

CHAPTER 5

DIVERSITY AND ABUNDANCE OF DECAPOD CRUSTACEANS IN THE RIO NEGRO BASIN, PANTANAL, MATO GROSSO DO SUL, BRASIL

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SUMMARY STATISTICS

- The macrocrustacean fauna sampled in the Rio Negro basin, Upper Rio Taquari and Upper Rio Miranda consisted of ten species, belonging to seven genera and two families – shrimps (Palaemonidae) and crabs (Trichodactylidae).
- Shrimp species included: *Macrobrachium amazonicum*, *M. brasiliense*, *M. jelskii*, *Palaemonetes ivonicus*, *Pseudopalaemon* sp. 1 and *Pseudipalaemon* sp. 2. The following crabs were collected: *Dilocarcinus pagei*, *Sylviocarcinus australis*, *Trichodactylus borellianus* and *Valdivia camerani*.
- The species *Macrobrachium jelskii* and *Palaemonetes ivonicus* were recorded for the first time in the Pantanal of Mato Grosso do Sul during this expedition.
- This AquaRAP expedition also recorded the first occurrence of the genus *Pseudopalaemon* in the Pantanal, with two possible distinct forms (the small number of individuals collected, mainly juveniles and immature forms do not allow for definitive identification).
- A species of Conchostraca, a small crustacean of the periphyton, and at least three species of Branchiura, were also found parasitizing three different types of carnivorous fishes.
- A species of a cave dwelling crustacean, *Potticoara brasiliensis* (Pires, 1987), one of the three species of the order known as Spelaeogriphacea and the only species ever described in Brasil is endemic to the Blue Lagoon Cave (near the town of Bonito, Mato Grosso do Sul).

ABSTRACT

A preliminary survey of the Crustacean (Decapod) fauna was carried out at 59 sampling stations of four rivers draining the Pantanal of Mato Grosso do Sul. Thirty-four stations were sampled along the length of the Rio Negro, but only the upper portions of the Rio Taquari (eight stations), Rio Aquidauana (three stations) and Rio Miranda (14 stations) were sampled. The habitats sampled consisted of rivers, creeks, waterfalls/rapids, baías (seasonal lakes or ponds generally isolated from the river system except in times of flooding), brackish water bays, remansos (abandoned meanders formed by the lateral arm of a river, which may be linked to the main river by a passage or a channel) and swamp. The microhabitats studied included beach, bank, submersed leaf litter, aquatic vegetation, marginal vegetation, rocky substrate and wooded debris. The survey was strictly qualitative and performed both manually and by using seine nets, hand nets, and traps.

Overall, a total of 10 species were encountered, six of which were shrimps from the crustacean family Palaemonidae and four of which were crabs from the family Trichodactylidae. The shrimp *Macrobrachium amazonicum* was the most recurrent and abundant species collected. The first occurrence of the genus *Pseudopalaemon* in Pantanal was registered during this survey. The species *Macrobrachium jelskii* and *Palaemonetes ivonicus* were also recorded in the Pantanal of Mato Grosso do Sul for the first time during this expedition. The habitats and microhabitats sampled indicated good conservation status, even though some areas exhibited some environmental impact such as deforestation, silting and forest fires.

INTRODUCTION

The crustaceans (decapods) found in the Pantanal of Mato Grosso do Sul belong to two families of shrimps (Palaemonidae and Sergestidae) and one crab family (Trichodactylidae). They consist of what Rodríguez (1981) called low plains fauna, as they inhabit bodies of water which rarely exceed 300 meters in altitude. Decapods are of great importance to the ecological processes of aquatic environments – acting at the different levels of the trophic chain as herbivores, predators, decomposers and prey for other groups (Beissinger et al., 1988; Benetton et al., 1990; Goulding and Ferreira, 1984; Magnusson et al., 1987; Walker 1987, 1990). These crustaceans constitute a complex group of conspicuous organisms in the Pantanal of Mato Grosso do Sul, with the shrimps representing an important food resource for carnivorous fishes of the region (Resende et al., 1996).

There is little known about the shrimp and crab fauna of the Pantanal of Mato Grosso do Sul, since literature is scarce and the majority of the few existing records are based on old sporadic surveys. Rare information about decapods in the area studied during the AquaRAP expedition is given by Gomes-Corrêa (1977), recording the shrimp *Macrobrachium amazonicum* at the Rio Miranda, for example. Also, Magalhães (1991) and Magalhães and Türkay (1996) record the occurrence of Trichodactylidae crabs in the watershed of the same river. In the Pantanal and surrounding areas, *M. amazonicum* has been recorded in the Rio Paraguai, in the towns of Cáceres (Moreira 1912) and Descalvado (Holthuis, 1952), and *M. brasiliense* has been discovered in the city of Cuiabá (Nobili, 1901) and the town of Nioaque (Lemos de Castro, 1985). Zwink (1990) recorded the shrimps *M. brasiliense*, *M. jelskii* and *Palaemonetes ivonicus* in the northern Pantanal and in the headwaters of rivers draining this wetland in southwestern Mato Grosso. Records of the crabs Trichodactylidae were made in this area by Zwink (1990), Magalhães (1991), Rodríguez (1992) and Magalhães and Türkay (1996).

The AquaRAP expedition to the Rio Negro watershed and headwaters region of the Pantanal of Mato Grosso do Sul has accomplished one of the most thorough and systematic collections of crustaceans (decapods) ever carried out in Pantanal, as well as being the first survey for this group in the region. The expedition results will be of great value for a better understanding of the species composition and distribution in the Rio Paraguai watershed, as well as offering valuable information about the overall status of the Rio Negro watershed and sustainable use of the region's natural resources.

METHODS

The expedition was carried out between August 24 and September 14, 1998 by two teams: one team of crustacean specialists surveyed several stations along the Rio Negro watershed, while the other team, composed of ichthyologists, sampled the headwaters of some of the rivers forming the Pantanal of Mato Grosso do Sul (upper portions of the Rio Taquari, Rio Miranda and Rio Aquidauana). The sampling stations were confined into the seven large regions, succinctly described below.

List of sampling regions:

Upper Rio Taquari

Rivers and creeks belonging to the Rio Taquari watershed, bordering the town of Costa Rica. The planalto (plateau region surrounding the Pantanal wetland) area has creeks with well defined banks, moderate to strong currents of sandy and rocky bed, and grassy riparian vegetation stretching to the main channel of the water body.

Upper Rio Aquidauana

Rivers and creeks of the Rio Aquidauana watershed next to the towns of Corguinho and Aquidauana. Physical characteristics of the area are similar to the above.

Bodoquena (Upper Rio Miranda)

Rivers and creeks of the Rio Miranda watershed, along the Serra da Bodoquena, in the towns of Bonito and Bodoquena. The area is similar to the Upper Rio Taquari region; transparent and alkaline rivers with moderate to strong currents, entangled branches and fallen tree trunks on sandy and rocky (pebble) beds. The banks are well defined margins with riparian vegetation present including marginal vegetation which reaches over the water, and the presence of aquatic floating and submerged vegetation.

Upper Rio Negro

Rivers near the town of Rio Negro, bordering the eastern side of the Pantanal floodplain. The river is representative of those of the planalto, with meanders and variable widths, waterfalls and rapids present, well defined banks alternating beaches and gullies. The river bed is rocky (rocks and pebbles) to sandy-silty; water is clear to dark and the currents are moderate to strong. Riparian vegetation is present with some disturbed areas – grassy marginal vegetation reaches above water with the presence of some small banks of submerged leaf litter and floating and submerged aquatic vegetation.

Middle Rio Negro

This biological region is subdivided into two discontinuous areas within the Pantanal low plain. Site 1:

Meandering rivers with well defined margins, occasional gullies, beaches and remansos. River beds are mainly sand and silt, and the water is clear to dark with weak to moderate currents. Riparian vegetation is present, but with eventual disturbances, and marginal grassy vegetation reaching above water, along with submerged litter banks, floating and submerged aquatic vegetation. Site 2: Contains swamps with areas flooded to various extents. There is abundant rooted and floating aquatic vegetation present, and the water is clear to dark with weak currents and a sandy to silty bed with large quantities of plant detritus.

Lower Rio Negro

Rivers and swampy areas near Passo do Lontra, along the highway between the Nhecolândia region and the BR-262 road, reaching part of the lower Rio Miranda basin. The area has river and swamps similar to those described for the previous site.

Taboco

Rivers and creeks inside the area of the Fazenda Taboco and between the Rio Negro and Cicolândia road, along the eastern transition side between the planalto and low plains of the Pantanal. Small creeks run along gallery forests with rocky bed, and rooted aquatic vegetation. The meandering river has well defined banks, occasional gullies, beaches and remansos, similar to those described above, although some marginal areas are flooded to variable extents and have large rooted and floating aquatic vegetation.

Habitats and Microhabitats Surveyed

The survey was carried out in seven distinct habitats, according to their hydrologic and geomorphologic characteristics: river, creek, waterfall/rapids, baía, brackish water lagoon, remanso (abandoned meander formed by a lateral arm of the river, might be linked to the main river by a passage or channel) and swamp (including brejos or charco – generally level areas with slight depressions of variable extent and with abundant rooted and floating aquatic vegetation). Within these habitats, the primary microhabitats were: beaches (sandy or silty), marginal gullies, submersed leaf litter, aquatic vegetation (especially roots of floating macrophytes), marginal riparian vegetation, rocky substrate and woody debris (tangled branches from dead trees, which may or may not be submerged).

Collecting Method

The materials used for collection were a small seine net (5 meters in length by 2 meters high in the central part, 5 millimeters mesh size), hand net (2 millimeters mesh size) and traps. Nocturnal manual collecting, aided by flashlights was carried out to capture crabs on marginal areas and

swamps. Periphyton and parasitic microcrustaceans were also collected manually with the help of forceps. The survey was strictly qualitative and no attempts were made to standardize the procedures.

The specimens were fixed and stored in 70% ethanol and then identified using descriptions by Holthuis (1952), Gomes-Corrêa (1977), Kensley and Walker (1982), Rodríguez (1992) and Magalhães and Türkay (1996). The majority of the sampled material can be found in the Crustacean Collection of the Instituto Nacional de Pesquisas da Amazônia (Manaus, AM, Brasil), but corroborative specimens will be kept at EMBRAPA (Corumbá, MS) and in the Zoological Collection of the Universidade Federal de Mato Grosso do Sul (UFMS, Campo Grande, MS, Brasil). A brief description of each species, including habitat, microhabitat, general geographic distribution, occurrence in Pantanal and surrounding areas, and other general observations, can be found in Appendix 5.

RESULTS AND DISCUSSION

Regional Overview

Upper Taquari Region

In the Upper Taquari, sampling was carried out on a sandy creek bed with woody debris and marginal vegetation (Table 5.1). Only one species of shrimp was collected (*Macrobrachium brasiliense*) (Table 5.2). Although lower species richness is expected in the headwaters, the presence of only one species does not necessarily indicate a reduction in decapod fauna. This restricted result was probably due to the short sampling period, the time of collection (diurnal rather than nocturnal, when the crustaceans are more active), seasonal factors, and the techniques used (seine net only).

Upper Aquidauana Region

No crustacean specimens were collected in the Upper Aquidauana region.

Upper Miranda Region

In the Bodoquena/Upper Miranda region, decapods were collected in rivers and creeks (Table 5.1). The headwater ichthyology team noted no specific information about the use of microhabitats by decapods. Two shrimp species (*Macrobrachium brasiliense* and *Pseudopalaemon* sp. 2) and one crab species (*Sylviocarcinus australis*) were collected in this region (Table 5.2). The same sampling limitations described for the Upper Taquari region apply to this region as well. The small cave dwelling crustacean, *Potiicoara brasiliensis*, although not collected during this expedition, is the only known species of the order Spelaeogriphacea described from Brasil. Occurring at the Blue Lagoon Cave, it is one of the three species known to date to be endemic to this region (Pires, 1987).

Table 5.1. Decapod crustacean distribution according to habitats and microhabitats sampled

Taxa	Habitats sampled							Microhabitats sampled						
	River	Creek	Waterfall/ rapids	Baia	Brackish water bay	Remanso	Swamp	Beach	Gully	Submersed leaf litter	Aquatic vegetation	Marginal vegetation	Rocky substrate	Wooded debris
Family Palaemonidae														
<i>Macrobrachium amazonicum</i>	■			■		■	■	■			■	■		
<i>Macrobrachium brasiliense</i>	■	■								■	■	■	■	■
<i>Macrobrachium jelskii</i>	■										■	■		
<i>Palaemonetes ivonicus</i>							■				■			
<i>Pseudopalaemon</i> sp. 1						■				■	■			
<i>Pseudopalaemon</i> sp. 2	■					■				■	■	■		
Family Trichodactylidae														
<i>Dilocarcinus pagei</i>						■	■				■			
<i>Sylviocarcinus australis</i>	■	■				■	■	■	■		■			■
<i>Trichodactylus borellianus</i>	■					■	■			■	■			■
<i>Valdivia camerani</i>	■													■

Table 5.2. Decapod crustacean distribution according to regions sampled.

Taxa	Sampling Regions						
	Upper Taquari River	Upper Aquidauana River	Bodoquena (Upper Miranda River)	Upper Rio Negro	Middle Rio Negro	Lower Rio Negro	Taboco
Family Palaemonidae							
<i>Macrobrachium amazonicum</i>				■	■	■	■
<i>Macrobrachium brasiliense</i>	■						■
<i>Macrobrachium jelskii</i>							■
<i>Palaemonetes ivonicus</i>					■		
<i>Pseudopalaemon</i> sp.1					■	■	
<i>Pseudopalaemon</i> sp.2			■	■		■	■
Family Trichodactylidae							
<i>Dilocarcinus pagei</i>					■	■	■
<i>Sylviocarcinus australis</i>			■	■	■		■
<i>Trichodactylus borellianus</i>					■	■	■
<i>Valdivia camerani</i>					■		
Total number of species	1	-	2	3	7	5	7

From reports by the headwater ichthyology team, this region appears to have greater productivity than the headwater regions of the Rio Taquari and Rio Aquidauana. Among other factors, it is possible that the larger calcium concentration found in this region encourages the development of crustacean populations.

Upper Rio Negro Region

In the Upper Rio Negro region, sampling was carried out in rivers, creeks and waterfalls/rapids. Crustaceans were collected by marginal vegetation (Table 5.1). The sampling of other microhabitats, including woody debris (in this case, holes and slits in trunks and submersed rotten branches) and rocky substrate (slits and spaces under and between rocks and pebbles on the riverbed), did not reveal any decapods.

Two species of shrimps (*Macrobrachium amazonicum* and *Pseudopalaemon* sp. 2) and one crab (*Sylviocarcinus*

australis) were recorded (Table 5.2). The sampling limitations described previously may have effected the evaluation of the biological richness of this region. For instance, *M. brasiliense*, a species commonly found in headwater habitats, was absent. It is interesting to emphasize that no decapods were collected in waterfalls and rapids of the region's rivers.

The number of specimens collected suggests a low productivity at the sampled stations. However, this low productivity may be related to factors such as: (i) season – the dry season is not the most favorable period for the development of the shrimps/crabs populations due to a reduced availability of food and habitats and an increase in predation; (ii) water quality – more acidic environments are normally not ideal for the development of crustacean populations.

Middle Rio Negro Region

In the Middle Rio Negro region, the habitats explored were rivers, creeks, remansos, baías, brackish water bays and swamps. Crustaceans were found in the microhabitats formed by the marginal vegetation, aquatic vegetation, submersed leaf litter, wooded debris, beach and marginal gullies (Table 5.1). The parasitic crustaceans collected were found in the gill slits of host fishes. No crustaceans were encountered in the brackish water bays explored.

Of the three shrimps species (*Macrobrachium amazonicum*, *Palaemonetes ivonicus* and *Pseudopalaemon* sp.1) and four crabs species (*Dilocarcinus pagei*, *Sylviocarcinus australis*, *Trichodactylus borellianus* and *Valdivia camerani*) that occur in this region (Table 5.2), *P. ivonicus* and *V. camerani* were found only in this region. In addition to these decapods, specimens of Conchostraca were found on the roots of floating macrophytes (*Eichhornia* spp.), and crustaceans of the Branchiura subclass (*Dolops* spp.) were found parasitizing the fish *Salminus maxillosus* (dourado) and *Pygocentrus nattereri* (piranha). The previously discussed sampling limitations also apply to this region.

The majority of the habitats surveyed had relatively low productivity, with exception of normal baías where productivity was medium. The same factors with respect to season and water quality could be responsible for this low productivity. The baías, with their stationery waters and large areas of floating macrophytes, offer very favorable conditions for the development of *M. amazonicum* populations, a species of shrimp mainly associated with lentic environments.

Lower Rio Negro Region

In the Lower Rio Negro region, sampling was carried out in rivers, remansos and swamps. Crustaceans were found in the following microhabitats: aquatic vegetation (especially roots of *Eichhornia* spp.), submersed leaf litter, woody debris (including slits and holes in submersed and exposed rotten branches, near the water line) and sandy-silty beaches (Table 5.1).

Three shrimp species (*Macrobrachium amazonicum*, *Pseudopalaemon* sp. 1 and *Pseudopalaemon* sp. 2), and two crab species (*Dilocarcinus pagei* and *Trichodactylus borellianus*) were recorded (Table 5.2). A positive identification of *Pseudopalaemon* spp. is still not possible due to the low number of specimens collected, the great majority of which were either juveniles or immature forms. Another crustacean (subclass Branchiura) – a fish ectoparasitic – was collected from the fish *Hoplias malabaricus*. The sampling limitations previously mentioned are also applicable to this region.

The majority of stations sampled presented a relatively low productivity. The same factors already discussed which apply to season and water quality could be responsible for this low productivity.

Taboco Region

In the Taboco region, sampling was carried out in rivers, creeks, remansos, baías and swamps. The microhabitats where crustaceans were found included: aquatic vegetation, submersed leaf litter, woody debris (including slits and holes in submersed rotten branches), sandy beach, silty beach and riverbanks (Table 5.1). The creeks sampled in this region did not have any crustaceans.

This region presented the highest diversity of species, with four shrimp species (*Macrobrachium amazonicum*, *M. jelskii*, *M. brasilinse* and *Pseudopalaemon* sp. 2) and three crab species (*Dilocarcinus pagei*, *Sylviocarcinus australis* and *Trichodactylus borellianus*). Although one of the species of shrimp, *M. jelskii*, occurred only in this region (Table 5.2), the habitats and microhabitats sampled here were not significantly different from sampling sites in other regions. The sampling limitations already mentioned also apply for this region.

The majority of stations sampled indicate a relatively low productivity. The same factors related to season and water quality which have already been mentioned may be the cause of this low productivity.

BIOLOGICAL AND ZOOGEOGRAPHICAL ASPECTS

The crustacean decapod fauna composition of the Rio Negro watershed is very similar to the Rio Paraguai watershed (C. Magalhães, data not published). Species like the shrimp *Acetes paraguayensis* (Sergestidae) and the crabs *Zilchiopsis oronensis* and *Poppiana argentiniana* (Trichodactylidae) were not recorded during this survey, but it is possible that they occur in the Rio Negro since the habitats occupied by these species are similar to the habitats where they have been recorded. The absence of these species in the survey could be due to sampling techniques (little sampling time in each station) or undetermined seasonal factors. The presence of *A. paraguayensis* is difficult to characterize due to their tendency to form dense ephemeral groups of individuals in restricted places.

M. amazonicum was the most frequent and abundant species sampled. It occurred in all the sampled sites of the Rio Negro watershed, but was absent from the headwater regions (Table 5.2). This species occurs mainly in lentic environments, often associated with the aquatic vegetation common in this region. The largest quantity of specimens were collected from baías and swamps, although some were also collected in rivers at clean beach zones with floating vegetation. Not abundant, but frequent, were the crabs *S. australis* and *T. borellianus*, and their occurrence is associated with several microhabitats within the habitats sampled (Table 5.1).

This fauna has much in common with those found in other South American basins, where large flooded areas like the Pantanal are found. Shrimp species like *M. amazonicum*, *M. brasiliense*, *M. jelskii* and *P. ivonicum* are also found in the Amazon and Orinoco rivers (Coelho and Ramos-Porto, 1985; López and Pereira, 1996). The two species of *Pseudopalaemon* are possibly endemic to the Pantanal, and as they are not similar to those previously described, they are probably new to science. However, a definitive conclusion will only be possible after the examination of several specimens. As for the crab species, only *D. pagei* and *T. borellianus* occur in other hydrographic basins (such as the Amazon), but are not found in the Orinoco basin. The remaining species, *S. australis* and *V. camerani*, live exclusively in the Rio Paraguai and lower Rio Paraná (Rodríguez, 1992; Magalhães and Türkay, 1996).

CONSERVATION IMPLICATIONS

Upper Taquari Region

From the short time spent in this region, it is difficult to evaluate threats and consequences to the decapod fauna. However, the analysis carried out by the headwater ichthyology group may be applied to crustaceans, considering the similarity between the habitats occupied by these two groups (see Chapter 6). It is recommended that further, detailed studies should be carried out on the biology and ecology of crustacean species. An incentive program should be established to encourage research by local institutions (UFMS, EMBRAPA, and private universities).

Upper Miranda Region

As mentioned above, analysis carried out by the headwater ichthyology team may be applied to crustaceans, taking into account the similarity between the habitats occupied by these two groups. Due to the peculiarity of the geomorphology and hydrology of the region, including a large number of caves and rivers of chemical composition distinct from the rest of the region, it is likely that the crustacean fauna is more diverse and particular than indicated by this preliminary survey. A careful and detailed survey of the crustacean fauna is recommended.

Upper Rio Negro Region

The habitats occupied by crustaceans, were in generally good conservation status. The main threats to the aquatic environment, that may affect the decapod fauna, are deforestation and silting of rivers and remansos. This would decrease or limit the microhabitat availability for shrimps and crabs, as well as the availability of food on the aquatic vegetation to the detriment of population development.

The region has good potential for ecotourism due to the number of waterfalls and its beauty. A program should be developed to guide and control ecological tourism in the

region. Monitoring of riparian vegetation according to local legislation should also be intensified, and campaigns that promote environmental education and raising the local population's awareness of the importance of headwater regions should be encouraged. Studies attempting to recover impacted areas should be promoted.

Middle Rio Negro Region

The habitats occupied by crustaceans generally had good conservation status. Possible threats to the decapod fauna include deforestation of the riparian vegetation and silting of river beds and baías, as well as forest fires along marginal areas. Continuing and/or intensifying these activities would present danger to crustacean populations on a middle and long term basis. The degradation of baías and remansos would be particularly harmful, since they contain major developments of floating aquatic vegetation that support the larger biomass of shrimps and crabs.

The great flooded area of the Brejo do Santa Sofia, with its large quantity of aquatic vegetation and remansos, offers very favorable conditions for the productivity and diversity of crustacean decapods. If other species also benefit from such conditions, then this area deserves special attention when conservation measures are taken.

A detailed faunal survey is recommended.

Lower Rio Negro Region

The habitats occupied by crustaceans were generally in reasonable conservation condition. Some areas showed evidence of marginal deforestation – for instance, the Rio Negrinho swamp pasture extended all the way to the water body, and the marginal and riparian vegetation were absent. In general, the Lower Rio Negro region is similar to the Middle Rio Negro region in regard to current conditions, threats, and conservation recommendations.

Emphasis should be given to the Lower Rio Negro region where recreational fishing has increased in popularity, and search for live bait by tourists has initiated a small-scale economic activity. The crab *Dilocarcinus pagei* is one of the baits used for fishing pintado (*Sorubim* sp.). Although the capture of specimens does not represent a risk to the natural reserve of this species in the environment, breeding of this species on a small scale could become an additional income for the local population. Specific studies on the reproduction and breeding of the crab *Dilocarcinus pagei* for bait should be promoted, so that this technique can be passed on to interested local communities.

Taboco Region

The habitats occupied by crustaceans were generally in good conservation condition, although some areas had evidence of marginal deforestation and silting. In general, the Taboco region is similar to the Upper Rio Negro region in regards to current conditions, threats, and conservation recommendations.

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