STOMATOPOD AND DECAPOD CRUSTACEANS COLLECTED DURING THE CEEDEX P5 AND CEEDEX P7 CRUISES TO THE GULF OF TEHUANTEPEC, MEXICO

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ABSTRACT. Thirty-three stations were visited in 1991-1992 in the Gulf of Tehuantepec, México CEEDEX P5 and P7) and samples were obtained with a 10.67 m (35 feet) and a 24.38 m (80 feet) headrope length shrimp trawl, and a Mediterranean bottom trawl. Fifty-five species and subspecies of macro-crustaceans were collected: 6 species of Stomatopoda, 14 Peneaocidae, 1 Caridea, 1 Palinura, 6 Anomura, and 26 Brachyura. As many as 14 species, hitherto unknown in the Gulf of Tehuantepec, were found, including 3 species of shrimp (Trachypanaeus faoe, Scyonia martini and Processa aequinana), 4 Anomura (Pagaristes cf. bakeri, Pagaristes digueti, Petrochirus californiensis, and Porcellana hancocki), and 7 Brachyura (Hypoconcha lowei, Paradasysygos depressus, Pyronoma tuberculata, Neodoclea borreli, Stenocyplops osawa, Callinectes toxotes, and Oediplax granulata). Most species range from California, Baja California or the Gulf of California, to Peru/Ecuador. Considering the entire CEEDEX project (P4 cruise, March-April 1991), a total of 77 species was collected. Of these, 22 species (28.9%) were consistently captured during the three legs of the project. Variations noted among composition of catches (three legs) were independent of the fishing effort, depth range and type of gear used. A sharp decrease in number of species collected was observed during the P5 cruise. The species richness observed along transects does not depend primarily on period of sampling. This is supported by a cluster analysis which showed very strong similarity among species assemblages obtained along individual transects during both cruises. It also indicates a stronger similarity, on the one hand, between the western Gulf assemblages (transects A-B), and on the other hand, among transects C-E, in the eastern portion of the Gulf.

Key words: Stomatopod and decapod crustaceans, Distribution, Gulf of Tehuantepec.

ESTOMATÓPODOS Y CRUSTÁCEOS DECAPODOS RECOLECTADOS DURANTE LAS CAMPAÑAS CEEDEX P5 Y CEEDEX P7 EN EL GOLFO DE TEHUANTEPEC, MÉXICO

RESUMEN. Se visitaron 33 estaciones entre 1991-1992 (5 transectos) en el golfo de Tehuantepec, México (CEEDEX P5 y P7) utilizando redes camareras tipo comercial de 10.67 m (35 pies) y 24.38 m (80 pies) y una red tipo mediterráneo. Fueron recolectadas 55 especies de macrocrustáceos: 6 de Stomatopoda, 14 Peneaocidae, 1 Caridea, 1 Palinura, 6 Anomura, y 26 Brachyura. Fueron recolectadas catorce especies nunca antes citadas para el golfo de Tehuantepec: 3 de camarones (Trachypanaeus faoe, Scyonia martini y Processa aequinana), 4 Anomura (Pagaristes cf. bakeri, Pagaristes digueti, Petrochirus californiensis, y Porcellana hancocki), y 7 Brachyura (Hypoconcha lowei, Paradasysygos depressus, Pyronoma tuberculata, Neodoclea borreli, Stenocyplops osawa, Callinectes toxotes y Oediplax granulata). La mayoría de las especies se distribuyen desde California, Baja California, o el golfo de California, hasta Perú/Ecuador. Considerando el proyecto CEEDEX completo (con el crucero P4, marzo-abril 1991), fueron recolectadas 77 especies; 22 (28.6%) fueron consistentemente capturadas durante las tres partes del proyecto. Las variaciones en la composición de las capturas son independientes del tipo de arte usado, del esfuerzo de pesca y de las profundidades del transecto. Hubo un descenso en el número de especies recolectadas durante el crucero P5. La riqueza específica observada a lo largo de los transectos no depende en primer término del periodo de muestreo. Eso es confirmado por un análisis de agrupaciones (clúster) que muestra una fuerte similitud entre los conjuntos de especies encontradas a lo largo de cada transecto en los cruceros P5 y P7. Muestra también una fuerte similitud, por una parte, entre la porción oeste del golfo (transectos A-B), y por otra parte entre los transectos C-E, en la porción este del golfo.

Palabras clave: Crustáceos estomatópodos y decápodos, Distribución, Golfo de Tehuantepec.


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INTRODUCTION

The offshore fishery along the Pacific coast of México is based principally on the exploitation of the *Peneaus* shrimp fishing grounds in the southeastern Gulf of California, the Gulf of Tehuantepec, and to a lesser degree, the northern Gulf of California and the Magdalena Bay area, on the southwest coast of Baja California (Rodríguez de la Cruz, 1981a, 1981b; Hendrickx, 1985). In order to obtain basic information related to the demersal macrofauna inhabiting the two major fishing grounds, a sampling program was designed by the Instituto de Ciencias del Mar, Barcelona, Spain, and the Universidad Autónoma de Sinaloa, Mexico ("Requirements for the re-structuring of the Mexican Pacific demersal fisheries", CEEMEX project). This project was sponsored by the European Economic Community (EEC) and consists of a series of prospective surveys. Sampling in the southeastern Gulf of California started in 1989, and in the Gulf of Tehuantepec in 1991 (Anonymous, 1993; Morales-Nin, 1994).

Results concerning the stomatopod and decapod crustaceans obtained during the first leg (March-April 1991) of the sampling program in the Gulf of Tehuantepec were presented by Hendrickx & Vázquez-Cureño (1997), who reported 46 species and subspecies. These authors also summarized our present knowledge of stomatopod and decapod crustaceans of the Gulf of Tehuantepec, and emphasized that published records are scarce. Consequently, results obtained during the first leg of the present project considerably increased information related to the macrocrustaceans fauna of the area. The results obtained during the second and third legs, at different periods of the year (December and May), allow for further report on species occurrence and interpretation of data related to the composition and distribution of this fauna over a much longer period of time. The southwestern part of the Pacific coast of México has repeatedly been recognized as a poorly known region as far as marine stomatopod and decapod crustaceans fauna is concerned (Hendrickx & Salgado-Barragán, 1991; Alvarez del Castillo et al., 1992; Hendrickx, 1993; Hendrickx & Estrada-Navarrete, 1996). In particular, there has been only one study so far of the subtidal macro-crustaceans fauna of the Gulf of Tehuantepec. This study, based on 22 samples obtained in October 1979, reported on 4 species of Stomatopoda and 23 species of Decapoda only (Sosa-Hernández et al., 1980). In the long term, however, these data are insufficient and comprehensive studies, including a consecutive series of sampling operations, are needed to characterize the system as far as the macrocrustaceans community is concerned. For this reason, samples of subtidal stomatopod and decapod crustaceans were obtained in this area. These represent the largest series of records ever made available for the Gulf of Tehuantepec. The purpose of this paper is to present the results obtained during the second and third legs of the survey, and to establish general trends related to the occurrence and distribution of species of macro-crustaceans in the Gulf of Tehuantepec.

MATERIAL AND METHODS

The material on which the present study is based was collected in December 1991 (CEEMEX P5) and May 1992 (CEEMEX P7) in the Gulf of Tehuantepec, southwestern México, aboard the RV "El Puma" of the Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México. A total of 33 localities were visited, most of these twice, and samples of invertebrates and fish were obtained. Sampling stations were located along 5 transects (A to E) (Fig. 1). Trawling was done either with a 10.67 m or 24.38 m headrope length shrimp trawl, similar to those used by shrimpers in the area, or with a Mediterranean bottom trawl, similar to the one used in the Mediterranean fisheries. Trawl duration varied slightly according to sampling conditions (type of gear and bottom); most trawls, however, were about 30 minutes long. Water temperature was measured at each sampling station in the water column and close to the bottom (epibenthic value) using a CTD instrument. Epibenthic dissolved oxygen concentrations were obtained from water samples collected with Niskin bottles. Environmental data were obtained from the final report of the CEEMEX Project (Anonymous, 1993) and from unpublished data files.
A species account is presented including author and year of description, material examined, the currently recognized distribution and depth ranges in the eastern Pacific, followed by sources where Gulf of Tehuantepec records are to be found, and remarks. Distribution and depth ranges of species already collected during the first leg will be found in the corresponding report (Hendrickx & Vázquez-Cureño, 1997) and are therefore not repeated herein. Abbreviations used are as follows: Sta., sampling station; T.L., total length; C.W., carapace width; C.L., carapace length; m male, f female, ovigerous female; OT35 and OT80, 35 (10.67 m) and 80 feet (24.38 m) commercial otter trawl; MBT, Mediterranean bottom trawl.

**STOMATOPODA**

**Squillidae**

1. *Squilla biforis* Bigelow, 1891.

Material examined: CEEMEX P5: Sta. 13, 11/XII/91, 68 m and 47 f (T.L. 66.0-106.0 mm), 100-117 m, OT80; Sta. 23, 12/XII/91, 20 m and 28 f (T.L. 61.0-97.0 mm), 125-134 m, OT35; Sta. 24, 12/XII/91, 8 m and 10 f (T.L. 73.0-86.0 mm), 152-166 m, OT35; Sta. 32, 13/XII/91, 51 m and 31 f (T.L. 80.0-135.0 mm), 124-132 m, OT35; Sta. 33, 13/XII/91, 19 m and 22 f (T.L. 71.0-105.0 mm), 162-169 m, OT35; Sta. 41, 14/XII/91, 7 m and 6 f (T.L. 89.0-119.0 mm), 72-75 m, OT80; Sta. 42, 14/XII/91, 14 m and 16 f (T.L. 82.0-111.0 mm), 187-196 m, OT80.

CEEMEX P7: Sta. 14, 10/V/92, 5 m and 8 f (T.L. 12.0-20.3 mm), 139-163 m, MBT; Sta. 23, 10/V/92, 18 m and 13 f (T.L. 80.0-116.0 mm), 140-148 m, OT80; Sta. 24, 11/V/92, 26 m and 73 f (T.L. 53.0-115.0 mm), 184-185 m, OT80; Sta. 33, 12/V/92, 50 m and 17 f (T.L. 97.0-130.0 mm), 161-178 m, OT80; Sta. 41, 13/V/92, 16 m and 9 f (T.L. 87.0-138.0 mm), 151-163 m, OT80; Sta. 42, 13/V/92, 15 m and 23 f (T.L. 80.0-132.0 mm), 208-220 m, OT80.


2. *Squilla hancocki* Schmitt, 1940.

Material examined: CEEMEX P5: Sta. 3, 16/XII/91, 11 m and 6 f (T.L. 6.5-8.8 mm), 50-54 m, OT80.

CEEMEX P7: Sta. 4, 14/V/92, 4 m and 3 f (T.L. 11.1-16.8 mm), 47-49 m, OT80; Sta.
Table 1.- List of species of stomatopod and decapod crustaceans collected during the CEEMEX P4 (after Hendrickx & Vázquez-Cureño, 1997), the CEEMEX P5 and P7 (this survey). Frequency of occurrence of each species in the different cruises is indicated (total number of catches per cruise). Number in boldface indicates maximum occurrence per species considering the 3 cruises (species in boldface were captured during the three cruises) (=atypical for soft bottom subtidal habitat).

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<td>Portunus acuminatus (Stimpson, 1871)</td>
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<td>Portunus xantusi (Stimpson, 1860)</td>
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<td>Portunus xantusi xantusi (Stimpson, 1860)</td>
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<td>Portunus xantusi xantusi (Faxon, 1893)</td>
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<td>Portunus tuberculatus (Stimpson, 1869) (*)</td>
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<tr>
<td>Anthidae</td>
<td>Edwardsium lobipes (Rathbun, 1895)</td>
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<td>Heteractea lunata (Milne Edwards &amp; Lucas, 1843) (*)</td>
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<td>Microcassiope xantusi (Stimpson, 1871) (*)</td>
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<td>Quadrilia nitida (Smith, 1869) (*)</td>
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<tr>
<td>Goneplaciida</td>
<td>Oedioplex granulata (Rathbun, 1893)</td>
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<td>TOTAL NUMBER OF COLLECTED SPECIES</td>
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<td>37</td>
<td>45</td>
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11, 9/V/92, 1 f and 4 m (T.L. 77.0-88.0 mm), 46 m, MBT; Sta. 31, 12/V/92, 3 f and 5 m (T.L. 61.0-84.0 mm), 76 m, OT80; Sta. 32, 12/V/92, 1 f and 1 m (T.L. 43.4-78.0 mm), 118 m, OT80.


3. **Squilla mantoidea** Bigelow, 1893.

**Material examined:** CEEDEX P5: Sta. 3, 16/XII/91, 3 m (T.L. 10.8-13.2 mm), 50-54 m, OT80; Sta. 19, 12/XII/91, 1 m and 3 f (T.L. 56.0-165.0 mm), 31-35 m, OT80; Sta. 37, 14/XII/91, 1 m (T.L. 145.0 mm), 25-30 m, OT80.

CEEDEX P7: Sta. 11, 9/V/92, 3 m (T.L. 92.0-178.0 mm), 46 m, MBT; Sta. 19, 10/V/92, 3 m and 3 f (T.L. 95.9-161.0 mm), 34 m, OT80; Sta. 28, 11/V/92, 6 m and 3 f (T.L. 93.0-149.0 mm), 28 m, OT80; Sta. 37, 12/V/92, 1 m (T.L. 102.0 mm), 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980) and Hendrickx & Vázquez-Cureño (1997).

4. **Squilla panamensis** Bigelow, 1891.

**Material examined:** CEEDEX P7: Sta. 13, 10/V/92, 15 m and 24 f (T.L. 40.0-101.0 mm), 104 m, MBT.


5. **Squilla parva** Bigelow, 1891

**Material examined:** CEEDEX P5: Sta. 37, 14/XII/91, 1 m (T.L. 55.7 mm), 25-30 m, OT80.

CEEDEX P7: Sta. 11, 9/V/92, 3 f (T.L. 44.0-61.0 mm), 46 m, MBT; Sta. 37, 12/V/92, 3 m and 4 f (T.L. 45.1-62.2 mm), 25 m, OT80.


**DECAPODA**

**Penaeidae**

6. **Penaeus (Farfantepenaeus) brevirostris** Kingsley, 1878.

**Material examined:** CEEDEX P5: Sta. 12, 11/XII/91, 18 m and 7 f (T.L. 8.2-108.0 mm), 59 m, OT80; Sta. 13, 11/XII/91, 1 m (T.L. 92.00 mm), 100-117 m, OT80; Sta. 40, 14/XII/91, 19 f (T.L. 127.0-177.0 mm), 96-97 m, OT80.

CEEDEX P7: Sta. 12, 11/XII/91, 1 f (T.L. 47.3 mm), 59 m, OT80; Sta. 13, 10/V/92, 3 f unmeasured, 104 m, MBT; Sta. 21, 10/V/92, 32 f (T.L. 136.0-175.0 mm), 72-75 m, OT80; Sta. 23, 10/V/92, 1 f unmeasured, 140-148 m, OT80; Sta. 31, 12/V/92, 5 m and 15 f unmeasured, 76 m, OT80; Sta. 32, 12/V/92, 37 m and 20 f unmeasured, 118 m, OT80.

**Distribution and depth ranges:** From northern Sinaloa, México, to Cabo Blanco, Perú (Wicksten & Hendrickx, 1992); Galápagos Islands (Pérez-Farfante, 1988). From 20 to 180 m depth (Hendrickx, 1995a). Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980).

7. **Penaeus (Farfantepenaeus) californiensis** Holmes, 1900.

**Material examined:** CEEDEX P5: Sta. 4, 16/XII/91, 1 m (T.L. 109.0 mm), 61-86 m, OT80; Sta. 11, 11/XII/91, 2 m (T.L. 88.0-110.0 mm), 42-49 m, OT80; Sta. 12, 11/XII/91, 5 m and 5 f (T.L. 96.0-125.0 mm), 59 m, OT80; Sta. 19, 12/XII/91, 6 m and 35 f (T.L. 123.0-198.0 mm), 31-35 m, OT80.

CEEDEX P7: Sta. 11, 9/V/92, 1 m and 3 f (T.L. 65.0-76.0 mm), 46 m, MBT; Sta. 12, 9/V/92, 23 m and 64 f (T.L. 58.0-138.0 mm), 65-66 m, MBT; Sta. 20, 10/V/92, 2 m, unmeasured, 42 m, OT80; Sta. 21, 10/V/92, 23 m and 31 f unmeasured, 72-75 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980) and Hendrickx & Vázquez-Cureño (1997).
8. *Penaeus (Litopenaeus) stylirostris* Simpson, 1871.

**Material examined:** CEMEX P7: Sta. 37, 13/V/92, 1 m unmeasured, 25 m, OT80.

**Distribution and depth ranges:** From Abreojos Point, west coast of Baja California to Paita, Peru, including the whole Gulf of California, Mexico (Wicksten & Hendrickx, 1992). Previously cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980). From 5 to 45 m depth (Hendrickx, 1995a).


**Material examined:** CEMEX P5: Sta. 4, 16/XII/91, 1 m (T.L. 115.0 mm), 61-86 m, OT80; Sta. 10, 11/XII/91, 1 f (T.L. 110.0 mm), 23 m, OT80; Sta. 11, 11/XII/91, 1 f (T.L. 143.0 mm), 42-49 m, OT80; Sta. 37, 14/XII/91, 5 m and 10 f (T.L. 95.0-185.0 mm), 25 m, OT80.

**CEMEX P7:** Sta. 10, 9/V/92, 7 m and 11 f (T.L. 132.0-190.0 mm), 26-27 m, MBT; Sta. 19, 10/V/92, 7 m and 4 f, unmeasured, 34 m, OT80; Sta. 28, 11/V/92, 11 m and 10 f unmeasured, 28 m, OT80; Sta. 37, 12/V/92, 11 m and 14 f unmeasured, 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980) and Hendrickx & Vázquez-Cureño (1997).


**Material examined:** CEMEX P7: Sta. 12, 11/XII/91, 2 f (T.L. 91.0-95.0 mm), 59 m, OT80.


**Remarks:** Present record increases the maximum depth range to 59 m. As noted by Holthuis (1980: 54), this species was mistakenly attributed to Loesch & Avila (1964) and misspelled in several publications. It is Holthuis (loc. cit.) who checked Obarrio’s original mimeographed publication and definitively reinstated the correct spelling and author for this species. The first correct citation of the specific name, however, is due to Lindner (1957). Ignoring Obarrio’s publication, Pérez-Farfante (1971: 643) selected a neotype for *Trachypenaeus fasco* [sic] from Loesch & Avila material from Ecuador (which she believed had been used to describe the species). The type locality of Obarrio’s species, however, is actually in Panamá. *Trachypenaeus fasco* has apparently never been cited for the Gulf of Tehuantepec.


**Material examined:** CEMEX P7: Sta. 28, 11/V/92, 1 m and 2 f unmeasured, 28 m, OT80; Sta. 37, 13/V/92, 2 m and 2 f (T.L. 95.0-130.0 mm), 25 m, OT80.

**Distribution and depth ranges:** From the Gulf of Tehuantepec, México, to Paita, Perú (Méndez, 1981; Pérez-Farfante, 1988; Wicksten & Hendrickx, 1992). From 5 to 100 m depth (Hendrickx, 1995a). Also cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980).

**Remarks:** Among the few species of tropical penaeoid shrimps that do not reach the Gulf of California, *T. fuscina* presents a distribution pattern in the Eastern Tropical Pacific similar to *Penaeus occidentalis* Streets.


**Material examined:** CEMEX P5: Sta. 12, 11/XII/91, 2 f (T.L. 71.0-78.0 mm), 59 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980) and Hendrickx & Vázquez-Cureño (1997).


**Material examined:** CEMEX P5: Sta. 4, 16/XII/91, 1 f (T.L. 62.0 mm), 61-86 m, OT80.
**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980) and Hendrickx & Vázquez-Cureño (1997).


**Material examined:** CEMEX P7: Sta. 37, 13/V/92, many specimens (fresh weight 2,530 g), unsexed and unmeasured, 25 m, OT80.

**Distribution and depth ranges:** From Piaxtla Point, Sinaloa, México to Paita, Perú (Wicksten & Hendrickx, 1992). From 0 to 70 m depth (Hendrickx, 1995a). Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980).

Sicyoniidae


**Material examined:** CEMEX P5: Sta. 11, 11/XII/91, 2 f (T.L. 70.0-73.0 mm), 42-49 m, OT80; Sta. 12, 11/XII/91, 8 m and 24 f (T.L. 53.0-77.0 mm), 59 m, OT80.

CEMEX P7: Sta. 11, 9/V/92, 8 m and 28 f (T.L. 41.0-71.0 mm), 46 m, MBT; Sta. 12, 9/V/92, 6 m and 14 f (T.L. 43.0-73.0 mm), 65-66 m, MBT; Sta. 37, 13/V/92, 2 m and 15 f unmeasured, 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980), Pérez-Farfante (1985) and Hendrickx & Vázquez-Cureño (1997).

16. *Sicyonia aliifinis* (Burkenroad, 1934)

**Material examined:** CEMEX P5: Sta. 19, 12/XII/91, 2 f (T.L. 65.0-77.0 mm), 31-35 m, OT80.

CEMEX P7: Sta. 20, 10/V/92, 1 m and 1 f unmeasured, 42 m, OT80; Sta. 21, 10/V/92, 16 m and 17 f unmeasured, 72-75 m, OT80; Sta. 28, 11/V/92, 7 f unmeasured, 28 m, OT80; Sta. 30, 12/V/92, 1 f (T.L. 74.9 mm), 60 m, OT80; Sta. 31, 12/V/92, 10 m and 5 f (T.L. 56.9-73.2 mm), 76 m, OT80; Sta. 32, 12/V/92, 4 f unmeasured, 118 m, OT80; Sta. 37, 13/V/92, 1 f unmeasured, 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980), Pérez-Farfante (1985) and Hendrickx & Vázquez-Cureño (1997).


**Material examined:** CEMEX P7: Sta. 31, 12/V/92, 2 m and 6 f (T.L. 33.5-64.0 mm), 76 m, OT80.

**Distribution and depth ranges:** From Santa Margarita Island, west coast of Baja California, Tiburón Island and Estero Tasttiota, Sonora, México, to southwest of Ana Maria Point, Gulf of Panamá (Wicksten & Hendrickx, 1992). From 9 to 242 m depth (Hendrickx, 1995a). Reported for Puerto Angel, at the northern limit of the Gulf of Tehuantepec by Pérez-Farfante (1985).

Solenoceridae

18. *Solenocera flores* Burkenroad, 1938

**Material examined:** CEMEX P5: Sta. 4, 16/XII/91, 2 f (T.L. 47.0-57.0 mm), 61-86 m, OT80.

CEMEX P7: Sta. 4, 14/V/92, 6 m and 12 f (T.L. 42.0-67.0 mm), 47-49 m, OT80; Sta. 12, 9/V/92, 23 m and 23 f (T.L. 31.0-72.0 mm), 65-66 m, MBT; Sta. 31, 12/V/92, 1 unsexed and unmeasured specimen, 76 m, OT80; Sta. 32, 12/V/92, 1 m and 3 f (T.L. 35.0-52.0 mm), 118 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980), Pérez-Farfante (1985) and Hendrickx & Vázquez-Cureño (1997).

19. *Solenocera mutator* Burkenroad, 1938

**Material examined:** CEMEX P5: Sta. 13, 11/XII/91, 139 m and 256 f (T.L. 40.0-73.0 mm), 100-117 m, OT80; Sta. 23, 12/XII/91, 27 m and 23 f (T.L. 49.5-72.0 mm), 125-134 m, OT35; Sta. 32, 13/XII/91, 46 m and 121 f (C.L. 17.6-26.7 mm), 124-132 m, OT35; Sta. 41, 14/XII/91, 42 m and 109 f (T.L. 51.0-76.0 mm), 72-75 m, OT80; Sta.
42, 14/XII/91, 1 m and 2 f (T.L. 56.0-60.0 mm), 187-196 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Hendrickx & Vázquez-Cureño (1997).

**Diogenidae**

22. *Dardanus sinistipes* (Stimpson, 1859)

**Material examined:** CEELEX P5: Sta. 3, 16/XII/91, 5 m and 2 f (C.L. 2.6-11.1 mm), 50-54 m, OT80; Sta. 4, 16/XII/91, 7 m and 2 f (C.L. 3.0-9.0 mm), 61-86 m, OT80; Sta. 10, 11/XII/91, 3 f (C.L. 2.1-2.9 mm), 23 m, OT80; Sta. 12, 11/XII/91, 2 m and 2 f (C.L. 4.1-5.3 mm), 59 m, OT80; Sta. 13, 11/XII/91, 1, 170 m and 2 f (C.L. 2.6-5.5 mm), 100-117 m, OT80; Sta. 19, 12/XII/91, 5 m and 1 f (C.L. 2.8-4.2 mm), 31-35 m, OT80; Sta. 20, 12/XII/91, 1 m and 1 f (C.3.7-16.9 mm), 25-44 m, OT80; Sta. 21, 12/XII/91, 5 m and 2 f (C.L. 2.5-6.8 mm), 69-72 m, OT80; Sta. 30, 13/XII/91, 14 m and 2 f (C.L. 2.5-3.9 mm), 60-63 m, OT35; Sta. 31, 13/XII/91, 6 m and 9 f (C.L. 0.0-15.6 mm), 80 m, OT35; Sta. 39, 14/XII/91, 9 m and 5 f (C.L. 2.5-7.2 mm), 62-66 m, OT35; Sta. 40, 14/XII/91, 2 m and 3 f (C.L. 3.5-6.5 mm), 96-97 m, OT80; Sta. 41, 14/XII/91, 1 f (C.L. 3.5 mm), 72-75 m, OT80.

**Material examined:** CEELEX P7: Sta. 4, 14/V/92, 11 m and 15 f (C.L. 2.5-9.2 mm), 70-80 m, OT80; Sta. 10, 9/V/92, 2 m (C.L. 2.6-13.5 mm), 26-27 m, MBT; Sta. 11, 9/V/92, 6 m (C.L. 6.6-10.5 mm), 46 m, MBT; Sta. 18, 10/V/92, 33 unsed and unmeasured specimens, 34 m, OT80; Sta. 21, 10/V/92, 11 unsed and unmeasured specimens, 27-75 m, OT80; Sta. 28, 11/V/92, 23 unsed and unmeasured specimens, 28 m, OT80; Sta. 37, 13/V/92, 7 m and 5 f (C.L. 3.7-9.9 mm), 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Ball & Haig (1974) and Hendrickx & Vázquez-Cureño (1997).

23. *Paguristes cf. bakeri* Holmes, 1900

**Material examined:** CEELEX P7: Sta. 13, 10/V/92, 3 m (C.L. 7.9-9.1 mm), 104 m, MBT.
Distribution and depth ranges: From San Francisco, California, USA, along the west coast of Baja California, and from off Consag Rocks to Teacapan, Gulf of California, México (Schmitt, 1921; Haig et al. 1970; Hendrickx, unpubl. data). From 40 to 232 m (Snyder-Conn, 1980).

Remarks: Specimens examined differ slightly from the much larger material of this species collected in the Gulf of California and kept in the Mazatlán invertebrates reference collections. If confirmed, the Gulf of Tehuantepec record would be the first for this species south of the Gulf of California, México. Morán & Dittel (1993) reported Paguristes holmesi Glassell, 1937, for the Pacific coast of Costa Rica (Gulf of Nicoya and vicinity). Glassell's species is a junior synonym of P. bakeri, and it is therefore very likely that the southernmost distribution limit of the latter is in Costa Rica.

24. Paguristes digueti Bouvier, 1893

Material examined: CEESEX P5: Sta. 17, 12/V/92, 1 m and 1 f (C.L. 6-3.6.9 mm), 25 m, OT80.

Distribution and depth ranges: From Magdalena Bay, west coast of Baja California, San Miguel Cape, Santa Rosalía and Arboleda Point, Gulf of California, México, to Ecuador (Glassell, 1937; Haig pers. com.; Hendrickx, unpubl. data). From 13 to 75 m depth (Glassell, 1937).

Remarks: This species has not been previously cited for the Gulf of Tehuantepec. Although it seems to be relatively common throughout the Gulf of California, it had only been previously collected once south of this area, in Ecuador.

25. Petrochirus californiensis Bouvier, 1895

Material examined: CEESEX P7: Sta. 19, 16/XII/91, 1 m and 10 f (C.L. 2.0-4.3 mm), 50-54 m, OT80; Sta. 19, 16/XII/91, 1 f (C.L. 1.8-2.4 mm), 23 m, OT80; Sta. 19, 12/XII/91, 1 f (C.L. 3.6 mm), 31-35 m, OT80; Sta. 20, 12/XII/91, 2 specimens, unsexed and unmeasured, 42 m, OT80; Sta. 30, 13/XII/91, 1 m (C.L. 5.4 mm), 60-63 m, OT35.

CEEX P5: Sta. 28, 11/V/92, 1 f (C.L. 5.7 mm), 28 m, OT80.
Distribution and depth ranges: San Juanico Bay, west coast of Baja California, and throughout the Gulf of California, México, to Tumbes, Perú (Haig, 1960, 1968; Gore & Abele, 1976). From 0 to 108 m depth (Gore, 1982). Previously cited for Puerto Huautulco by Haig (1968) and for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980).

28. Porcelliana hancockii Glassell, 1938

Material examined: CEELEX P5: Sta. 12, 11/XII/91, 1 unsexed specimen (C.L. 3.0 mm), 59 m, OT80.

Distribution and depth ranges: From Consag Rocks, Gulf of California, México, to the Bay of Panamá; Chidlayo, Perú (Haig, 1962; Gore & Abele, 1976; Salgado-Barragán & Hendrickx, 1996). From 45 to 216 m depth (Salgado-Barragán & Hendrickx, 1996).

Remarks: This species had not been previously cited for the Gulf of Tehuantepec.

29. Pisidia magdalenensis (Glassell, 1936)

Material examined: CEELEX P5: Sta. 10, 11/XII/91, 1 f (C.L. 2.9 mm), 23 m, OT80; Sta. 12, 11/XII/91, 1 m and 1 f (C.L. 2.3-3.0 mm), 59 m, OT80.

Distribution and depth ranges: From Santa María Bay, west coast of Baja California, Arboleda Point, Sonora and Mazatlán, Sinaloa, México to Tumbes, Perú (Haig, 1960, 1962; Hendrickx & van der Heiden, 1984). From 0 to 78 m depth (Gore, 1982). Previously cited by Haig (1960, 1968) for Puerto Huautulco, at the western limit of the Gulf of Tehuantepec.

BRACHYURA

Dromiidae

30. Cryptodromiopsis larraburei (Rathbun, 1910)

Material examined: CEELEX P7: Sta. 21, 10/V/92, 1 unsexed and unmeasured specimen, 72-75 m, OT80.


31. Hypoconcha lowei Rathbun, 1933

Material examined: CEELEX P7: Sta. 28, 11/V/92, 1 m and 2 f (C.W. 18.2-24.3 mm), 28 m, OT80; Sta. 37, 13/V/92, 2 m (C.W. 15.3-20.1 mm), 25 m, OT80.

Distribution and depth ranges: From San Felipe, northern Gulf of California, México to La Libertad, Ecuador (Garth, 1948; Brusca, 1980). From 13 to 100 m (Rathbun, 1937).

Remarks: Hypoconcha lowei is a rather uncommon species of dromid crab. In addition to the type locality (San Felipe) and the northern end of the Gulf of California where it is said to be abundant (Brusca, 1980), there are only three other published records for this species, all in Ecuador (Rathbun, 1937; Garth, 1948). Present record is the first for the Gulf of Tehuantepec.

Dorippidae

32. Ethusa lata Rathbun, 1893

Material examined: CEELEX P5: Sta. 3, 16/XII/91, 2 m and 1 f (C.W. 14.6-16.2 mm), 50-54 m, OT80; Sta. 12, 11/XII/91, 1 m (C.W. 8.7 mm), 59 m, OT80; Sta. 13, 11/XII/91, 1 f (C.W. 19.0 mm), 100-117 m, OT80.

Remarks: Cited for Puerto Huatulco by Garth (1966) and for the Gulf of Tehuantepec by Hendrickx & Vázquez-Cureño (1997).

Calappidae

33. Calappa convexa de Saussure, 1853

Material examined: CEELEX P5: Sta. 3, 16/XII/91, 1 m and 1 f (C.W. 123.0-144.0 mm), 50-54 m, OT80; Sta. 20, 12/XII/91, 1 f (C.W. 108.0 mm), 25-44 m, OT80.

CEEX P7: Sta. 10, 9/V/92, 10 m and 1 f (C.W. 60.0-134.50 mm), 26-27 m, MBT; Sta. 19, 10/V/92, 1 m and 2 f (C.W. 65.4-72.6 mm), 34 m, OT80; Sta. 20, 10/V/92, 1 f (C.W. 108.0 mm), 25-44 m, OT80.
97.0 cm), 42 m, OT80; Sta. 21, 10/V/92, 1 m (C.W. 144.0 mm), 72-75 m, OT80; Sta. 38, 12/V/92, 2 m and 1 f (C.W. 37.9-104.7 mm), 43 m, OT80.

**Remarks:** Cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980) and Hendrickx & Vázquez-Cureño (1997). Record at Sta. 21 represents a slight increase of maximum depth range for this species, from 58 to 72-75 m.

34. *Calappa saussurei* Rathbun, 1898

**Material examined:** CEELEX P5: Sta. 4, 16/XII/91, 1 m (C.W. 77.3 mm), 61-86 m, OT80; Sta. 13, 11/XII/91, 21 m and 10 f (C.W. 37.1-84.8 mm), 100-117 m, OT80; Sta. 32, 13/XII/91, 1 m and 1 f (C.W. 43.1-44.5 mm), 124-132 m, OT35; Sta. 33, 13/XII/91, 1 m (C.W. 43.2 mm), 162-169 m, OT35; Sta. 40, 14/XII/91, 2 m (C.W. 62.9-69.7 mm), 96-97 m, OT80; Sta. 41, 14/XII/91, 12 m and 8 f (C.W. 45.3-85.5 mm), 72-75 m, OT80.

**Distribution and depth ranges:** From Toscas Point, west coast of Baja California, and throughout the Gulf of California, from Puerto Refugio to Cabo San Lucas, Baja California, and from Estero Tastiota, Sonora, to Mita Point, Nayarit, México, south to La Plata Island, Ecuador (Hendrickx, 1990a). Cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980). From 1 to 274 m depth (Hendrickx, 1995b).

35. *Hepatus kossmanni* Neumann, 1878

**Material examined:** CEELEX P5: Sta. 3, 16/XII/91, 2 m and 2 f (C.W. 38.7-76.5 mm), 50-54 m, OT80; Sta. 12, 11/XII/91, 8 m and 5 f (C.W. 26.0-60.4 mm), 59 m, OT80.

CEELEX P7: Sta. 4, 14/V/92, 3 m and 6 f (C.W. 42.8-69.9 mm), 70-80 m, OT80; Sta. 10, 9/V/92, 1 m (C.W. 39.5 mm), 26-27 m, MBT; Sta. 11, 9/V/92, 4 m and 3 f (C.W. 61.6-77.8 mm), 46 m, MBT; Sta. 12, 9/V/92, 6 m and 16 f (C.W. 33.7-89.6 mm), 65-66 m, MBT; Sta. 28, 11/V/92, 11 m and 7 f (C.W. 33.8-58.5 mm), 28 m, OT80; Sta. 37, 13/V/92, 5 m and 8 f (C.W. 30.3-51.9 mm), 25 m, OT80.

**Remarks:** Cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980) and Hendrickx & Vázquez-Cureño (1997).

36. *Platymera gaudichaudii* H. Milne Edwards, 1837

**Material examined:** CEELEX P5: Sta. 4, 16/XII/91, 1 m (C.W. 77.3 mm), 61-86 m, OT80; Sta. 13, 11/XII/91, 21 m and 10 f (C.W. 37.1-84.8 mm), 100-117 m, OT80; Sta. 32, 13/XII/91, 1 m and 1 f (C.W. 43.1-44.5 mm), 124-132 m, OT35; Sta. 33, 13/XII/91, 1 m (C.W. 43.2 mm), 162-169 m, OT35; Sta. 40, 14/XII/91, 2 m (C.W. 62.9-69.7 mm), 96-97 m, OT80; Sta. 41, 14/XII/91, 12 m and 8 f (C.W. 45.3-85.5 mm), 72-75 m, OT80.

**Distribution and depth ranges:** From Toscas Point, west coast of Baja California, and throughout the Gulf of California, from Puerto Refugio to Cabo San Lucas, Baja California, and from Estero Tastiota, Sonora, to Mita Point, Nayarit, México, south to La Plata Island, Ecuador (Hendrickx, 1990a). Cited for the Gulf of Tehuantepec by Sosa-Hernández *et al.* (1980) and Hendrickx & Vázquez-Cureño (1997).

37. *Osachila lata* Faxon, 1893.

**Material examined:** CEELEX P5: Sta. 23, 12/XII/91, 1 f (C.W. 19.4 mm), 125-134 m, OT35.

CEELEX P7: Sta. 31, 12/V/92, 2 m and 5 f (C.W. 34.8-43.2 mm), 76 m, OT80.

**Remarks:** Cited for the Gulf of Tehuantepec by Hendrickx & Vázquez-Cureño (1997).

**Leucosididae**


**Material examined:** CEELEX P7: Sta. 4, 14/V/92, 11 m and 12 f (C.W. 18.4-30.6 mm), 70-80 m, OT80; Sta. 31, 12/V/92, 7 m and 7 f (C.W. 22.7-29.3 mm), 76 m, OT80.

**Distribution and depth ranges:** From Santa María Bay, west coast of Baja California, Arboleda Point, Sonora and Rico Fuerte, Sinaloa, México, south to Santa Elena Cape,

39. Persephona townsendi (Rathbun, 1893)

**Material examined:** CEEDEX P5: Sta. 12, 11/XII/91, 1 f (C.W. 30.5 mm), 59 m, OT80.

CEEMEX P7: Sta. 4, 14/V/92, 1 m and 1 f (C.W. 27.5-32.3 mm), 70-80 m, OT80; Sta. 28, 11/V/92, 3 f (C.W. 27.7-30.4 mm), 28 m, OT80; Sta. 31, 12/V/92, 4 f (C.W. 20.0-20.4 mm), 76 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Hendrickx & Vázquez-Cureño (1997).

40. Persephona edwardsii Bell, 1855

**Material examined:** CEEEMEX P7: Sta. 37, 12/V/92, 7 m and 9 f unmeasured, 25 m, OT80.

**Remarks:** Previously cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980) and Hendrickx & Vázquez-Cureño (1997). Present record increases the maximum depth to 25 m.

**Inachidae**

41. Stenorynchus debilis (Smith, 1871)

**Material examined:** CEEEMEX P5: Sta. 39, 14/XII/91, 3 m (C.W. 11.2-14.1 mm), 62-66 m, OT35.

CEEMEX P7: Sta. 11, 9/V/92, 1 m (C.W. 10.4 mm), 46 m, MBT; Sta. 28, 11/V/92, 2 f unmeasured, 28 m, OT80; Sta. 37, 12/V/92, 1 f (C.W. 10.0 mm), 25 m, OT80.

**Distribution and depth ranges:** From Magdalena Bay, west coast of Baja California, and the northern Gulf of California to Valparaíso, Chile; Alijos Rocks, Revillagigedo, Coco and Galápagos Islands. From shore to 145 m depth (Garth, 1958; Hendrickx, 1990a; Wicksten, 1996).

**Remarks:** Previously cited for the Gulf of Tehuantepec by Hendrickx & Vázquez-Cureño (1997).

**Inachoididae**

42. Parasygylus depressus (Bell, 1835)

**Material examined:** CEEEMEX P5: Sta. 3, 16/XII/91, 17 m and 18 f (C.W. 10.7-26.4 mm), 50-54 m, OT80; Sta. 12, 11/XII/91, 1 f (C.W. 177.0 mm), 59 m, OT80.

CEEMEX P7: Sta. 3, 14/V/92, 1 m (C.W. 25.0 mm), 48 m, OT80; Sta. 4, 14/V/92, 2 m and 2 f (C.W. 25.1-27.9 mm), 70-80 m, OT80.

**Distribution and depth ranges:** Throughout the Gulf of California, México, south to Cueva Bay, Colombia (Hendrickx et al., 1990). From 9 to 100 m depth (Garth, 1958).

**Remarks:** A very common and abundant species in the Gulf of California, *Parasygylus depressus* had apparently never been reported in the area extending from the southern Gulf of California to Puerto Parker, Costa Rica (Garth, 1958; Hendrickx, 1990a).

43. Pyromaia tuberculata (Lockington, 1877)

**Material examined:** CEEEMEX P5: Sta. 12, 11/XII/91, 1 m (C.W. 13.6 mm), 59 m, OT80.

**Distribution and depth ranges:** From Tomales Bay, California, USA, to Corientes Cape, Colombia, including the whole Gulf of California (Hendrickx, 1990a). From 0 to 412 m depth (Garth, 1958).

**Remarks:** As in the previous species, there is an apparent lack of published records for *P. tuberculata* in the area extending from the southern Gulf of California to San José, Guatemala (Garth, 1956; Hendrickx, 1990a).

**Pisidae**

44. Neodoclea boneti Buitendijk, 1950
Material examined: CEMEX P7: Sta. 37, 13/V/92, 1 m and 2 f (C.W. 34.7-43.3 mm), 25 m, OT80.

Distribution and depth ranges: Known only from Macapule and Mazatlán (Hendrickx, unpublished record), Sinaloa, Chacahua Bay, Oaxaca, México, San José, Guatemala, the Canal Zone, Panamá and Tumbes, Perú (Garth, 1958; Holthuis, 1966). From 9 to 20 m (Garth, 1958).

Remarks: This is the first capture of this species on record for the Gulf of Tehuantepec, and it represents a slight increase of the maximum depth range, to 25 m.

Mithracidae

45. Stenocionops ovata (Bell, 1835)

Material examined: CEMEX P7: Sta. 31, 12/V/92, 2 m (C.W. 54.0 mm), 76 m, OT80; Sta. 32, 12/V/92, 1 f (C.W. 41.6 mm), 118 m, OT80.

Distribution and depth ranges: From Abreojos Point, west coast of Baja California, Angel de la Guarda Island and off Consag Rocks, Gulf of California, México, south to Santa Elena Bay, Ecuador; Coco and Galápagos Islands (Hendrickx, 1990a, 1995b). From 15 to 275 m depth (Hendrickx, 1995b).

Remarks: Although S. ovata is a large species (C.W. of up to 130 mm; Hendrickx, 1990b), present record is the first for the Gulf of Tehuantepec. Juveniles of S. ovata (no more than 26 mm C.W.) are quite distinct from the adult and have been occasionally confused with one of the two other species of Stenocionops (S. beebei and S. angusta) occurring in the eastern pacific. The possibility that young specimens of S. ovata collected in the Gulf of Tehuantepec might have been confused with another species of this genus, however, must apparently be discarded as there are no published record of any other species of Stenocionops south of the Gulf of California.

Parthenopidae

46. Parthenope (Platylambrus) exilipes (Rathbun, 1893)

Material examined: CEMEX P5: Sta. 31, 13/XII/91, 1 f (C.W. 23.6 mm), 80 m, OT35.

CEEMEX P7: Sta. 31, 12/V/92, 6 m and 7 f (C.W. 23.8-36.9 mm), 76 m, OT80; Sta. 37, 13/V/92, 3 f (C.W. 21.6-31.9 mm), 25 m, OT80.

Distribution and depth ranges: From Santo Domingo Point, west coast of Baja California, Estero Tastiota and San Miguel Cape, Gulf of California, México, south to Lobos de Afuera Island and Tumbes, Perú; Revillagigedo, Coco and Galápagos Islands (Hendrickx et al., 1990; Hendrickx, 1995b). Cited for the Gulf of Tehuantepec by Sosa-Hernández et al. (1980). From 22 to 146 m (Rathbun, 1925; Sosa-Hernández et al., 1980).

Potrunidae

47. Callinectes arcuatus Ordway, 1863

Material examined: CEMEX P7: Sta. 19, 10/V/92, 5 f (C.W. 78.0-86.4 mm), 34 m, OT80.


48. Callinectes toxotes Ordway, 1863

Material examined: CEMEX P5: Sta. 37, 14/XII/91, 1 f unmeasured, 25-30 m, OT80.

Distribution and depth ranges: From San Lucas Cape and Río Plaxta, Gulf of California, México to Tumbes, Perú (Hendrickx, 1984). From 0 to 30 m depth (Hendrickx, 1995b).

Remarks: This species has not been previously cited for the Gulf of Tehuantepec.

49. Euphilax dovii Stimpson, 1860

Material examined: CEMEX P5: Sta. 3, 16/XII/91, 2 f (C.W. 33.9-42.5 mm), 50-54 m, OT80; Sta. 4, 16/XII/91, 1 f (C.W. 37.0 mm), 61-66 m, OT80.
Remarks: Previously cited for the Gulf of Tehuantepec by Villalobos-Hiriart & Hernández-Aguilera (1984), Gracia et al. (1986; dead specimens on sandy beaches), and Hendrickx & Vázquez-Cureño (1997).

50. Euphylax robustus A. Milne Edwards, 1874

Material examined: CEEEMEX P5: Sta. 3, 16/XII/91, 2 m and 3 f (C.W. 27.3-74.3 mm), 50-54 m, OT80; Sta. 12, 11/XII/91, 1 f (C.W. 55.6 mm), 59 m, OT80.

CEEEMEX P7: Sta. 10, 9/V/92, 3 m (C.L. 73.6-82.2 mm), 26-27 m, MBT; Sta. 12, 11/XII/91, 3 f (C.W. 50.4-72.1 mm), 59 m, OT80; Sta. 28, 11/V/92, 1 m (C.W. 73.7 mm), 28 m, OT80.


51. Portunus asper (A. Milne Edwards, 1861)

Material examined: CEEEMEX P5: Sta. 3, 16/XII/91, 23 m and 22 f (C.W. 43.3-89.7 mm), 50-54 m, OT80; Sta. 11, 11/XII/91, 1 f (C.W. 835.0 mm), 42-49 m, OT80; Sta. 19, 12/XII/91, 9 m and 22 f (C.W. 46.0-90.0 мм), 31-35 m, OT80; Sta. 37, 14/XII/91, 3 m and 1 f (C.W. 43.9-60.0 mm), 25-30 m, OT80.

CEEEMEX P7: Sta. 4, 14/V/92, 38 m and 16 f (C.W. 52.5-88.9 mm), 47-49 m, OT80; Sta. 10, 9/V/92, 10 m and 12 f (C.W. 43.9-89.3 mm), 26-27 m, MBT; Sta. 11, 9/V/92, 6 m and 6 f (C.W. 31.4-88.0 mm), 46 m, MBT; Sta. 12, 11/XII/91, 15 m and 3 f (C.W. 28.3-100.5 mm), 59 m, OT80; Sta. 19, 10/V/92, 11 m and 24 f (C.W. 48.9-97.0 mm), 34 m, OT80; Sta. 20, 10/V/92, 1 f (C.W. 52.0 cm), 42 m, OT80; Sta. 28, 11/V/92, 16 m and 29 f (C.W. 33.0-78.9 mm), 28 m, OT80; Sta. 31, 12/V/92, 3 m and 3 f (C.W. 45.1-91.5 mm), 76 m, OT80; Sta. 37, 12/V/92, many specimens (fresh weight, 1,250 g), unsexed and unmeasured, 25 m, OT80.


52. Portunus acuminatus (Stimpson, 1871)

Material examined: CEEEMEX P5: Sta. 12, 11/XII/91, 2 f (C.W. 25.0-26.1 mm), 59 m, OT80.

CEEEMEX P7: Sta. 4, 14/V/92, 2 m (C.W. 31.2-35.7 mm), 70-80 m, OT80.

Distribution and depth ranges: From Santa María Bay, west coast of Baja California Sur, Canjeme, Sonora, Altata, Sinaloa and San Blas, Nayarit, México to Parado Cape, Ecuador (Garth & Stephenson, 1966). From 3 to 80 m (Garth & Stephenson, 1966). Previously reported from Puerto Huatulco, Gulf of Tehuantepec (Garth, 1961).

53. Portunus xanthusii (Stimpson, 1880) undetermined subspecies

Material examined: CEEEMEX P5: Sta. 11, 11/XII/91, 2 m (C.W. 207.0-213.0 mm), 42-49 m, OT80; Sta. 12, 11/XII/91, 24 m and 18 f (C.W. 19.6-46.4 mm), 59 m, OT80; Sta. 13, 11/XII/91, 1 m and 1 f (C.W. 39.0-44.6 mm), 100-117 m, OT80; Sta. 19, 12/XII/91, 1 m (C.W. 18.0 mm), 31-35 m, OT80; Sta. 30, 13/XII/91, 3 m (C.W. 24.4-26.6 mm), 60-63 m, OT80; Sta. 32, 12/V/92, 11 m and 39 f (C.W. 29.5-47.6 mm), 118 m, OT80.

CEEEMEX P7: Sta. 13, 10/V/92, 9 m and 11 f (C.W. 19.2-41.4 mm), 104 m, MBT; Sta. 14, 10/V/92, 5 m and 8 f (C.W. 26.0-40.7 mm), 139-163 m, MBT; Sta. 31, 12/V/92, 7 m and 9 f (C.W. 21.7-46.6 mm), 76 m, OT80; Sta. 32, 12/V/92, 11 m and 39 f (C.W. 29.5-47.6 mm), 118 m, OT80.

Remarks: Specimens belonging to intermediate forms of the subspecies of xanthusii were already reported for the area by Hendrickx & Vázquez-Cureño (1997). Sosa-Hernández et al. (1980) have reported the third subspecies, xanthusii minimus Ruthbun, from the Gulf of Tehuantepec.

Xanthidae

54. Edwardsium lobipes (Rathbun, 1898)

Material examined: CEEEMEX P5: Sta. 4, 16/XII/91, 3 unsexed specimens (C.W. 5.4-
8.2 mm), 61-86 m, OT80; Sta. 12, 11/XII/91, 2 m (C.W. 67.0-118.0 mm), 59 m, OT80; Sta. 21, 12/XII/91, 1 m (C.W. 9.9 mm), 72-69 m, OT80; Sta. 30, 13/XII/91, 2 m (C.W. 9.7-11.4 mm), 60-63 m, OT35; Sta. 31, 13/XII/91, 1 f (C.W. 16.4 mm), 80 m, OT35.

CEEMEX P7: Sta. 4, 14/V/92, 1 m and 1 f (C.W. 20.7-27.0 mm), 70-80 m, OT80; Sta. 20, 10/V/92, 3 m and 1 f (C.W. 13.5-18.9 mm), 42 m, OT80; Sta. 21, 10/V/92, 1 unsexed and unmeasured specimen, 72-75 m, OT80.


Goneplacidae

55. Oedioplax granulata Rathbun, 1893

Material examined: CEEMEX P7: Sta. 12, 11/XII/91, 1 m (C.W. 60.0 mm), 59 m, OT80.

Distribution and depth ranges: Gulf of California from its northern part to Teacapan, Sinaloa, México; Tumbes, Perú (Rathbun, 1893; Garth, 1960; del Solar, 1970). From 22 to 80 m (Hendrickx, unpubl. data).

Remarks: This is the first published record of this species for the Gulf of Tehuantepec between the southern Gulf of California and Tumbes, Perú.

Hydrographic conditions

Epibenthic temperatures obtained during both cruises were compared. The differences observed between the P5 (December cruise) and the P7 (May cruise) for similar stations were lower than 1°C, except along most of transect E and at a few additional stations (i.e., Sta. 12, 3.3°C; Sta. 32, 1.8°C; Sta. 37, 1.1°C). These variations are not considered critical for benthic tropical species, because temperature measured at sampling localities was always slightly warmer or within the normal range recorded in tropical water at these depths (Hendrickx, 1992; Maurer et al., 1984). During both cruises, epibenthic water temperature decreased sharply and rapidly with depth in the shallowest part of the Gulf. Further offshore, it tends to stabilize within the range of 10-15°C below the 100 m depth (Fig. 2).

Epibenthic dissolved oxygen concentration at sampling stations varied from 5.30 to 0.30 ml O₂/l during the December cruise (P5) and from 4.42 to 0.26 ml O₂/l during the May cruise (P7), according to depth. Comparison of distribution within the Gulf of Tehuantepec of critical (below 2.0 ml O₂/l) and very critical (below 1.0 ml O₂/l) values of dissolved oxygen did not permit detection of a significant variation between the December and May cruises, except along transect B when epibenthic oxygen concentrations measured in December were never below 2.0 ml O₂/l. As expected, lowest oxygen concentrations were registered in deepest stations, with critical and very critical values observed below ca. 70 m and below ca. 100 m, respectively, during both cruises (Fig. 2).

Figure 2.- Relationship between epibenthic dissolved oxygen concentrations (A, B) and water temperature (C, D) and total depth measured at sampling stations during the CEEMEX P5 (A, C) and P7 (B, D) cruises.

Figura 2.- Relación entre concentraciones epibenticas de oxígeno disuelto (A, B) y temperatura del agua (C, D) y la profundidad total medida en las estaciones de muestreo en los cruceros CEEMEX P5 (A, C) y P7 (B, D).
DISCUSSION
Composition of community

The number of species and subspecies of macro-crustaceans collected during the CEEMEX P5 and P7 cruises (55: 5 stomatopods and 50 decapods) is slightly higher than that reported by Hendrickx & Vázquez-Cureño (1997) for the first leg of this survey (52 species). Among these 52 species, however, were included 5 species atypical of a soft bottom, subtidal environment. None of these were collected again during this survey (see Table 1). Comparative analysis of lists of species obtained during the three legs (Table 1) indicates that only 37 species were caught during the second leg and 45 during the third leg. All stomatopods had previously been reported for the Gulf of Tehuantepec. Among the decapods, 10 species (Peneaus brevirostris, P. stylirostris, Trachypenaeus fuscina, Xiphopeneaus riveti, Porcellana cancellata, Pisidia magdalenensis, Calappa saussurii, Ilicantha hancocki, Parthenope exilipes, and Portunus acuminatus) had not been collected during the first leg but were already known from the Gulf of Tehuantepec, while 14 species (Trachypenaeus faoe, Siconyia martini, Processa aequinana, Paguristes cf. bakeri, P. digueti, Petrochirus californiensis, Porcellana hancocki, Hypoconcha lowei, Paradasysgylus depressus, Pyromaia tuberculata, Neodorelea boneti, Stenoclonops ovata, Callinectes toxotes, and Oedipax granulata) had never been reported for the Gulf of Tehuantepec in published literature. All these species, however, have a clear tropical affinity and, with only a few exceptions (S. martini, to Panama; Processa aequinana, to the Gulf of Tehuantepec; Paguristes cf. bakeri; Pyromaia tuberculata and Paradasysgylus depressus, to Colombia) present a distribution range extending either from California, the west coast of Baja California or the Gulf of California to Ecuador-Perú.

Altogether, 76 species and subspecies were obtained during the whole survey (CEEMEX P4, P5 and P7). Of these, only 22 (28.9 %) (23 if Portunus xantusi is included) were consistently captured during the three legs (Table 1). Most are large, very conspicuous species. Further comparison among lists of collected species indicated that 27 species were common to P4-P5 cruises, 27 to P5-P7 cruises, and 25 to P4-P7 cruises. Sampling stations and efforts of capture (12 hours in P4; 13 1/2 hours in P5; 11 hours in P7) were similar during the three cruises. Depth range was slightly higher during P4 cruise, but only Squilla biformis was captured in the deepest station (Hendrickx & Vázquez-Cureño, 1997). Gears used during the cruises were different and larger during the P7 cruise. The Agassiz dredge was used only in deeper (121-360 m) sampling stations of P4. Only three species were collected with this gear (6 stations), and data indicate that Squilla biformis was consistently collected in 5 out of these 6 stations, together with Pleuroncodes planipes (2 stations) and Solenocera mutator (one station). All these species were again captured during the present study, roughly at the same stations and using commercial trawls. Among the 22 species consistently captured during the three legs of this project, only 11 had been collected by Sosa-Hernández et al. (1980) during their exploratory survey.

Occurrence and species richness

As seen previously, 22 species were captured during all three legs (P4, P5 and P7) of the survey. Their frequency of occurrence at the different sampling stations, however, was rather irregular and 8 stations yield no species (6 in P5, 2 in P7). Maximum occurrence during the P5-7 cruises was for Dardanus sinistrius (P5, 13 stations), which was also the most frequently collected species (27 catches) during the whole survey (P4-5-7), and for Portunus asper (P7, 9 stations). Maximum occurrence for the rest of the 22 species during the P5-7 cruises was much lower (7 for Squilla biformis, P5 cruise; and 6 for Portunus xantusi, Platymera gaudichaudii, Hepatus kossmanni, Solenocera mutator, and Sicyonia aliaflinis). Values for other species were comprised between 5 and 1. Comparedly, frequencies observed during the first leg of the project (P4 cruise) were generally higher. Considering the 22 species consistently collected during the study and all the samples obtained during the entire survey, highest frequencies of occurrence were for 12 species collected during the P4, versus
4 during the P5, and 13 during the P7 (Table 1).

A relatively high number of species was collected during only one (P4) of the three legs of the survey. Five species were caught during the P5 and not in other cruises. Of these, 4 species were collected in the same area (Sta. 10 and 12 of transect B) and another (Callinectes toxotes) in station 37. As many as 10 species were found during the P7 and never before in the Gulf of Tehuantepec, including 1 species of shrimp (Trachypenaeus faveo), 2 hermit crabs (Paguristes digueti and Petrochirus californiensis), and 7 brachyuran crabs (Hypoconcha liovi, Paradosygylus depressus, Pyromaia tuberculata, Neodoclea boneti, Stenocionops ovata, Callinectes toxotes, Oediplus granulata). Seven of these species were collected along transects D and E. Comparatively, 19 species were collected during the P4 and never caught again in subsequent sampling. A closer analysis of this series of species, however, indicates that 8 were caught in a single station (Sta. 10) and do not belong to a typical soft bottom, subtidal benthic community, but rather to rocky or mixed substrates, either intertidal or subtidal (Hendrickx & Vázquez-Cureño, 1997); 8 other species were caught in transect E (Sta. 37, 38 and 39).

Analysis of series of species collected per transect indicates that highest numbers of species were obtained along transect B (34 species) and D (28 species). Transect A (21 species) and C (20 species) yielded the poorest fauna. The species richness observed along transects, however, does not depend primarily on the period of sampling. This is supported by the cluster analysis (based on correlation coefficient distance, Ward linkage) which showed very strong similarity among species assemblages obtained during both the P5 and the P7. The same analysis also indicates a stronger similarity between the western Gulf assemblages (transects A-B) and among transects C-E, in the eastern portion of the Gulf (Fig. 3). Analyses of the list of species collected along the transects during the P5 and P7 cruises, indicates that a shift occurs from December, when the highest number of species occurs in the western part of the Gulf of Tehuantepec (transects A-B), to May, when a reverse pattern is observed, and the highest number of species occurs in the east and southeastern part of the Gulf (transect C-E).

Variation among these values might be due to two major factors: fishing effort and environmental conditions. As stated previously, total fishery efforts during the three legs of the survey were roughly similar as far as trawling duration is concerned. Although three different gears were used during the survey, there does not seem to exist a marked influence of size of trawl on the number of species caught. Indeed, one would expect a larger trawl like the MBT to yield a larger number of species. Results, however, indicate quite the contrary, and more species were actually caught along transect B (71% of total) during the P5 cruise, when an OT80 was used, than when the MBT was used during the P7 (Table 2). Sampling effort along transect A was very similar, and the richest fauna collected during P5 cannot be explained by the slightly longer trawling duration. Total trawling time along transects C-E was invariably longer during the P5, although a smaller gear (OT35 vs. OT80) was used part of the time. Still, figures indicate that numbers of species collected during the P7 were consistently higher (Table 2).

Figure 3. Dendrogram representing affinity among the transects visited during CEMEX P5 and P7 cruises. Correlation coefficient distance was used, Ward linkage method (A-E transects; 5 and 7 refer to P5 and P7 cruises).

Figura 3.- Dendrograma que representa la afinidad entre los transectos visitados durante los cruces CEMEX P5 y P7. Se utilizó la distancia del coeficiente de correlación. Método de unión de Ward (A-E transectos; 5 y 7 se refieren a los cruces P5 y P7).
Table 2. Number of species of stomatopod and decapod crustaceans obtained per transect during the P5 and P7 cruises (% of total in parenthesis) and corresponding fishing effort.

<table>
<thead>
<tr>
<th>Area</th>
<th>P5 (Dec. 1991) (100% of species)</th>
<th>P7 (May 1992) (100% of species)</th>
<th>P5 + P7 Fishing effort P5</th>
<th>P5 + P7 Fishing effort P7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transect A</td>
<td>18 (68%)</td>
<td>12 (57%)</td>
<td>OT80, 60°</td>
<td>OT80, 50°</td>
</tr>
<tr>
<td>Transect B</td>
<td>24 (71%)</td>
<td>22 (65%)</td>
<td>OT80, 150°</td>
<td>MBT, 130°</td>
</tr>
<tr>
<td>Transect C</td>
<td>14 (67 %)</td>
<td>17 (81%)</td>
<td>OT80, 150° and OT35, 140°</td>
<td>OT80, 148°</td>
</tr>
<tr>
<td>Transect D</td>
<td>9 (32 %)</td>
<td>26 (93 %)</td>
<td>OT80, 60° and OT35, 140°</td>
<td>OT80, 168°</td>
</tr>
<tr>
<td>Transect E</td>
<td>13 (62)</td>
<td>22 (88 %)</td>
<td>OT80, 156° and OT35, 60°</td>
<td>OT80, 165°</td>
</tr>
</tbody>
</table>

Although sampling depth range along transects was somewhat different from one cruise to the other, the only significant variation was experienced along transect A. During the P5 cruise, trawling operations were made down to 124-184 m (Sta. 6). No species of macro-crustaceans were captured at that depth, however, and contribution to the richness of transect A was entirely due to catches at stations 3 and 4.

The other factor which could influence composition of catches is water temperature. In normal conditions, ocean circulation in the Gulf of Tehuantepec is dominated by coastal currents flowing along the coast in opposite directions. These currents combine around 97° W and then flow offshore. In some periods of the year, principally in the months of October to February, extremely violent winds (Tehuano or Northers) blow normal to shore lasting from a few days up to a fortnight. These winds effect a movement of surface water to the south, leading to a marked decrease in the surface temperature in the Gulf of Tehuantepec as compared to the surrounding waters (Blackburn, 1962; Stumpf, 1975; Weaks, 1985; Alvarez et al., 1989). The decrease in number of species caught during the December cruise (P5) in the eastern and southeastern parts of the Gulf of Tehuantepec could be related to a shift of environmental conditions resulting in lower epibenthic water temperature, particularly in shallow water. Values of epibenthic temperatures obtained during the survey, however, do not seem to confirm this hypothesis as they do not appear to vary drastically from one cruise to the other. In addition, there is no clear pattern of epibenthic water temperature that fits with the observed shift of species richness.

Low concentrations of dissolved oxygen at bottom level is known to represent a limiting factor for the survival of many species of benthic invertebrates (Rosenberg, 1980; McMahon & Wilkens, 1983; Rosenberg et al., 1991). Although the spatial and temporal variability of the oxygen minimum layer off the coast of western Mexico is poorly documented, it has often been detected and measured (see Parker 1963, Hendrickx, 1986, 1995c). In the eastern Pacific, only a few species of shelf macrocrustaceans (Squilla biformis, Pleuromarion planipes, Solenocera mutator) are known to occur frequently in an oxygen deficient environment. Another two species do so to a lesser extend (Platymera gaudichaudii and Cancer jonghartha) (Hendrickx, 1985, 1996, 1997; Hendrickx & Salgado-Barragán, 1991). Comparison of epibenthic dissolved oxygen data obtained during P5 and P7 cruises show similar values throughout the sampling area (Fig. 2). Oxygen values were slightly higher at the deepest stations (i.e. over 200 m) during P5, but no specimens were obtained at these depths. Three species, Squilla biformis, Pleuromarion planipes, and Solenocera mutator were obtained during the P7 at 208-220 m (station 42), thus indicating that very low oxygen concentrations are required for these species to occur.

Distribution of species

Several species collected during the P5-P7 cruises show a clear distribution pattern within the Gulf of Tehuantepec. Many of these are among the group of 22 species consistently collected during the three cruises (Table 1). Squilla biformis, for in-
stance, was captured almost exclusively below 100 m depth (one capture at 72-75 m), while all other species of Squilla were consistently found in much shallower water, closer to shore (Fig. 4A). A similar pattern was found with Solenocera mutator, Penaeus brevisrostris, and Sicyonia disedwardsii, which constitute a small group of shrimps with a marked outer-shelf affinity. Other species of Peneaeidea (except Solenocera florea, which presents a somewhat intermediate distribution pattern), were almost invariably collected in shallower water, close to shore (Fig. 4B). Dardanus sinistripes features a remarkably homogeneous distribution pattern and was caught throughout the Gulf. Other hermit crabs were found mostly closer to shore (Fig. 5A). Among brachyuran crabs, Platymera gaudichaudi (Fig. 5B) and Portunus xantusii (Fig. 6A) also show certain affinity for the outer shelf area, while Hepatus kossmanni and

Figure 4.- Sampling locations of stomatopods (A) and penaeid shrimps (B) in the study area during the CEEMEX P5 and P7 cruises.

Figure 5.- Localización de estaciones de cangrejos ermitanos (A) y cangrejos de la familia Calappidae (B) en el área de estudio durante los cruceros CEEMEX P5 y P7.

Calappa convexa were rather confined to shallow water (Fig. 6B). Portunus asper was also well-represented in the sampling area, showing a somewhat intermediate distribution pattern, while other species of Portunidae were found closer to shore (Fig. 6A). Edwardsium lobipes, the only Xanthidae consistently collected during the CEEMEX project, was found in shallow and intermediate depths (42-86 m) (Fig. 6B).

The distribution pattern observed for stomatopods coincides with what has been reported for the tropical eastern Pacific region, although some shallow-water species are known to occur occasionally in deeper water (e.g. Squilla parva, S. panamensis and S. mantoea) (Hendrickx & Salgado-Barragán, 1991, 1994). Distribution of shrimps in the SE Gulf of California has been documented by Hendrickx (1986, 1996), who recognized a
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REFERENCES


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Appendix. Species of the CEE MEX P5 and CEE MEX P7 cruises deposited in reference collections of the Instituto de Ciencias del Mar, Barcelona, Spain (column A) and of the Escuela de Ciencias del Mar, Universidad Autónoma de Sinaloa, Mazatlán, México (column B).

**Apéndice.** Especies de los cruceros CEE MEX P5 y CEE MEX P7 depositadas en las colecciones de referencia del Instituto de Ciencias del Mar, Barcelona (columna A) y de la Escuela de Ciencias del Mar, Universidad Autónoma de Sinaloa, Mazatlán, México (columna B).

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
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<tbody>
<tr>
<td><em>Squilla biformis</em> Bigelow, 1891</td>
<td><em>Squilla biformis</em> Bigelow, 1891</td>
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<tr>
<td><em>Squilla hancocki</em> Schmitt, 1940</td>
<td><em>Squilla hancocki</em> Schmitt, 1940</td>
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<tr>
<td><em>Penaeus brevirostris</em> Kingsley, 1878</td>
<td><em>Penaeus brevirostris</em> Kingsley, 1878</td>
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<tr>
<td><em>Penaeus californiensis</em> Holmes, 1900</td>
<td><em>Penaeus californiensis</em> Holmes, 1900</td>
</tr>
<tr>
<td><em>Trachypenaeus fuscus</em> Pérez-Farfante, 1971</td>
<td><em>Trachypenaeus pacificus</em> Burkenroad, 1934</td>
</tr>
<tr>
<td><em>Sicyonia atalanti</em> (Burkenroad, 1934)</td>
<td><em>Sicyonia affinis</em> Faxon, 1893</td>
</tr>
<tr>
<td><em>Sicyonia discorsalis</em> (Burkenroad, 1934)</td>
<td><em>Solenocera florea</em> Burkenroad, 1938</td>
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<tr>
<td><em>Sicyonia martini</em> Pérez Fargante &amp; Botto, 1981</td>
<td><em>Solenocera mutator</em> Burkenroad, 1938</td>
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<tr>
<td><em>Solenocera florae</em> Burkenroad, 1938</td>
<td><em>Dardanus spinipes</em> (Stimpson, 1859)</td>
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<td><em>Dardanus spinipes</em> (Stimpson, 1859)</td>
<td><em>Pleuroncodes planipes</em> Stimpson, 1860</td>
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<td><em>Pleuroncodes planipes</em> Stimpson, 1860</td>
<td><em>Platymera gaudichaudi</em> (H. Milne Edwards, 1837)</td>
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<td><em>Pleuroncodes planipes</em> Stimpson, 1860</td>
<td><em>Euphylax dovi</em> Stimpson, 1860</td>
</tr>
<tr>
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<td><em>Euphylax robustus</em> A. Milne Edwards, 1874</td>
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<td><em>Calappa convexa</em> de Saussure, 1853</td>
<td><em>Portunus asper</em> (A. Milne Edwards, 1861)</td>
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<td><em>Cryptodromiophasis laraburei</em> (Rathbun, 1910)</td>
<td><em>Hepatus kossmanni</em> Neumann, 1878</td>
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<tr>
<td><em>Hepatus kossmanni</em> Neumann, 1878</td>
<td><em>Persephona townsendi</em> (Rathbun, 1893)</td>
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<tr>
<td><em>Paradopseytus depressus</em> (Bell, 1835)</td>
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<tr>
<td><em>Pathenopax eilipes</em> (Rathbun, 1893)</td>
<td><em>Edwardsium lobipes</em> (Rathbun, 1896)</td>
</tr>
<tr>
<td><em>Portunus xanthus</em> (Stimpson, 1860)</td>
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