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***Caranx latus* (Carangidae) Chooses Dock Pilings to Attack Silverside Schools:
A Tactic to Interfere With Stereotyped Escape Behavior of Prey?**

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In predator-prey dynamics, structural complexity of the habitat is traditionally considered to convey benefits to prey (1, 2, 3). Alternatively, Flynn and Ritz (4) have proposed that habitat structures may interfere with escape behavior in tightly aggregated formations of prey. Field observations of horse-eye jack, *Caranx latus*, suggest that this fish predator may exploit habitat structure to interrupt stereotyped prey defense. The jacks were observed attacking mixed schools of silversides (Engraulidae, Clupeidae, Atherinidae) near Wee Wee Caye, a mangrove island in Belize. Attacks were observed exclusively under a dock where silversides routinely gathered. In this paper I describe the jack hunting patterns, and develop a spatial model based on the argument that dock pilings interfere with prey escape and have therefore become the driving factor for the predator to attack only under the dock.

Holding on to a dock piling, I recorded predator presence, absence, and attack events continuously for 90-minute sessions three times per day spaced evenly from 0550 to 1800. Attacks were evident from the sudden accelerations of the predator group, the scattering behavior of the prey, and the remains of the prey that were often visible in the aftermath. Subsequently, I tracked the predator schools in their excursions beyond the dock. The path of the school was constructed by swimming behind it and recording my positions with reference to a grid of shore points and submerged landmarks.

While under the dock I observed 31 attacks in 3 days. Through tracking observations, groups of *C. latus* comprising 4–25 individuals were identified; these predators traveled in loops up to 70 m in length, and each time returned to the dock to attack (Fig. 1A). During the 5-day sampling period, every attack recorded during 15 observation sessions ($n = 40$); 8 stationary sessions, $n = 31$; 7 tracking sessions, $n = 9$) was between the pilings under the dock, although the predators would calmly cruise through the same dense aggregation of silversides just outside the dock.

Thirty-seven of the forty observed attacks were completed across an identical set of dock pilings, dubbed “hot spots.” The predators, attacking at high velocity in a straight trajectory, would cause a stereotyped avoidance response by the prey. As the silversides could not outrun the jacks in a straight line, they dashed sideways, out of the path of the attacking predators, and immediately filled in the space left in the predators’ wake. Computer modeling studies of the defensive formations of related prey (Clupeidae) have demonstrated that this observed “vacuole” formation

is a stereotyped response to a predator attack and results from individual lateral movement (5). Placed in the context of the hotspots, this lateral escape path is, in specific places, blocked by the pilings (Fig. 1B). Some prey will not be able to make the necessary lateral move and will therefore be forced to remain in the path of the predators for a longer time.

The avoidance formation, although observed at the school level, is a product of individual prey maximizing distance from the predator, and using conspecifics as shields (6). Prey may aggregate in a high density because the number of surrounding conspecifics is more effective as a shield against attack. However, under these conditions, prey-to-prey interference with escape is also greatest and exacerbates the blocking effect of the pilings.

The silversides, however, were not always present in high density. Due to their diel patterns of migration, they occupied the area under the dock only in the daylight hours. During dock observations, prey accumulation at dawn was quantified from “time at first prey sighting” until “time at homogenous distribution” (400 individuals/m³) (Fig. 1C). The predators visited the dock before and during prey accumulation. The first attack did not occur until 2 min after the highest density was attained (Fig. 1D). This predator behavior is consistent with maximizing the proposed blocking effect of the pilings.

In sum, the behavioral observations clearly indicate that the predators are choosing the dock habitat for attack. The spatial model demonstrates that dock pilings can interrupt stereotyped prey defense. Finally, the temporal attack pattern shows that these predators hunt under the dock only when the high density of the prey causes further limits on their escape. The predator thus uses both spatial and timing constraints in its hunting attacks. From these observations, I could not determine if the dock pilings and prey densities actually improved hunting efficiency since the jacks never attacked at other locations or at low prey densities. The Pacific bluefin trevally, *Caranx melampygus*, has been shown to use natural habitat structure to allow ambush attack behavior (7). Here, I show that the Caribbean *Caranx latus* selects an anthropogenic structure for its daily hunting attacks. These findings add to the repertoire of known fish hunting tactics and support the developing theory that habitat structure is not solely beneficial for prey.

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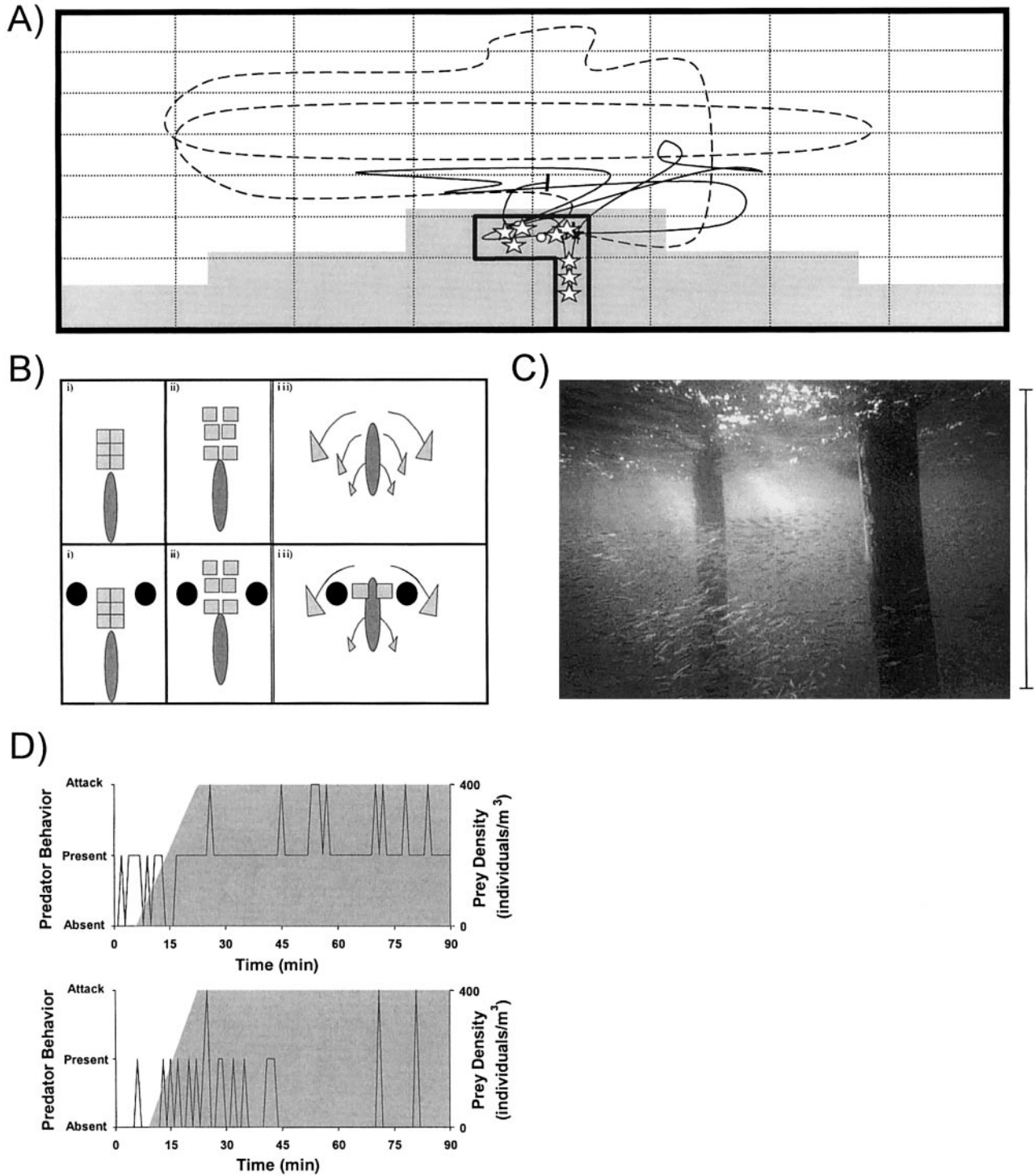


Figure 1. (A) Maps of *Caranx latus* path on 12-09-01 (0555–0640; dashed line), and 12-10-01 (0601–0630; solid line). Grid is 5 m × 10 m beyond the nearshore area. Gray area is the approximate daytime prey distribution. ☆ = attack; ○ = tracking start; | = tracking end. (B) Two-dimensional model of a silverside school splitting in an open habitat (top row); compare with a hotspot, with pilings positioned along the sides of the linear predator attack run (bottom row). Path of the prey school is adapted from the “vacuole” formation of Vabo and Nottestad (5). The oval represents the predator group of average size 10, in 2 rows of 5 fish each (observation). The rectangles each represent a group of prey (5–10 fish). For clarity, the rest of the aggregation is omitted; the focus is only on those silverside groups in the most immediate danger when the velocity of the predators increases. In the observed habitat, the prey would permeate the entire area shown. (i) The initial increase in velocity by the predator group. Split point (ii), and time of lateral movement (iii). (C) Photograph of maximum prey density (400 individuals/m³). Scale bar is 1 m. (D) Graphs of predator behavior on two mornings (12-07-01 and 12-08-01; 0550–0720) under the dock with prey accumulation data (gray).

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