4 at a time) then swam 3–4 m off the bottom, above the prey fishes, and corralled them back down toward the reef in a similar manner, albeit at a slower rate compared to *S. dumerili* (C, intraspecific cooperation—behavior not previously described). Nonetheless, the effect was similar, with a compression of the school of prey fishes and increased feeding opportunities for the *M. microlepis. Mycteroperca microlepis* exhibited this dual midwater and benthic feeding and swimming behavior three times during an 8-min period, thus having a similar effect as that of two predatory species.

These observations, particularly those involving intraspecific cooperation, raise some interesting questions. First, did consumption rates increase when *M. microlepis* exhibited both midwater and benthic behaviors? Although we were unable to quantify consumption rates during the rapid feeding events, they clearly increased for *M. microlepis*—as evident from observed manipulation and swallowing of prey—that remained near the bottom when prey were corralled toward them relative to when prey remained higher in the water column. Interestingly, we did not observe prey capture by *M. microlepis* performing the midwater role, yet we can assume these individuals experienced higher energetic costs and associated risks of swimming above the reef rather than remaining near it. Coordinated hunting involving role differentiation where certain individuals benefit more than others (e.g., via differences in risk or prey consumption) has been reported for only a few species and never for fishes, but appeared to be the case here. Perhaps individuals switched roles between feeding events (e.g., Sancho 2000), but we were unable to confirm that from our observations. Furthermore, how common are the observed intraspecific behaviors? Other researchers have also recently reported the typically benthic-oriented *M. microlepis* swimming high above the reef in the Gulf of Mexico (Z Biesinger and W Lindberg, unpubl data) and Atlantic Ocean (Auster et al. 2009). Intraspecific cooperative hunting may provide a mechanistic explanation to these other observations. However, if the behavior was contextual, how did the *M. microlepis* come to acquire it? The observation was made while conducting a study across 18 reefs that are surveyed on a seasonal basis. Although both *M. microlepis* and schools of prey fishes co-occurred on 13 of 18 reefs surveyed during the spring census, the corralling behavior by *M. microlepis* was observed on the only reef where interspecific cooperation involving both *M. microlepis* and *S. dumerili* was also observed. Moreover, *M. microlepis* did not exhibit the midwater swimming behavior when *S. dumerili* were present. Perhaps the alternating behaviors were coincidental, but if not, it could suggest that *M. microlepis* were imitating *S. dumerili.* Although there is no prior evidence that *M. microlepis* possess the cognitive abilities required for imitation, social transmission of feeding behaviors has been demonstrated in other members of their family (Serranidae; Anthouard 1987) and has been suggested to be an important aspect of their spawning behaviors (Bolden 2000). Obviously, caution is required for interpreting a novel, yet single observation. Our aim in documenting this observation is to pique the interest of field ecologists so that we may ultimately better understand the commonality and ecological implications of such behaviors.

Literature Cited

Anthouard M. 1987. A study of social transmission in juvenile *Dicentrarchus labrax* (Pisces, Serranidae), in an operant conditioning situation. Behavior. 103:266–275. http://dx.doi.org/10.1163/156853987X00206

Auster PJ, Godfrey J, Watson A, Paquette A, McGall G. ~~2009. Behavior of prey links midwater and~~ demersal piscivorous reef fishes. Neotrop Ichthyol. 7:109–112.

Bolden SK. 2000. Long-distance movement of a Nassau grouper (*Epinephelus striatus*) to a spawning aggregation in the central Bahamas. Fish Bull. 98:642–645.

Bshary R, Hohner A, Ait-el-Djoudi K, Fricke H. 2006. Interspecific communicative and coordinated hunting between groupers and giant moray eels in the Red Sea. PLoS Biol. 4:e444.

Hixon MA, Carr MH. 1997. Synergistic predation, density dependence, and population regulation in marine fish. Science. 277:946–949.

Sancho G. 2000. Predatory behaviors of *Caranx melampygus* (Carangidae) feeding on spawning reef fishes: a novel ambushing strategy. Bull Mar Sci. 66:487–496.

Date Submitted: 20 January, 2012.
Date Accepted: 2 March, 2012.
Available Online: 21 March, 2012.

Addresses: (CDS) 1: *Florida State University Coastal and Marine Laboratory, 3618 Coastal Highway 98, St. Teresa, Florida 32358.* 2: *College of Marine Science, University of South Florida, 140 7th Avenue South, St. Petersburg, Florida 33701.* Present Address: *College of Marine Science, University of South Florida, St. Petersburg, Florida 33701.* (ALD) *Department of Biology and Marine Biology, University of North Carolina Wilmington, 601 S. College Road, Wilmington, North Carolina 28403.* Corresponding Author: (CDS) *Telephone: 727-553-3371, Fax: 727-553-1189, E-mail: <stallings@usf.edu>.*