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Exploratory II

Environmental Effects on Foraging in *Gobiesox maeandricus*

Introduction: The northern clingfish, *Gobiesox maeandricus*, is a small fish inhabiting the eastern Pacific rocky intertidal from southern Alaska (Lamb and Edgell, 1986) to Baja California (Eschmeyer et al., 1983). Specifically, it lives underneath boulders and seaweeds (Martin and Bridges, 1999), and feeds on mollusks, benthic crustaceans, and polychaetes (Fishbase, 2008); however, little is known about its specific foraging habits (Fishbase, 2008). Many fish, for instance, are known to feed nocturnally; nocturnal feeding may be due to food availability at night (Annese and Kingsford, 2005), but is sometimes used to avoid predation (Fischer, 2004). Some fish, such as the stone loach (*Barbatula barbatula*), have a strict nocturnal feeding pattern and will not feed during daylight under any circumstances, while others may shift to daylight feeding hours in the absence of a predator (Fischer, 2004). This experiment sought to determine whether or not *G. maeandricus* displays a nocturnal feeding pattern, as well as to determine whether or not its foraging habits can be manipulated with its environment. Our hypothesis is that *G. maeandricus*, being a small fish, is nocturnal in its natural environment, but that when denied shelter or when given extensive shelter, it will feed at all times of day.

Materials & Methods: Three *G. maeandricus* individuals, one from Fossil Point and two from Cape Arago in Charleston, OR, were collected and placed in separate cages in a water table. One individual was provided with no shelter; only small pebbles were used to weigh the cage down, but none were large enough to provide shelter to the fish (*Fig. 1c*). The second was placed in a cage that was entirely sheltered (*Fig. 1b*), and the

third was placed in a "varied" habitat cage where one half was sheltered and the other half was unsheltered (*Fig. 1a*). Rectangular, plastic storage containers were used as cages; holes were drilled into the short sides to allow for water movement. Square, flattened blocks of concrete, each with a hollowed out "scoop" in the center, were used as shelter for the fish. Prior to the experiment, several food items (small limpets, polychaetes, and littorine snails) were fed to the fish to determine their preferred prey. The polychaetes were eaten the most frequently and quickly, and were therefore used for the 3 day foraging experiment. Each morning, five freshly caught polychaetes were given to each fish; they were placed at random in the unsheltered cage and sheltered cages and in the unsheltered portion of the varied cage. At nighttime, fish were provided with a number of polychaetes varying between 3 and 5, depending on availability. Each morning and evening, remaining worms were counted in each cage; the number and portion of worms eaten was noted and attributed to the previous time period (day or night). At night, a black plastic bag was placed over the cages to block out any lights that may have been turned on during the night.

Results: The unsheltered fish ate all polychaetes given, day and night; the sheltered fish ate a low number of polychaetes, and the fish with varied habitat did not eat throughout the experiment (*Fig. 2*). Out of the polychaetes eaten by the sheltered fish, 67% were eaten during nighttime; the other two fish displayed no differential foraging pattern during day or night.

Discussion: These results contradict the hypothesis that *Gobiesox maeandricus* is a nocturnal forager, as well as the hypothesis that its foraging schedule can be manipulated by supplying or denying shelter. Only one individual (the sheltered) displayed any

foraging difference, and this was based on a total of three worms eaten over the course of the experiment; this is not a large enough number to determine a true foraging pattern.

The results may be due to a combination of shelter being used for predation avoidance by the fish (without any diurnal pattern) and serving as shelter for the polychaetes. The unsheltered fish was the smallest, yet it ate 100% of the worms provided, while the fish in varied habitat, despite being the largest of the three, ate none. It is possible that, when provided with shelter, *G. maeandricus* does not venture out to forage, but rather eats whatever food it finds within its shelter. The unsheltered fish may have eaten more because its prey was easily visible, and it did not have to leave any shelter to forage; it was already out in the open. The sheltered fish, meanwhile, also did not have to leave its shelter to forage, but had a more difficult time capturing its prey in the dim light underneath its shelter.

It is also possible, however, that the fish were under varying levels of stress from being placed in laboratory conditions; the time from capture to the experiment, as well as the trial period of the experiment, may not have been long enough. Furthermore, a sample size of only three fish may not have been large enough to yield conclusive results. Finally, the preliminary feeding preference test was not conducted using the larger fish; it is possible that these fish may not prefer polychaetes as much as the smaller, unsheltered fish did. In order to yield more conclusive results, it would be prudent to repeat the experiment with a greater number of fish. It would also be important to allow a period for adjustment to laboratory conditions, a longer experimental time period, and fish of similar size with similar prey preferences.

Figure 1: Diagram of different cages providing different habitats for *G. maeandricus* individuals: A) = Varied habitat, B) = Sheltered Habitat, C) = Unsheltered habitat.

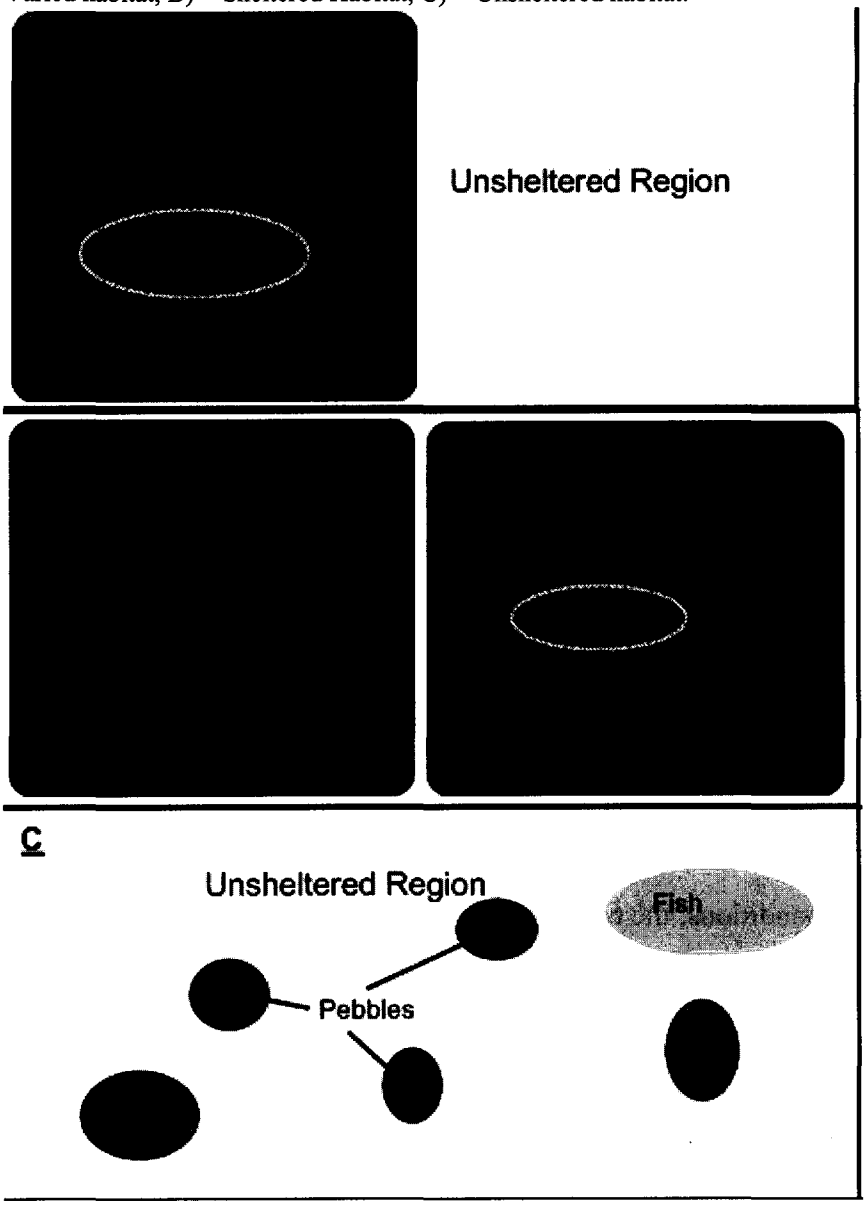
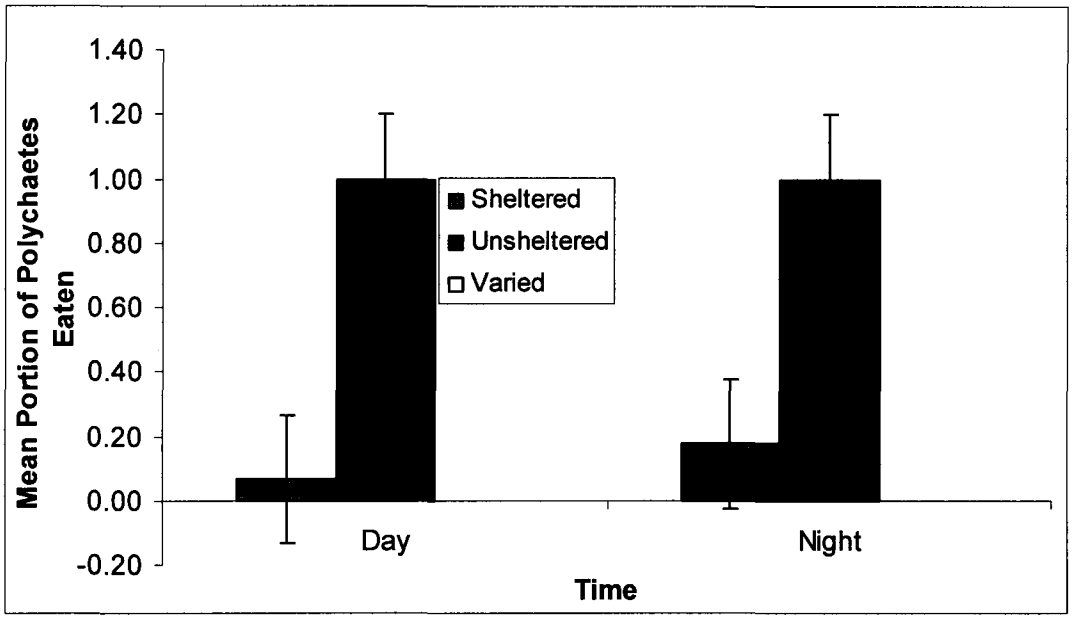


Figure 2: Polychaete predation levels for each individual fish during different time periods (day and night).



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