Neotropical Ichthyology, 7(1):113-116, 2009


## Scientific Note

# Stirring, charging, and picking: hunting tactics of potamotrygonid rays in the upper Paraná River

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Hunting tactics of potamotrygonid freshwater rays remain unreported under natural conditions. Three main foraging tactics of *Potamotrygon falkneri* and *P. motoro* are described here based on underwater observations in the upper Paraná River. Both species displayed similar behaviors. The most common tactic was to undulate the disc margins close to, or on, the bottom and thus stirring the substrate and uncovering hidden preys. Another tactic was to charge upon prey concentrated in the shallows. The least common tactic was to pick out prey adhered to the substrate. The first tactic is widespread in several species of marine rays in the Dasyatidae, whereas the remainder (especially picking up prey on substrata above water surface) may be restricted to the Potamotrygonidae.

As táticas de caça de raias potamotrigonídeas permanecem sem registro sob condições naturais. Três táticas de forrageamento são aqui descritas para *Potamotrygon falkneri* e *P. motoro*, com base em observações subaquáticas no curso superior do rio Paraná. Ambas as espécies apresentaram comportamento semelhante. A tática mais comum foi a de ondular as margens do disco próximo ao, ou no, fundo e assim perturbando o substrato e revelando presas abrigadas. Outra tática foi a de investir sobre presas concentradas no raso. A tática menos frequente foi a de apanhar presas aderidas ao substrato. A primeira tática é comum em diversas espécies de raias marinhas da família Dasyatidae, ao passo que as outras duas (em particular apanhar presas em substratos acima da superfície da água) podem estar restritas a Potamotrygonidae.

**Key words:** Potamotrygonidae, *Potamotrygon falkneri*, *Potamotrygon motoro*, Variable hunting tactics, Southwestern Brazil.

Freshwater rays of the Potamotrygonidae are restricted to South America, where they occur in all main river systems (Rosa, 1985). These rays are often caught for ornamental trade, and occasionally used as food by riverine people (Castex, 1963; Rosa, 1985; Charvet-Almeida *et al.*, 2002). As any other elasmobranch, potamotrygonids are carnivorous and prey on a variety of animals, from aquatic insects and crustaceans to fishes, feeding behavior of theses rays being inferred from gut analyses (Castex, 1963; Achenbach & Achenbach, 1976; Lasso *et al.*, 1996; Lonardoni *et al.*, 2006; Garrone Neto *et al.*, 2007; Silva & Uieda, 2007).

We describe here the variable hunting tactics of two species of *Potamotrygon* based on records made under natural conditions in the upper Paraná River, and compare these to hunting tactics of some species of marine rays.

The study area is in the vicinity of Castilho and Três Lagoas (about 20°47'S, 51°37'W) on the border of São Paulo and Mato Grosso do Sul States, Southwestern Brazil. We recorded the behavior of 132 individuals identified in the field as *Potamotrygon falkneri* (n= 62) and *Potamotrygon motoro* (n= 70). Hunting tactics were recorded underwater while snorkeling or scuba-diving (Sabino, 1999) at day and night hours during the dry season from June to October in 2006 and 2007. A total of 112 h of underwater observation was made through the study, most of them with snorkeling (97 h at depths of 0.5 to 12 m) and the remainder time with scuba-diving (15 h at depths of 8-18 m). "*Ad libitum*" and "behaviour" sampling rules (Martin & Bateson, 1986) were used throughout

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the observational sessions, mostly recorded on a plastic slate. Nocturnal observations were made with use of waterproof spotlights covered with red plastic filter or indirect illumination, both of which apparently disturb the fishes less than yellow light or direct illumination (pers. obs.). Additionally, digital photographs and video-records were taken to check visual observations. Two specimens of each of the two field-identified species, as well as images and extracts from video-tapes are stored in the Fish Collection of the Museu de Zoologia "Prof. Dr. Adão José Cardoso" (ZUEC 6331 – *P. falkneri* and 6332 – *P. motoro*) at the Universidade Estadual de Campinas. A picture of *P. orbignyi* from another locality is used here to demonstrate an unusual hunting tactic we recorded for the two species described in this paper.

Both species displayed similar hunting tactics. The most common one (n= 113 records) was a ray to hover close to the bottom or settle on it, and undulate the disc margins (Figs. 1a and 2a). The undulating movement stirred the substrate and uncovered hidden small invertebrates (mostly larval insects, snails, and crabs), apparently trapped under the ray's disc. The body of the ray assumed a convex shape and expansions and retractions of the orobranchial chamber were clearly visible, along with sediment being expelled through the gill slits and spiracle. This behavior was recorded both during the day (n= 35) and at night (n= 78) for rays ranging about 15-70 cm in disc diameter and in depths ranging 0.2-16 m. Another tactic was recorded while a ray slowly approached the shallows and charged at prey concentrated there (Fig. 2b). The prey likely was trapped or stunned under the ray's disc. Prey types obtained during this hunting behavior were mostly freshwater shrimps (Palaemonidae) and small fishes (mostly Characiformes). The charging behavior was recorded at night only (n= 13) for rays ranging about 25-40 cm in disc diameter and in depths ranging 0.2-0.5 m. The third tactic we recorded was while a ray approached vertical or inclined surfaces such as tree stumps, boulders, and concrete slabs and walls. The ray often exposed the anterior part of the disc above the water surface and picked out prey adhered to the substrate (Figs. 1b and 2c). Prey types obtained this way were mostly snails (Ampulariidae and Hydrobiidae). This behavior was recorded during the day only, and was the least common (n= 6) for rays ranging about 30-40 cm in disc diameter and in depths ranging 0.4-2.2 m. We suppose that larger individuals would need to exert greater effort to maintain the vertical position needed to pick prey with use of this technique. Additionally, larger individuals gradually include small fishes in their diet (Silva & Uieda, 2007, our pers. obs.).

The first hunting tactic, namely "undulate disc and stir substrate", here recorded for *Potamotrygon falkneri* and *P. motoro* seems a preying mode widespread in marine species of the Dasyatidae such as *Dasyatis americana* (Aguiar, 2005; Sazima *et al*., 2007), *D. centroura* (I. Sazima, pers. obs.), *D. crysonota* (Ebert & Cowley, 2003), and *Taeniura lymma* (Fishelson, 1977). This hunting tactic is likely found in most if not all dasyatid rays while foraging over unconsolidated substrata. A similar hunting tactic seems to be used by some species of myliobatid rays such as *Rhinoptera bonasus* (Smith & Merriner, 1985), although the also myliobatid *Aetobatus narinari* mostly uses its spade-like snout to dig out snail and other preys while hovering close to sandy substrate (see an instructive picture in DeLoach, 1999).

The two remainder hunting tactics, namely "charging in the shallows" and "picking up prey on substrata above water surface" (this latter a variant of "picking up prey on vertical and inclined substrata") seems restricted to the

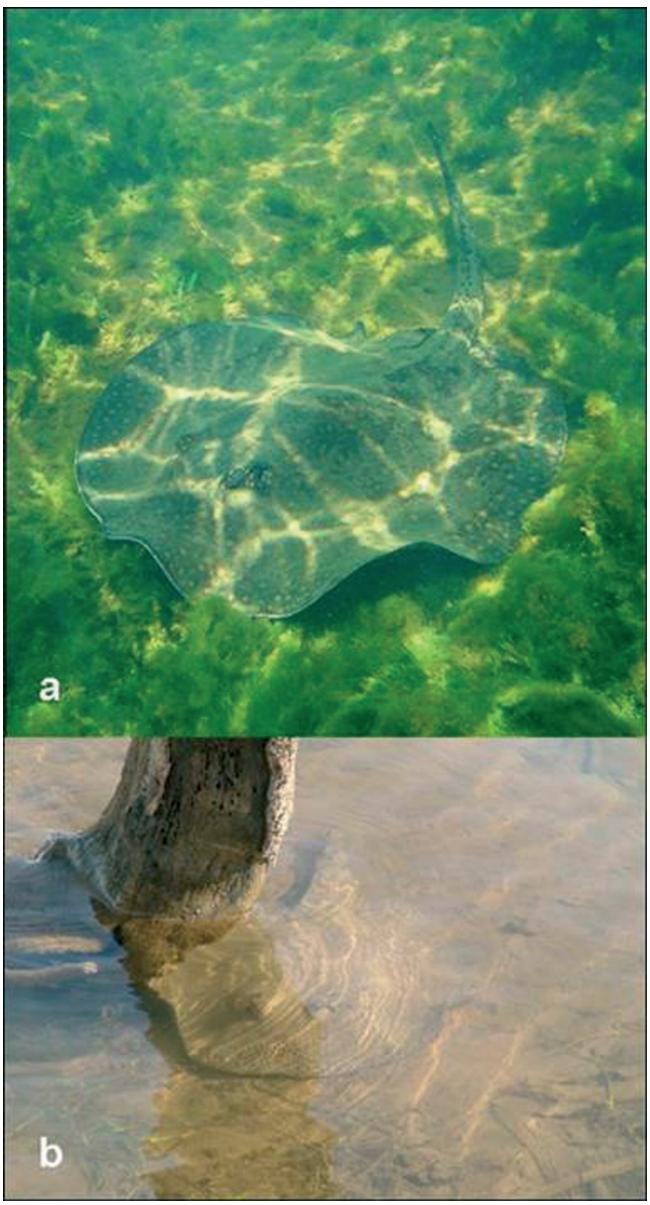


**Fig. 1.** Two hunting behaviors of potamotrygonid rays. *Potamotrygon falkneri* undulating its disc close to the bottom, stirring the substrate and uncovering hidden prey (a), and *Potamotrygon orbignyi* approaching a tree stump to pick snails adhered above water surface (not visible on the photograph) (b). The former species is from the study area mentioned in this paper, whereas the latter species was observed in the Maranhão River in Goiás State, Central Brazil.

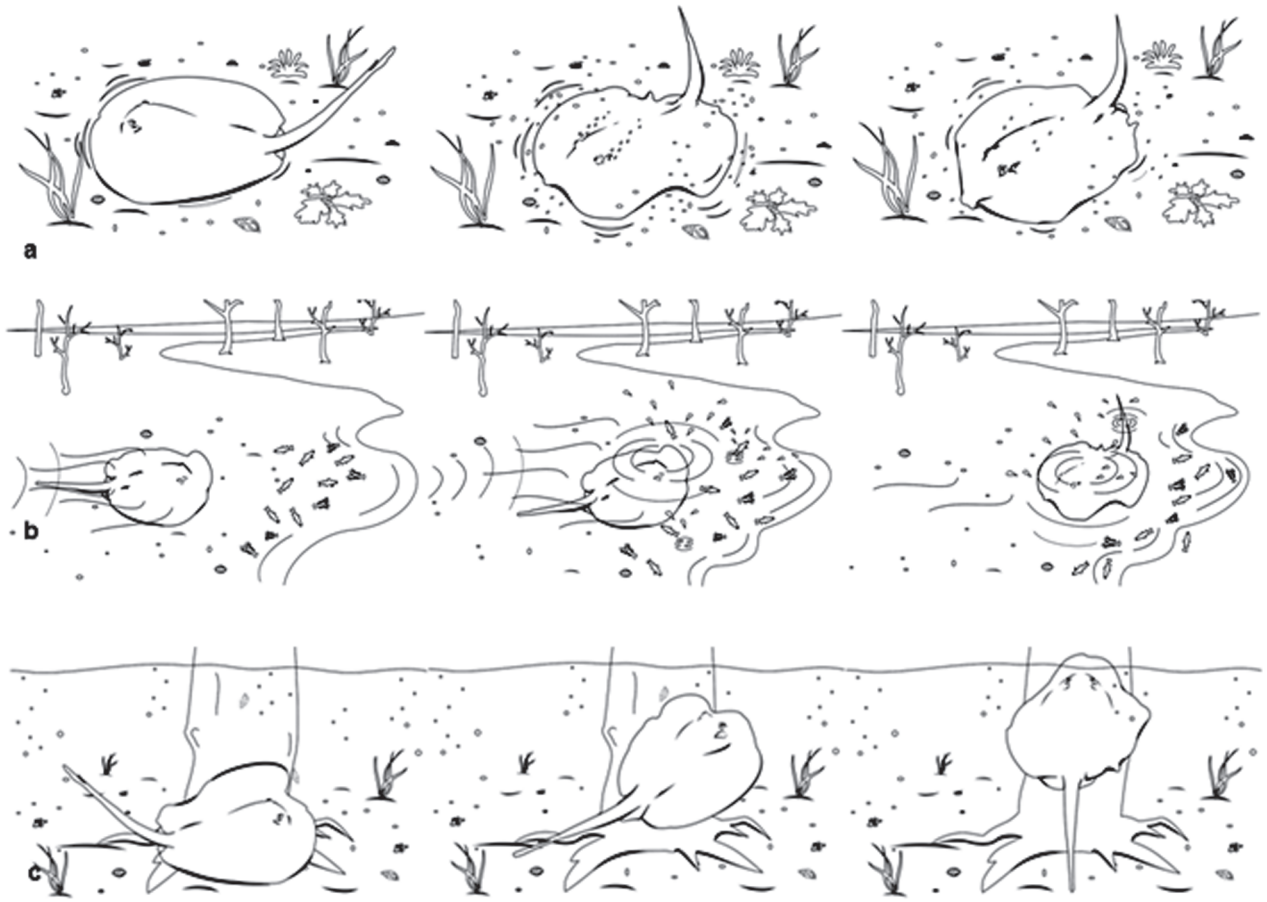


**Fig. 2.** Hunting tactics of *Potamotrygon falkneri* and *Potamotrygon motoro* at the Paraná River. Settling close to the bottom, undulating the disc to stir the substrate, and engulfing uncovered prey trapped under the disc (a); approaching the shallows, charging towards concentrated preys, and engulfing prey trapped under the disc (b); approaching a submerged tree stump, ascending towards surface, and exposing anterior part of the disc to pick snails adhered slightly above water surface (c).

Potamotrygonidae among Myliobatoidei as far as we are aware. The versatile hunting behavior reported here for the two species of *Potamotrygon* likely contributed to their recent and successful colonization of new areas and habitats in the upper Paraná River (see Garrone-Neto *et al*., 2007 and references therein).

## Acknowledgments

We greatly thank to Cláudia Eiko Yoshida and Paulo José Pyles Cicchi for valuable help during fieldwork and the photographs; Ottilie Carolina Forster e Laura Furlan Luvisoto for help during fieldwork at the Três Lagoas area; Marcos Teixeira da Silveira, diving fisherman of the Colônia Z-3/MS gave us valuable information about the rays and the study sites; logistic support at the Universidade Federal de Mato Grosso do Sul - Campus Três Lagoas was possible through the kindness of Maria José Alencar Vilela; part of financial support went through the kindness of Virgínia Sanches Uieda (PROAP-CAPES/UNESP); both authors are grantees of the CNPq.

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Accepted November 2008
Published March 31, 2009