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A study on foraging behavior of four species in the genus *Pterogobius* (Pisces: Gobiidae), with note on speciation

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The analysis of the phylogenetic relationships among *Pterogobius* species confirmed that the genus *Pterogobius* was monophyly and was divided into two groups. One was a group including *Pterogobus virgo* and *Pterogobius zacalles* and the other included *Pterogobius elapoides* and *Pterogobius zonoleucus*.

P. virgo foraged mostly on polychaetes by fin digging in the sandy bottom. Fin digging behavior consisted of a repeated identical sequence of activities throughout daylight time. Fin digging usually comprised pectoral fin swing and swing of pectoral fin and body. This species always foraged at the same spot during the daytime.

P. zacalles were observed at two size classes at study site. Two sizes of fish coexist in the same habitat and foraged on benthic invertebrates. This species held on to feeding territory. The large fish included or overlapped one or two territories of the small fish. The large fish foraged mainly on prey from the muddy substrates among boulders, while the small fish consumed mainly prey from the surface of boulders. The overlapping of feeding territory results from the partition of foraging sites.

The main prey item of *P. elapoides* shifted from pelagic invertebrates and algal invertebrates to benthic invertebrates with growth. Ontogenetic diet shifts of *P. elapoides* were accompanied with shift of foraging behaviors and microhabitats. This species temporarily defend their feeding territory in foraging on benthic invertebrates. In general, feeding territory sizes were usually influenced by food and competitor abundance. In this species, shelter was also very important factors in the determination of feeding territory size.

P. zonoleucus is a shoaling goby and only foraged on pelagic copepod. The shoals were always situated in upper reefs covered with large brown algae and were quite stationary. Feeding rates and shoal sizes were positively correlated with prey densities in water column. Nearest neighbor distance decreased with increasing prey density, up 1991/m^3, while individuals constantly maintained nearest neighbor distance, when prey density was over 2038 /m^3 in the water column. It suggests that the individuals in the shoal control the balance between foraging and antipredator behavior.

Morphological, ecological, foraging behavioral attributes of *Pterogobius* species are very diverse. The genus *Pterogobius*, however, is monophyly. Ecological attributes coincide with phylogentic relationships. This suggests that the evolution of reproductive isolation among *Pterogobius* species correlates with consequence of resource-based divergent natural selection and resource competition. This may lead to ecological speciation of the genus *Pterogobius*.

Key words: Gobiidae, *Pterogobius virgo*, *P. zacalles*, *P. elapoides*, *P. zonoleucus*, foraging behavior, speciation