Behaviors of the pelagic red crab *Pleuroncodes planipes* (Decapoda: Anomura: Galatheidae) observed in captivity.

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Abstract.—Little is known about the typical behaviors of the pelagic red crab *Pleuroncodes planipes* (family Galatheidae). The crabs were observed in an aquarium to determine the typical repertoire of behaviors. An activity budget was developed to address two important questions: 1) how important are locomotory behaviors among overall red crab behavior; and 2) what additional non-locomotory behaviors comprise the behavioral repertoire of red crabs. Locomotory behaviors executed by the crabs were only 15% of the total observed behaviors and were divided into active (90.4%) and passive (9.6%), or benthic (41.9%) and water column (58.1%) components. Active locomotory behaviors included “power swimming,” “hovering,” “walking” and “climbing,” while “sinking slowly” was the only passive behavior. The crabs spent nearly 79% of their time in feeding and grooming their exoskeleton and 6.1% interacting with other crabs. The locomotory behaviors of captive red crabs are correlated well with *in situ* observations where they feed on planktonic organisms in the surface waters during early stages of their life, alternately swimming to the surface and sinking down in the water.

INTRODUCTION

Behavioral studies contribute to understanding the interrelationship between evolutionary development and the possible environmental influences on observed behaviors (Warner, 1977; Dunham, 1983; Carefoot, 1989). The types of general behaviors common to all animals encompass locating food and feeding, mating and reproduction, defense, grooming, locomotion, and agonistic behaviors (Dunham, 1983). Locomotory behaviors mainly consist of walking, swimming, crawling, and floating; these behaviors are essential for animals to find food, escape predators, migrate to new locations or find mates.

Locomotory behaviors of crustaceans are typically responses to environmental cues (Dunham, 1983). Rhythms and orientation cues of long- or short-distanced movements are based on a variety of conditions. There are daily short migrations to feeding areas (Boyd, 1967; Aurioles-Gamboa & Pérez-Flores, 1997), long distance seasonal migrations for mating and egg-laying (Dunham, 1983; Tankersley *et al.*, 1998), migrations based on circadian and circatidal rhythms linked to temperature or light (Jansson & Källander, 1968; Dunham, 1983; Wilber & Herrnkind, 1986; Chatterton & Williams, 1994), and inshore and offshore movements in order to reduce physiological stress and mortality (Dunham, 1983; Wilber & Herrnkind, 1986; Jury *et al.*, 1994).

Galatheid crabs *Pleuroncodes planipes*, or pelagic red crabs, make daily migrations to surface waters to feed on the rich abundance of plankton found in the upwelling coastal waters of the Pacific Ocean along the Baja California peninsula (Longhurst, 1967; Kato, 1974; Aurioles-Gamboa & Pérez-Flores, 1997; Robinson & Gómez-Gutiérrez, 1998). They are found in great abundance along the western coastline of Baja California Sur (Boyd, 1962; Blackburn, 1977; Longhurst, 1967; Aurioles-Gamboa, 1992; Robinson & Gómez-Gutiérrez, 1998) where they form large surface swarms thousands of miles north of their known breeding grounds (Boyd, 1967; Longhurst, 1969; Kato, 1974; Aurioles-Gamboa *et al.*, 1994). There have been numerous studies that have focused on the pelagic red crab’s population den-
sity (Boyd, 1962; Longhurst, 1967; Aurioles-Gamboa & Pérez-Flores, 1997), its ecological role in the Baja California peninsula coastal waters and its viability as a productive fishery (Longhurst, 1967; Kato, 1974; Robinson & Gómez-Gutiérrez, 1998).

However, little is known about the typical behaviors of *P. planipes*. Kato (1974) briefly described how they swim to the surface, change posture to a parachute-shaped pose, and then feed while slowly sinking. This brief description leaves some important questions unanswered: 1) how important are locomotory behaviors to overall red crab behavior; and 2) what additional non-locomotory behaviors comprise the behavioral repertoire of the red crabs? In this study, the red crabs were observed in an aquarium to determine the typical repertoire of behaviors and to develop an activity budget for all locomotory and non-locomotory behaviors as part of an on-going larger study of locomotion in this species (Tulipani, 2005).

**MATERIALS AND METHODS**

**General procedure**

*Pleuroncodes planipes* in captivity were under frequent, but not continuous, personal observation each day. Total observation time from June 2001 to September 2003 was approximately 800 hours. At any given time over this period, there were a varying number of red crabs, from a few up to 100, in an aquarium at the University of San Diego. The crabs in captivity were videotaped and photographed at various times during the study period in support of behavior, kinematic, fluid dynamic, and locomotory behaviors analyses.

**Specimen collection and care**

In June 2001, the first group of approximately 90 *P. planipes* was collected, using a large dip net, from the surface waters at the mouth of Bahía Magdalena (24°32.89' N and 112°02.63' W) on the southwestern coast of the Baja California peninsula in Baja California Sur, Mexico. Fifteen crabs were transported live to the University of San Diego via auto-mobile. Another group of approximately 100 crabs was collected from various San Diego, California beaches during multiple stranding events that occurred over the course of nearly three weeks from the end of April to early May 2002.

The crabs were kept at the University of San Diego in a 250-gallon aquarium with a recirculating filtration and cooling system under the cycle of light (07:00 to 21:00) and dark (21:00 to 07:00) periods. In addition to daytime observations, the crabs were observed with the aid of a flashlight at various times during the dark photoperiod. The retention area of the aquarium was approximately 2.5 m (x-axis) long and 66 cm wide (y-axis) with the water depth (z-axis) approximately 1 m. The water temperature was maintained between 15–18°C. The crabs were fed squid once a day and supplemented with phytoplankton and pellet food, with all uneaten food removed after several hours.

**Activity budget**

For the purpose of developing a “typical” or “average” activity budget for the red crabs in captivity, undisturbed activities of a total of 30 randomly chosen crabs were videotaped for 15 minutes per crab, five crabs on each of six different occasions on 23 May, and 8, 12, 20, 22, and 25 June 2002. Using a 8 mm video camera model RCA Pro842 attached to a tripod, behaviors were recorded twice during morning hours (8:00 am–10:00 am Pacific Daylight-savings Time (PDT), on 8 and 25 June 2002), twice during afternoon hours (1:30 pm–4:30 pm PDT, on 20 and 22 June 2002), and twice during evening hours (6:00 pm–8:30 pm PDT, on 23 May and 12 June 2002). The tapes were each viewed twice, once to categorize the behaviors and secondly to count the number of times each behavior occurred.

The behaviors were grouped into two broad categories: locomotory and stationary, and these were further broken into subcategories that were more descriptive. Locomotory behavior was defined as that conducted when a crab moved from one place to another and included: 1) swimming (using tail-flips for propulsion)
(Fig. 1A–C), 2) sinking (Fig. 1D), 3) surface swimming pattern (whereby the crab stays near the water’s surface to feed) (Fig. 2A), 4) hovering (crab maintains vertical position within the water column by using several abbreviated tail-flips) (Fig. 2B), 5) walking (Fig. 2D), and 6) climbing (Fig. 2C).

Stationary behavior defined as the crab standing relatively still on a surface was divided into three subcategories: 1) interactions with another crab, included a) pushing, b) bumping, c) landing on (Fig. 2F), d) sparring (Fig. 2E), e) tail-flick, and f) antenna flick; 2) “grooming behavior” was based on which body part was being cleaned and usually entailed the scrubbing, rubbing, or wiping of these various body parts with one (or both) of the two modified fifth pereopods, wiping an eye with both maxillipeds, or by dragging an antenna between the maxillipeds; 3) “feeding behavior” was based on the appendage by which food was captured and transferred to the mouth region. The above-mentioned subcategories 2) and 3) had more detailed components based only on the greater variety of modes of collecting food and areas of grooming.

Each occurrence of behaviors was tallied on a datasheet during the 15-minute observation time for each crab. The tallies for each behavior were totaled and summarized. Terminology and
function described by Bauer (1989) were followed for the fifth pereopods.

Analysis of active swimming and passive sinking sequences

On 13 and 14 September 2001, the swimming activity of four crabs in the aquarium was videotaped for two hours each day, using both an RCA Pro842 8mm and a Panasonic VHS-C Palmcorder IQ model PV-IQ405D video cameras, one attached to a tripod and the other handheld. Prior to videotaping, a laminated grid (2.54 cm x 2.54 cm squares) was attached to the back of the aquarium to provide a scale of horizontal and vertical linear distance. The videos were then viewed on a Sony DA Pro 4-head VCR, Model SLV-373UC, with stop-frame capabilities. Individual swimming bouts were identified for each crab and the crab’s vertical, horizontal and diagonal movements were recorded, with particular note of ‘power swim’ segments and passive sinking segments of each bout. The elapsed duration of each swimming bout was calculated based on the start and end times recorded while reviewing the videotapes.

RESULTS

General behavioral observations

All of the captive Pleuroncodes planipes routinely observed throughout their captivity were active at all times of the day and night.
Although many of the crabs were captured swimming in surface waters, all quickly settled to a mostly benthic lifestyle when introduced to the aquarium. Common behaviors of decapods, such as swimming, climbing, feeding, grooming, molting, and interacting with each other, were noted at all times during both light and dark photoperiods. When food items, like cut squid, were dropped into the aquarium, active feeding was observed, sometimes with aggressive interactions between crabs over pieces of food. Crabs would catch, hold, and sometimes tear pieces of food with their chelipeds while eating it.

Activity budget

All of the behaviors observed throughout the period of captivity were performed by all of the red crabs. Based on the videotaped observations, captive red crabs spent 85% of their total activities performing stationary behaviors (Fig. 3). Of the stationary behaviors, the majority of their activity was feeding behaviors, which accounted for 66.4% of all observed activities where the crabs performed any of the five feeding-related activities. Grooming as a whole was 12.5% of the behaviors (Fig. 3). Interactions with other crab were 6.1% of all behaviors (Fig. 3).

Locomotory behaviors accounted for 15% of the total crabs' observed activities (Fig. 3) which included walking (35.7%), surface swimming (23.5%), power swimming (16.2%), sinking (9.6%), hovering (8.8%) or climbing (6.2%) (Table 1). These six behaviors were further categorized as active or passive movement (Table 1), but only sinking (comprising 9.6% of locomotory behaviors) was considered a passive locomotory behavior, as a crab did not actively move any of its appendages while it sank. Of all locomotory behaviors, 90.4% were active, with the crab using its appendages to move in the water column or on a surface within the aquarium (Table 1).

The locomotory behaviors were further categorized into water column or benthic for the captive crabs (Table 1) which is reflective of reported in situ behaviors of red crabs. Water column behaviors (swimming, sinking, surface swimming, and hovering) accounted for 58.1%
of all locomotory behaviors, while benthic behaviors (climbing and walking) comprised the other 41.9% (Table 1). Therefore, the crabs spent the majority of the locomotory time actively moving around in the water column.

**Locomotory behavior**

A swimming bout was a finite event that began once a crab launched itself from a surface in the aquarium and ended when the crab landed on some other surface in the aquarium (Fig. 1). For example, a complete swimming bout could start with a crab hanging head down from one of the side walls of the aquarium, then launching itself away from the wall, performing several tail-flips, alternatively sinking and tail-flip swimming, until landing on the bottom. A ‘power swim’ segment was defined as a portion of a swimming bout when a crab rapidly moved in a curved or straight path using many consecutive tail-flips without stopping until it reached the surface of the water, a side wall, or performed another maneuver (Fig. 1B).

Swimming consisted of propulsive tail-flips executed with the abdomen and tail fan while the crab adopted a streamlined swimming position, moving around in the water column. A tail-flip consisted of five sequentially occurring movements that, when combined, generated the propulsive force that moved a crab rapidly in a posterior and dorsal direction (Fig. 4A–D). First, a tail-flip started from the position where the abdomen was contracted and the tail fan was flat against the thoracic plate (Fig. 4A). Second, there was an extension of the abdomen and tail fan posteriorly (Fig. 4B). Third, when the abdomen was at its maximum extension, the tail fan was extended perpendicular to the abdomen at the fourth abdominal segment with a simultaneous abduction of the uropods (Fig. 4C). Fourth, this was followed by a rapid contraction of the abdomen with the telson and uropods still expanded (Fig. 4D). Fifth, the tail-flip ended with a contraction of the abdominal muscle to press the retracted tail fan against the thoracic plate of the crab producing a jet of water that propelled the crab posteriorly and dorsally. This final position was the same as the first and completed the tail-flip propulsion (Fig. 4A).

During some swimming bouts, crabs could hover in mid-water by using several tail-flicks where the abducted tail fan beat against the abdomen without the full abduction-adduction cycle of the uropods (Fig. 2B). In this case, the crab positioned its body with its rostrum pointing to the bottom of the aquarium, the curved dorsal edge of its abdomen pointing to the water’s surface, and all of thoracic legs were extended away from the body; once in this posture, it executed numerous tail-flicks. This particular motion did not create a full jet of water like that in tail-flip swimming. Thus the crab maintained its relative vertical position in the water column with this sequence of movements. While hovering, crabs sometimes drifted horizontally due to the water flow in the aquarium.

Passive sinking segments were identified easily when a crab splayed out all of its legs, extending them so that none were touching, and slowly sank without moving any appendages. The general body shape in the passive sinking posture was similar to the shape of an opened parachute, and the setae that line the pereopods and chelipeds passively extended away from both the medial and lateral edges of all limbs to be perpendicular to the limb (Tulipani, 2005).
Behaviors of *Pleoncodes planipes*

Passive sinking continued until the crab landed on the bottom or side wall, hovered, or performed another series of tail-flips to move to another location in the aquarium.

Using pereopod pairs 2, 3, and 4, red crabs walked or climbed in any direction (anteriorly, posteriorly, or laterally), over the rocks and plastic tubing on the bottom of the aquarium, holding their two chelipeds extended anteriorly and elevated from the bottom’s surface (Fig. 2). The plastic grating lining the side walls enabled the crabs to climb to the top of the aquarium, stopping just below the water’s surface (Fig. 2).

**Stationary behaviors**

When stationary, red crabs stood with their cheliped tips touching the surface they were on. Grooming behaviors appeared to concentrate on setal maintenance whereby a crab kept the setae on the carapace and pereopods free from visible fouling particles. Using the distal end (propodus and dactylus) of one or both chelate fifth pereopods, which are covered with sickle-shaped setae (Fig. 5), crabs wiped, rubbed, or scrubbed their pereopod in the same direction as the orientation of the body setae. Crabs used the cleaner pereopod to clean the entire
lipeds to wipe off the tip of the fifth pereopod, which was immediately followed by the anteri-or-posterior movement of the mandibular palps. The movement of the maxillipeds towards the mouth region appeared to transfer particles to the mouth. The mandibular palps would wave rapidly towards and away from the mouth to move the particles into the mouth. In addition, captive red crabs were observed feeding, independent of grooming, while standing on the bottom of the aquarium or hanging from a side wall. With the rostral spine tilted slightly upwards, crabs would extend and retract their maxillipeds away from and then towards their mouth region generating water movement (visible as the movement of food particles) towards their mouth while intermittently oscillating their mandibular palps. Occasionally, red crabs quickly scraped the dactyl tip of one of the pereopods along the bottom, kicking up particles and moving them towards the maxillipeds, which in turn would capture any particles then move them towards the mandibular palps and mouth. In the aquarium, red crabs quickly sensed any food dropped into the tank, moved directly towards it, and collected as much as they could hold with their chelipeds and/or mouthparts. Some crabs even performed a couple of tail-flips moving away from other crabs preventing them from potentially stealing the food.

Regarding interactions between individuals, crabs were often observed walking into, bumping, pushing, or landing on other crabs that were standing on the bottom or hanging from a side wall (Fig. 2). When a crab approached or bumped into another, typical agonistic behaviors observed were either apparent aggressive behaviors or avoidance behaviors. Both crabs would usually move away when such an encounter occurred. Sometimes neither crab moved to avoid the other despite antennae flicks or tail fan flexions from the opponent. Sparring occurred when one crab approached another head-on without giving way (Fig. 2). The stationary one would open the dactyls on its chelipeds and gesture forward while raising the chelipeds up slightly towards the approach-
ing crab. This type of gesturing usually resulted in the approaching crab changing directions. Sparring between males also occurred when one male approached a female that was being guarded by another male either prior to or just after mating.

**DISCUSSION**

*Pleuroncodes planipes* have been described as dividing their time between the benthos during the day and the epipelagic zone to feed at night (Boyd, 1962; Blackburn, 1977). However, the crabs were also found in large surface swarms during the day (Boyd, 1967; Auriolos-Gamboa, 1992) and are considered the most abundant nektonic organism off southern Baja California waters (Blackburn & Thorn, 1974). When the crabs were initially collected for this study, they were small (standard carapace length < 32 mm), which corresponded with the pelagic phase of their life cycle (Boyd, 1967); they floated frequently and could not walk well when stranded on the beaches. However, after being introduced into the aquarium with numerous surfaces to rest on, *P. planipes* began to exhibit more benthic behaviors. Once in captivity, the red crabs seemed to grow quickly and many of those collected in April 2002 molted after only a month in the aquarium. Over time, they adopted a mainly benthic lifestyle with intermittent periods of swimming, hovering and passive sinking. This change in the red crabs’ behavior from planktonic to mostly benthic was also observed of the captive crabs kept in an aquarium by Boyd (1962).

Boyd (1967) described red crabs as voracious eaters, with an omnivorous diet. This has been supported by observations in the water column off southern Baja California where red crabs feed on phytoplankton and zooplankton (Longhurst, 1967) and even ingest particulate organic matter when on the ocean bottom (Auriolos-Gamboa & Pérez-Flores, 1997). Red crabs moved their maxillipeds and then their mandibular palps every few seconds ingesting food particles or moving water towards the mouth. Similar limb motions have been observed in palinurid lobsters, and many other malacostracan crustaceans, where they flick their antennules and mouthpart appendages and create convective flows of water that facilitate the tracking of the chemical signatures of food (Goldman & Patek, 2002).

Additional limb motion, possibly related to feeding behaviors, occurred frequently when the red crabs groomed themselves. In contrast to some species of brachyuran spider crabs (*Macropodia* spp.) that attach pieces of algae to their carapace or those that have modified pereopods to hold sponges to their bodies for camouflage (*Dromidia* spp.) (Warner, 1977; Ross, 1983), *Pleuroncodes planipes* spent time meticulously cleaning their exoskeleton of particles that had adhered to it with their chelate fifth pereopods. Bauer (1989) listed numerous sources of fouling particles, such as sediment, unicellular algae, and parasites that can accumulate on the exoskeleton of aquatic crustaceans and negatively impact normal functions of sensory, respiratory and locomotory behaviors. Accumulated debris on the exoskeleton of the red crab may be akin to fouling organisms on the hull of a ship (Bauer, 1989). If the exoskeleton was not frequently cleaned between molts, the fouling particles would build up, eventually modifying the natural streamlining of the red crab’s carapace, pereopods, abdomen and tail-fan with their associated setae. Maintaining the exoskeleton appeared to be an important function that may enhance the pelagic red crabs’ swimming efficiency by reducing the drag along the body (Tulipani, 2005). Furthermore, these accumulated particles were a food source for the red crabs.

When red crabs interacted with each other in the aquarium, they preferred keeping some distance between each other, a common behavior among crabs which allows them to avoid one another (Warner, 1977; Salmon & Hyatt, 1983). When distance was not maintained, agonistic behaviors (gesturing with chelipeds with dactyls abducted or fighting) and avoidance behaviors (brief tail-flips away) were observed of red crabs and have been similarly described for other decapod crab species (*Pilumnus* sp.,
**Pagurus** sp., and *Callinectes sapidus* (Warner, 1977).

Crustaceans move from one location to another for purposes of feeding, mating, or dispersal of juveniles (Dunham, 1983; Wilber & Herrnkind, 1986; Chatterton & Williams, 1994; Tankersley *et al.*, 1998) with the pelagic red crab being no different. For example, in the wild, they migrate to surface waters to feed (Boyd, 1967; Longhurst, 1967; Blackburn, 1977). The red crabs’ benthic inshore-offshore movements were associated with coastal upwelling of cold water and the crab’s reproductive cycle (Aurioles-Gamboa, 1992; Aurioles-Gamboa & Pérez-Flores, 1997). Red crabs occupy both the water column and the benthos in the wild, and the movements observed in the aquarium clearly fell into two subcategories reflective of where they occurred. Of all locomotory behaviors, those occurring in the water column were observed more often than the ones occurring on the bottom of the aquarium (58.1% vs. 41.9%, respectively) (Table 1). Differences in benthic behaviors in captivity vs. *in situ* can probably be attributed to influences of external environmental effects of each habitat (Chatterton & Williams, 1994).

Swimming in the water column or at the surface were the most frequently performed active behaviors of *Pleuroncodes planipes* (Table 1). Boyd (1962) and Kato (1974) anecdotally described the same intermittent swimming pattern as a way for the crabs to maintain their relative position in the water column. In the wild, pelagic red crabs feed on plankton in the surface waters (Longhurst, 1967; Longhurst *et al.*, 1967), therefore, it would be advantageous to the red crab to stay within the epipelagic zone as long as possible where phytoplankton and zooplankton are abundant. Swimming rapidly upwards, followed by slow sinking, in the captive red crabs mirrors the classic behavior patterns seen in their coastal habitat. This uniquely efficient swimming ability (Tulipani, 2005) had never previously been described for galatheid crabs. The red crab’s ability to quickly transition to its streamlined swimming posture from its high-drag sinking position is probably an adaptation to life in the water column.

Red crabs also swim to escape predation, though not like typical swimming brachyuran crabs. Red crabs are not like *Callinectes sapidus* (Portunidae), which use modified fifth pereopods as swimming paddles (Warner, 1977; Welch *et al.*, 1999), nor are they like *Tritonocidum horvathi* (Pinnotheridae), which uses its heavily setose pereopods to swim (Takahashi *et al.*, 1999). In physical appearance and swimming mode, pelagic red crabs more closely resemble lobsters and crayfish, which lead to their common name of squat lobsters (Newland *et al.*, 1992). Red crabs tuck in all their thoracic limbs; adopt a streamline body shape and swim backwards using tail-flip escape swimming (Boyd, 1962; Tulipani, 2005). Spanier *et al.* (1991) described a similar type of escape response and a similar shape of the tail-fan for the Mediterranean slipper lobster, *Syllarides latus* (Syllaridae). The marine shrimp *Crangon crangon*, also completely flexes its abdomen, squeezing the tail-fan against the thorax giving the appearance of folding its body completely in half (Arnott *et al.*, 1998). The mantis shrimp, *Squilla mantis*, exhibits a maximal tail-flip response to rostral stimuli by completely inverting itself then righting itself with a half-roll before swimming away (Heitler *et al.*, 2000). Other crustaceans similarly perform tail-flip escapes but with species-specific maneuvers, such as half-twists, lateral rolls, or inversion of the body, during the execution of the escape movement (Newland *et al.*, 1988, 1992; Arnott *et al.*, 1998; Heitler *et al.*, 2000). Thus *P. planipes* swims much more like a lobster or a shrimp than like a brachyuran crab.

Further evidence of unusual swimming behaviors for a crab can be seen in the hovering behavior which could permit red crabs to easily transition to either swimming or sinking postures. It may have developed in the aquarium because there were solid surfaces against which the crabs could “lean” while in the water column. Just as treading water can help conserve energy, hovering has the potential for energetic savings for captive red crabs, enabling them to swim to the surface with less effort than
launching from the bottom of the aquarium. Comparisons of field observations of crustacean activity to observations of laboratory activity patterns have shown that the two are not necessarily the same, and that many organisms modify their behavior in captivity (Chatterton & Williams, 1994). This seems to be the case with this hovering behavior of *P. planipes* in the aquarium. We have not seen any evidence of hovering in any in situ observations (Tulipani, 2005).

Yet Kato (1974) suggested that red crabs maintain their position in the water column, akin to hovering, by alternating between actively swimming and slowly sinking. Analysis of in situ video of *Pleuroncodes planipes* supports these conclusions (Tulipani, 2005) where they swim rapidly upward with several tail-flips and then slowly sink with limbs extended. The slow sinking was the only passive locomotory behavior since the red crabs did not move their pereopods or chelipeds while they sank. Movement of their mouthparts indicated typical feeding behavior while sinking, observed by Kato (1974) and seen on in situ videotapes (Tulipani, 2005). The repeated surface swimming and sinking pattern probably enables the large swarm of crabs to feed without expending much energy once they have reached the surface. Other smaller crustaceans, such as copepods (Buskey *et al*., 1996) and mysids (Buskey, 1998), also form large aggregations in surfaces waters yet are usually continually swimming to maintain their position and expending much energy to do so. Feeding while sinking is probably beneficial energetically for the red crabs because once they reach the surface, they stop swimming and simply float before beginning their slow, passive descent. After each sinking segment, they only need to swim a short time to reach the surface again. This may be analogous to blue crabs (*Callinectes sapidus*) using tidal cycles to assist long distance travel, migrating up to 1000m day⁻¹ to reach spawning areas (Full & Weinstein, 1992; Tankersley *et al*., 1998) a potential energetic benefit. It is particularly evident in gravid female *Callinectes sapidus* who apparently use ebb-tides to travel seaward to release embryos and then use flood-tides to return up-estuary afterwards (Tankersley *et al*.1998).

Thus, it appears that *Pleuroncodes planipes* utilize their complex suite of locomotory behaviors, especially the unique alternation of efficient jet-propelled swimming and low cost slow sinking patterns, to feed more efficiently. Analysis of their body design and fluid dynamic parameters support the contention that they are very well adapted to active swimming and passive sinking (Tulipani, 2005). Though locomotion accounts for only 15% of their total repertoire, pelagic red crabs show a clear synergy between their functional morphology and their behaviors. They may not appear that different from other decapods in their stationary behaviors but their unique swimming modes set them apart from other crabs.

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