

# Benthic Amphipods (Crustacea) in *Panulirus* Spiny Lobster (Crustacea) Postlarvae Collectors

Martin Ignacio Borrego<sup>1</sup>, Jennifer Zoe Borrego-Durán<sup>2</sup>, Yecenia Gutiérrez-Rubio<sup>1</sup>,  
Jorge Payán-Alejo<sup>2</sup> and Juan Francisco Arzola-Gonzalez<sup>2\*</sup>

<sup>1</sup>Faculty of Marine Sciences, Autonomous University of Sinaloa, Mexico

<sup>2</sup>Postgraduate in Science in Aquatic Resources. Faculty of Marine Sciences, Autonomous University of Sinaloa, Mexico

## Abstract

This study is the first report of benthic amphipods for a new line of research in this area of the Mexican Pacific. We analyze the first records of amphipods in spiny lobster (*Panulirus* spp) pueruli collectors in Cosipita bay, Gulf of California, Mexico. The organisms were obtained collectors that simulate seaweed that present cavities as refuges. The collectors were submerged to a depth of 1 to 1.5m. 170 benthic amphipods were obtained, distributed in four superfamilies, seven families, seven genera and three species. The most representative genus were *Bemlos* and *Tritella* and the most abundant families were Aoridae, Ischyroceridae and Caprellidae. The records of amphipods indicated here represent the basis for the knowledge of this taxonomic group and the artificial collectors are refuge for benthic amphipods in this area.

## Introduction

In northwestern Mexico there is an important fishery for spiny lobster (*Panulirus inflatus* and *Panulirus gracilis*) where the Faculty of Marine Sciences has carried out various investigations related to their biological-fishing aspects of these lobsters [1-3]. Among the crustaceans, the amphipods in the seabed stand out due to their abundance and diversity, which inhabit from the coastal zone to a depth of 9000 m [4], in addition, the amphipods play an important role in the trophic chain of aquatic ecosystems. Investigations of amphipods in the Mexican Pacific are mainly focused on taxonomic studies [5-7]. Despite this, the number of investigations on benthic amphipod species in the Mexican Pacific northwest, and particularly in the Gulf of California, is limited: with the exception of the studies by [8] who analyzed benthic amphipods [4] in Petatalco bay, Guerrero, reported the taxonomic identification keys of the gammarids amphipods of the Eastern Tropical Pacific and [9,10] who analyzed the marine benthic invertebrates for the Gulf of California, where they include taxonomic keys and generalities of the amphipods. In the Caribbean, the diversity of benthic amphipods associated with different types of substrates such as algae, rocks, sediment and mangroves, associated with coral reefs [11] and macroalgae [12], indicating in all these studies new records of species and geographical records of these crustaceans. On the Sinaloa, Mexico coast, [13] reported a new geographic distribution for the Mazatlán bay of *Paracaprella pusilla* amphipod in oyster boxes. While [14] analyzed the presence of spiny lobster juvenile (pueruli) in artificial collectors in the bay of Mazatlán, although these authors did not report the presence of amphipods. However, in the present investigation, benthic amphipod species were determined for the first time using artificial collectors that simulate the presence of marine algae for spiny lobster hatchlings. The objective of this was to obtain information on the species of benthic amphipods that inhabit artificial collectors for sheltering pueruli (postlarvae) of spiny lobster (*Panulirus* spp) in Cosipita bay, Gulf of California, Mexico.

## Material and Methods

The amphipods were collected in Cosipita bay, Gulf of California, Mexico (24°09'N-107°15'W). The capture of amphipods corresponded from February 2014 to January 2015 and with a monthly sampling frequency. Were collected of benthic amphipods, modified algae-type collectors were used, described by [15] and combination of the Phillips-type collector [16] that simulates the presence of marine algae and collector which presents hollow spaces and cavities as shelters for postlarvae of spiny lobster *Panulirus*. The modification in the artificial collector prototype (Figure 1) was carried out by the personnel of the Laboratory of Lobster Program of Faculty of Marine Sciences of Autonomous University of Sinaloa (PROLAN-FACIMAR-UAS).

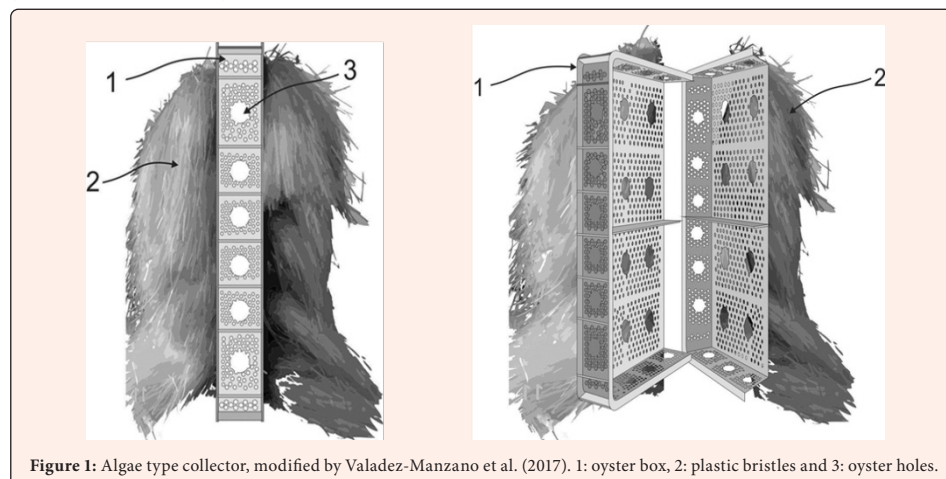


Figure 1: Algae type collector, modified by Valadez-Manzano et al. (2017). 1: oyster box, 2: plastic bristles and 3: oyster holes.



Two collectors were established for each station. For their transfer to the sampling stations, a 12 m boat with a 50 Hp outboard motor was used. When extracting the collector to the surface of the boat, the collector was opened to 50% for this the straps were broken and for a period of 10 minutes they were shaken on a plastic container with a capacity of 170L. Later it was extracted and the sample was concentrated through a sieve and its concentration was deposited in plastic containers, previously labeled with field data. Finally, the amphipods were separated from the spiny lobster pueruli. The collected amphipods were deposited in 70% alcohol for their conservation. Its taxonomic determination was made using identification keys for amphipods [4] and the species were corroborated by Garcia-Madrigal from the Marine Invertebrates Systematics Laboratory (LABSIM). In addition, the amphipod species were compared with the Scientific Reference Collection of Marine Invertebrates, Crustacea Section, and University of Sea, Oaxaca, Mexico. The amphipods indicated here were deposited and registered in the mentioned LABSIM collection.

## Results and Discussion

On average, 14.16 amphipods/collectors/month were collected. The months with the highest collection percentage were April, March and May with 12.35, 30.0 and 42.94%, respectively. A total of 170 specimens were obtained and the collection of benthic amphipods recorded here is made up of the order Amphipoda, four superfamilies, seven families, seven genera and three species. For the first time, the amphipods for the Cospita bay of the genera *Bemlos*, *Tritella*, *Podocerus*, *Amphithoe* and *Monocorophium* and the species *Batea cf susurrator* and *Erichthonius cf brasiliensis* are reported. Likewise, the families Aoridae, Caprellidae, Podoceridae, Amphithoidae, Corophiidae, Bateidae and Ischyroceridae. The most representative genus were *Bemlos* and *Tritella*. The most abundant families were Aoridae, Ischyroceridae and Caprellidae. The species with the highest frequency of appearance coincided on five occasions: *Bemlos* sp., *Tritella* sp and *Erichthonius cf brasiliensis*. This research represents the effort to know the diversity of species of benthic amphipods associated with the settlement of *Panulirus* spiny lobster hatchlings on the coast of Sinaloa, Gulf of California, as part of the Lobster-FACIMAR project. 170 amphipods captured in this pueruli collector, means an important bycatch of amphipods in this area to continue with other similar studies, since there is not information regarding this taxonomic group for the center and north of Mexican Pacific. It has only been contributed for amphipods in general for the southern coast (Guerrero, Oaxaca and Chiapas) of the Mexican Pacific [4]. In this study, seven families, seven genera and three species were determined, this information is not less if this study is considered as the first recorded of amphipods associated with juvenile *Panulirus* lobster, and also as the first report of benthic amphipods in the northwest of the Mexican Pacific. The collection of 170 amphipods in the present study through the use of the algae collector designed by [14], it can be considered an excellent half of recruiting a great diversity of species and larvae of minor crustaceans such as amphipods and other marine benthic invertebrates [4]. However, according to [9] the taxonomic identification of the amphipods species is difficult due to the little information on the species in the scientific literature of the Mexican Pacific, although the seven families mentioned here were reported by [4] for amphipods in the Eastern Tropical Pacific. In the Pacific Ocean, but for the Indo-West Pacific, [17] determined 11 new amphipods species, none of which matched here.

In this study, seven families distributed in seven genera and three species of amphipods were identified; these results were below the work of [9] who reported 12 families of amphipods for the Gulf of California; however, compared to the present investigation, this author only reported four families of amphipods, the remaining three families indicated here: Caprellidae, Ischyroceridae and Bateidae, were reported for the first time by these artificial collectors and for this study area. At the family level, those registered here no comparison with the study by [17] who analyzed the date base (DELTA) on amphipods [18], and indicated that there are approximately 183 families and that they could increase up to 189 families of amphipods of amphipods depending on the type of phonetic or phylogenetic classification, in addition, [17] reported 22 new families of amphipods in their study compared to the 154 families reported by [19]. However, [6] reported the family of Caprellidae amphipods but with emphasis on *Caprella suprapiscis* for the Mexican Pacific coast.

The most common amphipod genera were *Bemlos* and *Tritella*, which did not coincide with [8] who pointed out *Rhepoxynius* and *Metharpinia* as the most abundant in Petatalco bay, Guerrero, in the southern Mexican Pacific [3], found two new species of amphipods of the genus *Caprella* (*Caprella calderoni* and *Caprella mercedesae*), but both species were collected by the oceanographic vessel "El Puma", in the central region of the Gulf of California, that is, to a greater area and depth than this study determined a composition of 16 species distributed in five genus of amphipods, resulting in this study with two genera less than the present investigation, although

the latter authors analyzed the amphipods from Baja California Sur (Mexico) to Peru, compared to this study that was carried out only in Cospita bay, Sinaloa, northwest of Mexico. The results obtained here for the order Amphipoda, with four superfamilies, seven families, seven genera and three species, represent an important taxonomic interest for this geographical area, since there are not records of benthic amphipods in Cospita bay, and also obtaining of 170 amphipods in artificial collectors for *Panulirus* lobster juveniles, represents an alternative microhabitat for this community of benthic crustaceans as indicated by [14] for the southeastern Gulf of California. The species that make up the minor crustaceans and particular the amphipods, since many of these species are part of the food chain of the trophic chain and most likely the success of higher species for the marine ecosystem to function properly [20-22].

## Conclusions

The number of amphipods obtained here in the spiny lobster pueruli collector represents an excellent artificial habitat for refuge of benthic amphipods on the northwestern coast of Mexico. In addition, the taxonomic composition of the benthic amphipods reported here in four superfamilies, seven families, seven genera and three species, represent the basis for knowledge of this group in this area, since there are practically no studies that precede the present investigation in regarding the taxonomic composition and capture of amphipods by collectors of spiny lobster hatchlings in this area.

## Acknowledgements

Thanks, the National Council of Sciences Humanities and Technology (CONACYT) in Mexico for the scholarship awarded to complete his postgraduate studies to the second author (CVU: 415832). The staff of the Consolidated Group on Fisheries Resources Management (UAS-CA-132) and staff of the Marine Invertebrate Systematics Laboratory of the University of Sea, Puerto Angel campus and especially Maria del Socorro García-Madrigal Ph.D for the taxonomic determination of the amphipods.

## References

1. Arzola González JF, LM Flores Campaña, MA Ortiz Arellano, Y Gutiérrez Rubio (2007) Captura y aspectos reproductivos de la pesquería de langostas *Panulirus inflatus* y *P. gracilis* (Crustacea: Decapoda) en el sur de Sinaloa, México. *Revista Ciencia y Mar* 11(31): 15-22.
2. Arzola González JF, R Pérez González, I Muñoz García, Y Gutiérrez Rubio, LM Flores Campaña (2011) Distribución de tallas de langosta *Panulirus inflatus* y *Panulirus gracilis* en la pesquería del sur de Sinaloa, México. *Revista Latinoamericana de Recursos Naturales* 7(1): 15-20.
3. Muñoz García IR, FJ García Rodríguez, R González Armas, R Pérez Enríquez, M Ayón Parente (2014) Taxonomy of the phyllosoma of *Panulirus inflatus* y *P. gracilis*, based on morphometry and molecular analysis. *Nauplios* 22(1): 41-51.
4. García Madrigal MS (2007) Clave ilustrada para las familias de anfípodos gamáridos (Peracarida: mphipoda) litorales del Pacífico Oriental Tropical y glosario de términos. *Revista Ciencia y Mar* 9(32): 3-27.
5. Hendrickx. M, MJ Ayón Parente (2014) Two new species of deep-water Caprella (Peracarida, Amphipoda, Caprellidae) from the Pacific coast Mexico collected during the Talud XIV cruise, with a checklist of species of Caprellidae recorded for the eastern Pacific. *Crustaceana* 87(1): 41-63.
6. Galván Villa CM, MJ Ayón Parente (2015) Caprella *suprapiscis* sp. nov. (Crustacea: Amphipoda. Caprellidae) from the Pacific coast of Mexico. *Zootaxa* 3956(4): 569-578.
7. Alarcón Ortega LC, AL Cupul Magaña, AP Rodríguez Troncoso, FG Cupul Magaña (2017) Distribución de los caprellidos (Crustacea: Amphipoda: Caprellidae) en la región del Pacífico oriente tropical: revisión documental. *Hidrobiológica* 27(2): 229-239.
8. Caraveo-Patiño J (1999) Anfípodos bentónicos de la bahía Petatalco, Estado de Guerrero, México. Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional.
9. Brusca R (1980) Common Intertidal Invertebrates of the Gulf of California. Arizona, USA. University of Arizona Press.
10. Brusca R, G Brusca (2003) Invertebrates. Massachusetts, USA. Sinauer Associates.



11. Winfield I, E Escobar Briones (2007) Anfípodos (Crustacea: Gammaridea) del sector norte del Mar Caribe: listado faunístico, registros nuevos y distribución espacial. *Revista Mexicana de Biodiversidad* 78(1): 51-61.
12. Winfield I, MR Muciño-Reyes, M Ortiz, S Chazaro Olvera, MA Lozano Aburto (2015) Biodiversidad de los anfípodos bentónicos (Peracarida: Amphipoda) asociados a macroalgas de Puerto Progreso, Yucatán, México. *Revista Mexicana de Biodiversidad* 86(3): 613-619.
13. Alarcón Ortega LC, AP Rodríguez Troncoso, FG Cupul Magaña (2015) First records of non-indigenous *Paracaprella pusilla* (Crustacea: Amphipoda) in the Northern Tropical East Pacific. *BioInvasions Records* 4(3): 211-215.
14. Valadez Manzano LM, R Pérez-González, D Becerra Arroyo, MI Borrego (2017) Settlement of the spiny lobster *Panulirus inflatus* (Bouvier, 1895) postlarvae in the southeastern Gulf of California. *Ecosistemas y Recursos Agropecuarios* 4(11): 403-409.
15. Montgomery SS, JR Craig (1997) A strategy for measuring the relative abundance of pueruli of spiny lobster *Jasus verreauxi*. In: *Fisheries Resources. The state of science and management*. 2<sup>nd</sup> World Fisheries Congress Proceedings.
16. Phillips BF (1972) A semi-quantitative collector of the puerulus larvae of the western rock lobster *Panulirus longipes cygnus* George (Decapoda: Palinuridae). *Crustaceana* 22: 147-154.
17. Lowry JK, AA Myers (2003) New amphipods crustaceans from Indo-West Pacific (Amathillopsidae, Eusiridae, Iphimediidae). *The Raffles Bulletin of Zoology* 51(2): 219-256.
18. Dallwitz MJ (2005) Overview of the DELTA System.
19. Martin JW, GE Davis (2001) An updated classification of the recent Crustacea. *Natural History Museum of Los Angeles Country. Science Series* 39: 2-124.
20. Landeros-Armenta JA (2017) Crecimiento de postlarvas de langostas *Panulirus inflatus* y *Panulirus gracilis* en cajas ostrícolas en la bahía de Mazatlán y el estero Cospita, Culiacán, Sinaloa, México. *Facultad de Ciencias del Mar, Universidad Autónoma de Sinaloa*.
21. Lowry JK (2006) New families and subfamilies of amphipod crustacean. *Zootaxa* 1254: 1-28.
22. Martin A, YJ Diaz (2003) La fauna de anfípodos (Crustacea: Amphipoda) de las aguas costeras de la región oriental, Venezuela. *Boletín del Instituto Español de Oceanografía* 19(1-4): 327-344. *West Pacific (Amathillopsidae, Eusiridae, Iphimediidae)*. *The Raffles Bulletin of Zoology* 51(2): 219-256.
23. Dallwitz MJ (2005) Overview of the DELTA System.
24. Martin JW, GE Davis (2001) An updated classification of the recent Crustacea. *Natural History Museum of Los Angeles Country. Science Series* 39: 2-124.
25. Landeros-Armenta JA (2017) Crecimiento de postlarvas de langostas *Panulirus inflatus* y *Panulirus gracilis* en cajas ostrícolas en la bahía de Mazatlán y el estero Cospita, Culiacán, Sinaloa, México. *Facultad de Ciencias del Mar, Universidad Autónoma de Sinaloa*.
26. Lowry JK (2006) New families and subfamilies of amphipod crustacean. *Zootaxa* 1254: 1-28.
27. Martin A, YJ Diaz (2003) La fauna de anfípodos (Crustacea: Amphipoda) de las aguas costeras de la región oriental, Venezuela. *Boletín del Instituto Español de Oceanografía* 19(1-4): 327-344.