Freshwater Crustaceans Decadpos: An Important Resource of Guatemala

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http://dx.doi.org/10.5772/intechopen.73638

Abstract

Guatemala is a mega diversity country because it has several ecosystems and the physiography has a high diversity. However, the local population uses this biodiversity as a natural resource of food mainly. The country had three main drainage slopes for their rivers and aquatic reservoirs with several basins (the Gulf of Mexico, the Caribbean Sea, and the Pacific Sea). In these slopes, crayfish, freshwater prawns, and crabs compose the aquatic biological resources. Several fieldtrips were performed around these slopes in order to identify the species which were used as natural aquatic resources and verify if the diversity supports the food needs of the local population. Our findings were that the country has at least four crayfish species of genus *Procambarus* spp., those living in the high and middle altitude areas. Five freshwater prawn species with abbreviated larval development of genus *Macrobrachium*, that is, *Macrobrachium cemai* were also found. The bigger species of *Macrobrachium* was also identified on the three slopes as *Macrobrachium americanum*, *Macrobrachium tenellum*, *Macrobrachium occidentale*, and *Macrobrachium digueti* on the Pacific slope, while on the Gulf of Mexico and the Caribbean Sea, *Macrobrachium carcinus*, *Macrobrachium achanthurus*, *Macrobrachium heterochirus*, *Macrobrachium olfersii*, and *Macrobrachium hobbsi* were recorded, and therefore, the nonnative species *Macrobrachium rosenbergii*; with respect to other shrimps, *Palaemon pandaliformis*, *Palaemonetes octavieae*, and atyids as *Atya scabra* and *Potimirim glabra* were found. According to the freshwater crabs, the Pseudothelphusidae family is the best to represent in comparison with Trichodactylidae where only one population was recorded. Also, we register the uses of these species around the main markets in the country and we found two main ways: the first one is for the bigger species of freshwater prawns and crabs that are offered very expensive in kilogram and are almost offered in restaurants as exclusive dishes. The second one is more for the local consumption, and many families of fishery species that include crayfishes, freshwater prawns with abbreviated larval development, and smaller crabs, and so on, are sometimes found in the markets, with the prices being cheaper and can be bought only
by the local people. Our findings show that Guatemala has an enormous potential in the crustaceans decapods for use as natural aquatic resources as protein sources at low cost, especially for the families with low economical level.

**Keywords:** Guatemala, crustacean decapods, biological resources

### 1. Introduction

Currently, Guatemala has been included as a mega diversity country, because it represents a geographical area where convergence of a lot of different ecosystems involved a change in the physiography, climates, and biomes [1]. Especially, the climate variations in small territory have been playing an important role in the speciation process and specializations and adaptations in diverse populations of plants and animals.

Originally, Guatemala was cataloged as diversity, mainly for the data from terrestrial ecosystems, which has been studied with more emphasis [2]. The marine environment has been few studied; however, the geographical position of the country indicates that there is an important marine diversity in both coasts (Atlantic and Pacific) [2]. Recently, due the interest in the sea resources exploitation, the attention on these resources has increased. In contrast, the aquatic epicontinental resources have scarcity attention as study subject and natural resources, and their potential social and economic benefits are limited. The richness and importance of these small sources of life, important to the subsistence of human populations closers has not evaluated before 2000 year, due to this, it was not possible to give their real value when it has been planning strategies to management and conserve these resources.

In Guatemala, the natural epicontinental aquatic resources begin to acquire an important role in the priorities in the country, mainly due the latent threat of climate change and desertification [3]. The freshwater springs now are considered in the planning and land preservation strategies. As an example of this, Atitlán lake (located in the Sololá Department) worry internationally, due the massive cyanobacteria bloom, due the waste water from human closer to the basin [4]; this case induces that the scientific research activity on freshwater resources increase to get data from springs and streams as bigger basins as source to know the diversity and establish management plans and uses on this natural resources (fisheries, transport, and water sources to human use).

Due to this interest, the biological resource increases in importance, and one group that has been well represented in these environments are the crustaceans, mainly freshwater shrimps, crayfishes, and crabs, together several species of fishes and mollusk are dominant in these habitats [2].

In Guatemala, these resources have been exploited economically [5]. However, their importance in production is so low that there are not records and hard data. Several human communities used directly or indirectly the river resources from springs through the coastal connection. As happened with freshwater crabs from family Pseudothelphusidae that is possibly found in the majority of rivers or springs of country on east slope, even the Maya communities from highlands have a fishery and are used for self-consumption [6]. On another slope (Ocean Pacific), *Macrobrachium tenellum* and *Atya margaritacea* have important fisheries and commercialization among the coastal towns on the Pacific especially on south of country mainly in the estuaries of rivers María Linda and Los Esclavos [7]. The aim of this chapter is the potential
in the freshwater aquatic natural resources in Guatemala, especially on those native species, and the analysis of native human populations that use these biological resources as protein sources.

2. Study area

Guatemala as country, has a great biological diversity on the subject of aquatic continental systems. Firstly, as the country is divided into three main slopes, two with drainage on Atlantic Ocean (Gulf of Mexico and Caribbean Sea), both very well defined by bigger basins that occupied all center to north of country [8]. The main river to drainage on Gulf of Mexico is the Usumacinta conformed by important rivers as La Pasión, Chixoy, Salinas e Icbolar, all these rivers with origins on highlands flow through lower lands, which permit to have different physical and chemical water conditions, and producing several habitats that bearing an important biological diversity [9].

![Figure 1. Location of aquatic reservoir in Guatemala (rivers and lakes).](http://dx.doi.org/10.5772/intechopen.73638)
On the Caribbean slope, Guatemala has other rivers with conditions completely different as Dulce, Motagua, and Sarstún Rivers, that with another they end on this slope. River Dulce is the main effluent of important aquifers on Sierra de las Minas and Cerro San Gil, as well as highlands from Alta Verapaz, all these rivers produce the Río Polochic that end on Izabal Lake with connection with the sea in the Amatique Bay [8].

The Motagua River is the longest of the country. However, due to their origin (closed to Guatemala City) and magnitude, induces an excessive carry of solid wastes mainly plastics and nondegradable material that reach the Caribbean Sea and produce marine pollution [10].

Finally on the Pacific Slope, some main rivers are María Linda, Los Esclavos, La Paz, Achiguate, Coyolate, and Naranjo are located and drainage on the Departments of Escuintla, Rethauleu, Santa Rosa, Jutiapa, Sichitpéquez, San Marcos Quetzaltenango y Sololá [7] (Figure 1).

3. Materials and methods

Two structured sampling trips were made on the Atlantic Slopes (Gulf of Mexico and Caribbean), and in Pacific Slope, different trips were made (Figure 2). In these trips, the crustaceans were collected using nets and hand. At that time, the GPS and physical and chemical water data were recorded using a GPS Garmin and YSI Oxygen Dissolved recording. In each place, the animals were preserved in ethanol to posterior lab identification. Also, in each
place, the use and the value that local community has on these animals were recorded. In several markets around the country, make a survey to identify the different crustaceans species that are to sale and know if the local or exotic species have special preferences or major value.

4. Results

Guatemala has three main basins and several economical decapod species associated to these. The first basin analyzed was Caribbean where it was possible to find the following species *Macrobrachium carcinus* (Figure 3A), *Macrobrachium acanthurus* (Figure 3B), *Macrobrachium olfersii*, *Macrobrachium hobbsi*, *Macrobrachium heterochirus*, and one introduced species *Macrobrachium rosenbergii*; in general, all these species have a good acceptance in the market and in some cases their acceptance had reached high levels, for example *Macrobrachium carcinus* (“La pigua” in Spanish) in the Departments of Quiche, Alta Verapaz, Izabal, and Petén, the populations recently shown an important decrease in the fisheries, due to the over exploitation, pollution of rivers and reservoirs, and therefore, the barriers as dams in rivers that limited their migrations. In contrast, the exotic species *M. rosenbergii* is more frequently in the market and fisheries at least in the harbor fishery of Río Dulce, just now is evaluated if this last species have an impact on native species in several rivers of region. Also, in this region, there are several populations that have an abbreviated larval development and recently was described *Macrobrachium cemai* (Figure 3C), that is, used as food by the autochthonous community of Qek’chi in Cerro San Gil, Puerto Barrios, and Izabal. Therefore, there are another small decapods that lack economical value as *Palaemon pandaliformis*, *Palaemonetes octaviae*, and some atyids as *Atya scabra* and *Potimirim glabra* (Figure 3D).

In this basin, the crayfish species of *Procambarus* spp. (Figure 3E) was recorded and in some rivers there are freshwater crabs of family Trichodactylidae (Figure 3F) and Pseudothelphusidae (Figure 3G) and the local populations especially the indigenous communities as Qek’chi used by self-consumption and these species are hard to be found in the markets and fisheries, but the families use the children to search these species and by this way, they contribute with food to family.

The second basin is the Gulf of Mexico, the rivers and aquatic reservoirs drainage on the Usumacinta River and the main species are *Macrobrachium carcinus*, *Macrobrachium acanthurus*, and *Macrobrachium heterochirus*, but in this case due to few important markets to sale these products in general are to self-consumption. On this basin, we have recorded two populations with abbreviated larval development but in general few people know their existence and only indigenous populations used this biological resources together crayfish (*Procambarus* spp.) and freshwater crabs of family of Pseudothelphusidae.

In contrast on the Pacific slope in Guatemala, the biological aquatic resources are more diverse in small areas because the mountain chain is a barrier to limit their distribution. But in this area, the species of freshwater prawns are *Macrobrachium tenellum*, *Macrobrachium americanum*, *Macrobrachium occidentale*, and *Macrobrachium digueti*, all these with high commercial value and are easy found in the markets or the people just sale in their houses. The water pollution on rivers or dams are sometimes especially those sites close to cities where few control of waste water exists, the data of oxygen registered was lower in these sites, and the animals were absent, in contrast with those sites so far from human effects. The *Macrobrachium* species are a good indicator of the water quality because there are species as *M. heterochirus* where the oxygen requirements are higher in comparison with another species.
5. Discussion

The aquatic biological resources in Guatemala are best represented with freshwater decapods species, but the economical values of these resources are lower in comparison with freshwater fishes and only few species have an important acceptance in their consumption of local population. The species of *Macrobrachium* that are the largest freshwater decapod have a big distribution on the three basins because the majority of sampling sites in this study were recorded (Table 1).
| Site                                  | Locality                             | Department | GPS X      | GPS Y      | Altitude | Taxa                          | Population richness |
|---------------------------------------|--------------------------------------|------------|------------|------------|----------|-------------------------------|---------------------|
| Caribbean and Gulf of Mexico Slope    |                                      |            |            |            |          |                               |                     |
| Escobas Cerro San Gil                 | Las Escobas                          | Puerto Barrios | −88.6456667 | 15.6851667 | 116      | *Macrobrachium cemai*          | High >200           |
|                                       |                                      |            |            |            |          | *Potinrim sp.*                 | Medium >50          |
|                                       |                                      |            |            |            |          | *Raddus sp*                    | Low >10 org          |
| El Boqueron                           | El Estor                             | Izabal     | −89.2844722 | 15.5660278 | 9        | *Trichodactylidae*            | Low >10             |
|                                       |                                      |            |            |            |          | *Pseudothelphusidae*           |                     |
| Rio Zarco                             | El Estor                             | Izabal     | −89.2951111 | 15.5571944 | 20       |                               |                     |
| Puente Pedernales                     | El Estor                             | Izabal     | −89.0426944 | 15.6364722 | 9        |                               |                     |
| Puente la Máquina                     | El Estor                             | Izabal     | −89.0753333 | 15.6157222 | 26       |                               |                     |
| Sumache                               | El Estor                             | Izabal     | −89.0941667 | 15.6056389 | 19       |                               |                     |
| Puente Manaco                         | El Estor                             | Izabal     | −89.1230278 | 15.5952778 | 16       |                               |                     |
| Bailinear caliente                    | El Estor                             | Izabal     | −89.2085556 | 15.5908611 | 35       |                               |                     |
| Afluente remanso                      | Sumache                              | Izabal     | −89.1074444 | 15.6054444 | 65       | *Procambarus sp.*             | High >100           |
| Aldea Manantiales, Esmeralda del Paraiso | Agua caliente                      | Izabal     | −89.2206111 | 15.5833056 | 55       |                               |                     |
| Rio Zarquito                          | Rio Oscuro                           | Izabal     | −89.3595278 | 15.3377222 | 5        | *Palaemon pandaliformis*      | High >200           |
| Rio Chapin                            | Chapin abajo                         | Izabal     | −89.2665278 | 15.3924444 | 9        |                               |                     |
| Rio Balandra                          | Quinel/Estor                         | Izabal     | −89.2481944 | 15.4031111 | 14       |                               |                     |
| Puente Prieto                         | Sa Rosita/El Estor                  | Izabal     | −89.2623889 | 15.5692222 | 13       | *Pseudothelphusidae*          | Low <50             |
| El lago                               | El Estor                             | Izabal     | −89.3294722 | 15.5239722 | 12       | *Palemonetes octaviae*        | High >200           |
| Arroyo colorado                       | El Bongo/El Estor                   | Izabal     | −89.1920833 | 15.6183333 | 212      | *Procambarus sp.*             | Medium >50          |
| Rio Bouro                             | El Bongo/el Estor                   | Izabal     | −89.1861667 | 15.6092222 | 159      | *Procambarus sp.*             | Medium >50          |
| Rio Branche                           | Esmeralda                            | Livingston | −89.0110278 | 15.6929722 | 17       | *Palaemon pandaliformis*      | High                |
| La Palma                             | Esmeralda                            | Livingston | −89.0103056 | 15.6942500 | 29       | *Procambarus sp.*             | High >200           |

http://dx.doi.org/10.5772/intechopen.73638
| Site                | Locality         | Department | GPS X       | GPS Y       | Altitude | Taxa                          | Population richness |
|---------------------|------------------|------------|-------------|-------------|----------|-------------------------------|---------------------|
| Cenote de Sarstum   | Sarstum          | Livingston | -89.9428056| 15.8822500  | 15       | Macrobrachium heterochirus    | Low <10             |
|                     |                  |            |             |             |          | Macrobrachium carcinus        | Medium >50          |
|                     |                  |            |             |             |          | Macrobrachium ofersii        | Medium >50          |
|                     |                  |            |             |             |          | Potimirim sp.                 | High >200           |
| Siete Altares       | Livingston       | Livingston | -89.7918889| 15.8542778  | 83       | Macrobrachium sp.             | Medium >100         |
|                     |                  |            |             |             |          | Pseudothelphusidae           | High >100           |
| Cueva del tigre     | Barra Lampa      | Livingston | -88.8123278| 15.7747500  | 74       | Pseudothelphusidae           | Low <10             |
| Las Conchas         | Chasac           | Alta Verapaz| -89.4616944| 15.8533056  | 144      | Macrobrachium sp.             | High <100           |
| Rio Lachua          | Santa Lucia, Reserva Lachua | Alta Verapaz | -90.6639722| 15.9245833  | 171      | Pseudothelphusidae           | High >100           |
| Puente la machaca   | Santa Lucia, Reserva Lachua | Alta Verapaz | -90.6750833| 15.9486389  | 195      | Macrobrachium sp.             | Low <20             |
| Arroyo El Caoba     | Santa Lucia, Reserva Lachua | Alta Verapaz | -90.6758333| 15.9406944  | 175      | Macrobrachium sp.             | Low <20             |
| Arroyo las ranas    | Santa Lucia, Reserva Lachua | Alta Verapaz | -90.6761944| 15.9376389  | 180      | Procambarus sp.               | High >100           |
| Hunal-Ye            | Chisec           | Coban      | -90.3143333| 15.6699722  | 403      | Macrobrachium sp.             | High >200           |
|                     |                  |            |             |             |          | Pseudothelphusidae           | Medium >30          |
| Semuc-Champey       | Larkin           | Alta Verapaz| -89.9558833| 15.5336667  | 353      | Macrobrachium sp.             | High >200           |
| Cueva las Marias    | Semuc-Champey    | Alta Verapaz| -89.9555556| 15.5875000  | 357      | Macrobrachium sp.             | Medium >50          |
| Las Mesas           | Rio Hondo Zacapa | Alta Verapaz| -89.5932000| 15.0545000  | 175      | Macrobrachium heterochirus    | Low <10             |
| **Pacific Slope**   |                  |            |             |             |          | Macrobrachium americanum     | Medium >50          |
| Las Pozas           | Buena Vista      | Santa Rosa | -90.16264"| 13.52519    | 14       | Macrobrachium occidentale     | Medium >50          |
| Manchon Guamuchal   | Manchon Guamuchal | Rethauleu  | -92.05112  | 14.27499    | 17       | Macrobrachium occidentale     | Medium >50          |
| Site               | Locality       | Department | GPS X  | GPS Y  | Altitude | Taxa                        | Population richness |
|--------------------|----------------|------------|--------|--------|----------|-----------------------------|---------------------|
| La verde           | Champerico     | Rethauleu  | −91.5408 | 14.195107 | 13       | *Macrobrachium tenellum*     | High >200           |
| Málaga             | Málaga         | Escuintla  | −91.0416.5 | 14.01048 | 19       |                             |                     |
| Otacingo           | Otacingo       | Escuintla  | −90.53562 | 13.59368 | 24       | *Macrobrachium digueti*      | Low >10             |
| Brito              | Brito          | Escuintla  | −90.40555 | 14.08333 | 44       |                             |                     |
| El Paraiso         | Santa Rosa     | Santa Rosa | −90.12144 | 13.485168 | 5        | *Macrobrachium tenellum*     | High >200           |
| Las Lisas          | Las Lisas      | Santa Rosa | −90.15489 | 13.485168 | 6        | *Macrobrachium tenellum*     | High >200           |
| Iztapa             | Iztapa         | Escuintla  | −90.42251 | 13.55576 | 7        | *Macrobrachium tenellum*     | High >200           |
|                     |                |            |         |        |          | *Macrobrachium americanum*   | Medium >50          |
| La Avellana        | Monterrico     | Santa Rosa | −90.28119 | 13.54231 | 6        |                             |                     |
| Peten Zone         |                |            |         |        |          |                             |                     |
| La campana         | La campana     | Peten      | −91.07213 | 15.56554 | 231      |                             |                     |
| Trinitaria         | Trinitaria     | Peten      | −90.47287 | 15.56126 | 168      | *Macrobrachium sp.*          | Medium >50          |
| Tres Rios          | Tres Rios      | Peten      | −90.26084 | 16.00559 | 138      |                             |                     |
| Las Pozas          | Las Pozas      | Peten      | −90.09585 | 16.20044 | 168      | *Pseudothephusidae*          | Low >10             |
| Flores             | Flores         | Peten      | −89.50106 | 16.55238 | 131      | *Macrobrachium sp.*          | Medium >50          |
| Melchor de Mencos  | Melchor de Mencos | Peten      | −89.09262 | 17.012404 | 106        | *Macrobrachium sp.*          | Medium >50          |
| Salpet             | Salpet         | Peten      | −89.16325 | 16.55458 | 146      | *Macrobrachium sp.*          | Medium >50          |
| Poptun             | Poptun         | Peten      | −89.293103 | 16.17421 | 420      | *Procambarus sp.*           | High >100           |
| Chabilchoch        | Chabilchoch    | Peten      | −89.56472 | 15.45272 | 190      | *Procambarus sp.*           |                     |
| San Antonio Las Cuevas | San Antonio Las Cuevas | Peten | −90.061916 | 15.52079 | 244      | *Macrobrachium sp.*          | Medium >50          |
| La Campana         | La Campana     | Peten      | −91.07391 | 15.564503 | 244      | *Procambarus sp.*           | High >100           |

*Table 1.* Relation of sites explored, GPS, species, and population richness data.
But only two or three species are possibly found in the market in different places around the country. In the Pacific slope, the acceptance of these resources are major, but it is due to the cultural aspects on the indigenous people. In the Gulf of Mexico and Caribbean Sea slopes, the Qek’chi people use these resources for self-consumption and only in the local markets, sometimes by seasons, this aquatic resource is possibly found. Also, there are another species smaller or with less economical value as crayfishes and freshwater prawns, that in general the people that fishing their animals are children as part of their contribution to food in the family. These problems on the acceptance and sale of resource is only in some areas because for special species (largest), the over exploitation of *Macrobrachium carcinus* in the recent years has produced an important decrease in the fishery on this species as was reported in another countries [11].

Therefore, less important problem is the increase in the pollution on rivers due the chemical products used in the sugar and palm farmers and their respective industries reported not only in Guatemala because it is a normal practice in Central America and Mexico.

In general, the commercial species have migrating behaviors, the constructions of dams, and the water use to agricultural activities also decreased the native populations producing that exotic species occupied the niches empty [12].

However, just now Guatemala has an important opportunity to make plans to development according the basin and their resources. To protect those species over exploited and increase their potential of those species that only are using by indigenous people could be establish farmers because there are the technologies to producing by tons, and could be one mechanism to conserve the biological diversity and have management plans on aquatic biological resources.

**Acknowledgements**

The authors are grateful with B. Flores, J. Pérez Brückweh, and A. Chale by their help in fieldtrip. This chapter is output from project: “Molecular systematics of freshwater prawns of genus *Macrobrachium* with abbreviated larval development in southeast of Mexico and their relationship with Guatemala & Belize”, support by CONACYT-Mexico-258494 (Fondo Sectorial de Investigación para la Educación).

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