

COMMUNICATION

## Gastropods and bivalves of commercial interest from the continental shelf of Jalisco and Colima, México

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**Abstract:** The distribution and abundance with respect to depth and type of substratum of 20 species of gastropods and four species of bivalves of economic importance were examined in the continental shelf of Jalisco and Colima, México. These species were taken with net trawls at depths from 24 to 83 m in August, 1988. Most individuals and species of gastropods were collected in stations with sandy silt substratum. Bivalves were collected in sandy silt and medium sand substrata. The six most abundant species represented 81.2 % of all gastropods and bivalves collected. These species are: *Cantharus pallidus*, *Fusinus dupetitouarsi*, *Ficus ventricosa*, *Hexaplex brassica*, *Harpa conoidalis* and *Arca pacifica*.

**Key words:** Gastropods, bivalves, continental shelf, Mexican Pacific.

The majority of the marine mollusks of economic importance are distributed in the coastal zones, including the inner shallower parts of the continental platform (Cifuentes-Lemus 1990). Mexico presents very favorable conditions for the exploitation of mollusks since its coastline is more than 10 000 km long, with a continental shelf area of 2 892 000 km<sup>2</sup> (Ruiz-Durá 1985) and 1 500 000 ha<sup>2</sup> of coastal water bodies (Lankford 1977). However, a problem for an adequate exploitation of these mollusks in Mexico is the scarcity of published information on their biology and ecology.

The knowledge on benthic marine mollusks of Jalisco and Colima is mainly the result of studies carried out in the intertidal and shallow subtidal zones. A few studies have also been conducted in the continental platform of this region. A review of this research and the localities studied so far are reported by Ríos-Jara *et al.* (1994, 1996), Pérez-Peña and Ríos-Jara (1998) and Esqueda *et al.* (2000). However, information on the gastropod and bivalve species of commercial interest from

the continental shelf of Jalisco and Colima is scarce. Only a few published records of these species are mentioned in the literature, they include checklists and museum collections. In addition, there have been some field collections (Morris 1966, Keen 1971, Holguín-Quiñones and González-Pedraza 1994). Therefore, the present study is important, since it provides information on the spatial distribution patterns of abundance with respect to depth and type of substratum of 24 species of gastropods and bivalves considered as commercially important in the continental shelf of Jalisco and Colima.

The area of study includes the continental shelf of Jalisco and Colima on the Pacific coast of Mexico (20°39'-18°39' N) (Fig. 1). The coastline of this area spreads along approximately 364 km. The continental platform of both states extends across an area of 5 315 km<sup>2</sup> (Ruiz-Durá 1985), and it is narrow and mostly rocky. Benthic mollusks were collected with a trawling net (24 m long, 21 m wide, mesh size of 4.5 cm, with cod end of 0.6 cm mesh size)

during the oceanographic expedition "Atlas V" on board of the R/V "El Puma" of the Universidad Nacional Autónoma de México (UNAM). The expedition was from August 23<sup>rd</sup> to August 30<sup>th</sup>, 1988. Samples of the sediment from the trawling areas were obtained with a geological grab (20 l capacity, 0.1 m<sup>2</sup> sampling area). A total of 22 sampling stations were performed throughout the study area (Fig. 1). One net trawl (43-95 min at 2.5 knots) was conducted at each sampling station. The depth at these stations ranged from 18 to 136 m. The distance covered by each trawl was calculated using the trawling time and the ship velocity. Thus, distance equals trawling time multiply by speed of the ship. Similarly, the area covered by the net in each cast was obtained by multiplying the distance of each trawl and the mouth opening width (21 m). The area is expressed in hectares.

All gastropods and bivalves caught were identified and counted using the works of Morris (1966) and Keen (1971). Only shells that permitted clear identification were used. Live organisms were preserved in 70 % alcohol. Scientific names and distribution ranges were reviewed and updated according to Skoglund (1991, 1992). Abundance was expressed as the mean number of individuals per hectare, and diversity as the number of species per station. These organisms form part of the collection of invertebrates at the Centro de Estudios de la Costa of the Universidad de Guadalajara in Melaque, Jalisco.

Three different types of substratum were recognized in the area of study: 1) silty clay, (most particles < 0.020 mm), 2) sandy silt (0.015-0.05 mm), 3) medium sand (> 0.2 mm). Sediments became more homogeneous toward deeper stations, decreasing in particle size, from medium sand and sandy silt to silty clay. At stations deeper than 40 m, only sandy silt or silty clay were found.

A total of 115 gastropod and bivalve species were collected during the oceanographic expedition; 267 individuals of 15 species were collected alive, the rest were recorded by the presence of their shells. Twenty species of gastropods are considered of



Fig. 1. The Pacific coast of Jalisco and Colima. Numbers indicate the location of sampling stations. The squares show those stations where gastropods and bivalves of commercial interest were collected.

commercial interest. They represent the 23.3 % of all species collected. In the case of bivalves, only four species (13.8 %) are commercially important. They were found in only 13 sampling stations in the area of study (Table 1, Fig. 1). Individuals of these species were obtained between 24 and 83 m in medium sand, sandy silt and silty clay substrata. Shallow (24-40 m) stations registered the lowest abundance and number of species of gastropods. Bivalve species were only found at depths between 24 and 48 m in medium sand and sandy silt substrata. The absence of organisms at deeper stations is probably related to a marked decrease in dissolved oxygen concentrations (< 0.8 mg l<sup>-1</sup>), recorded in all stations deeper than 100 m during the present study (Guzmán-Arroyo and Flores-Rosas 1998). Low oxygen levels may be the principal factor limiting the distribution of benthic mollusks in the continental shelf off Jalisco and Colima (Perez-Peña and Ríos-Jara 1998).

Five gastropods species were quite abundant in the samples, representing 50.7 % of the total of individuals: *Cantharus pallidus* (14.7 %), *Fusinus dupetitouarsi* (11.4 %), *Ficus ventricosa* (9.7 %), *Hexaplex brassica* (8.5 %) and *Harpa conoidalis* (6.6 %). These

TABLE 1  
Distribution and abundance (inds/ha) of 24 commercially important mollusk species from the continental platform of Jalisco and Colima, México

Sampling station	24	19	47	35	23	26	51	34	18	22	30	33	50	total	%
Type of substratum	SS	SS	MS	SS	SS	SC	SC	SC	SS	SS	SS	SC	SC	63.2	14.7
Depth (m)	24	36	40	48	49	57	59	60	71	72	73	83	83	1.9	0.4
Area (ha)	7.9	10.9	15.4	10.0	10.5	10.9	6.9	8.8	9.5	10.3	10.2	10.3	9.2	1.9	0.4
Gastropods															
<i>Cantharus pallidus</i> (Broderip and Sowerby, 1829)		0.1(0.1)			0.1	0.1			(1.7)	0.4	0.8	1.0(1.1)	0.2	63.2	14.7
<i>Conus dalli</i> Stearns, 1873.						0.1					0.1			1.9	0.4
<i>Conus poornani</i> Berry, 1968					0.1					0.1				1.9	0.4
<i>Conus princeps</i> Linnaeus, 1758				(0.2)		0.1				(0.1)				3.9	0.9
<i>Conus purpurascens</i> Sowerby, 1833										0.1				1.0	0.2
<i>Conus regularis</i> Sowerby, 1833				0.1	0.2	0.6				0.1(0.3)				12.3	2.9
<i>Conus tornatus</i> Sowerby, 1833										0.2				1.9	0.5
<i>Ficus ventricosa</i> (Sowerby, 1825)	0.3	0.2(0.1)	1.3	0.1(0.4)		0.6(0.1)			0.4(0.5)	0.1(0.5)	0.9	0.1		41.9	9.7
<i>Fusinus dupetitlhoarsii</i> (Kiener, 1846)					0.6	0.1		(0.1)	(0.9)	0.3(2.4)	0.4(0.9)			49.3	11.4
<i>Harpa conoidalis</i> Lamarck, 1822		0.2(0.3)	0.7(0.1)	(0.2)	0.5	0.3(0.2)	(0.1)				0.1			28.3	6.6
<i>Haustellum recurvirostris</i> (Broderip, 1833)					0.3					0.1				5.4	1.3
<i>Chicoreus brassica</i> (Lamarck, 1822)	0.1	(0.2)	0.7	(0.1)		0.3(0.1)				0.5(2.3)	0.2	0.2		36.8	8.5
<i>Chicoreus radix</i> (Gmelin, 1791)	(0.5)													5.1	1.2
<i>Chicoreus regius</i> (Swainson, 1821)	0.6	(3.8)				(0.1)								11.0	2.6
<i>Latirus concentricus</i> (Reeve, 1847)	0.6					0.1								0.9	0.2
<i>Latirus praestantior</i> Melvill, 1892						0.1								0.9	0.2
<i>Oliva incrassata</i> Lightfoot, 1786	0.1													1.3	0.3
<i>Oliva polypasta</i> Ducloux, 1935				(0.1)	0.4	0.6			0.1	0.3				14.3	3.3
<i>Oliva splendida</i> Sowerby, 1825						0.1								0.9	0.2
<i>Vasum caestus</i> (Broderip, 1833)	(0.3)													2.5	0.6
Bivalves															
<i>Arca pacifica</i> (Sowerby, 1833)	(13.0)													130.4	30.3
<i>Cardita laticostata</i> Sowerby, 1833	(0.8)			0.1										8.6	2.0
<i>Chama sordida</i> Broderip 1835	(0.4)													5.8	1.3
<i>Spondylus princeps</i> Broderip 1835	(0.1)													1.3	0.3
Mean abundance per station (inds. / ha)	16.6	2.5	4.6	1.9	3.3	3.3	14.5	11.3	9.2	7.2	3.5	7.8	21.7	430.9	100.0
Total number of species/station	11	4	3	5	7	13	1	1	4	11	6	3	1		

Number of individuals collected alive shown between parenthesis. MS = medium sand, SS = sandy silt, SC = silty clay.

gastropod species are epifaunal carnivores, which tend to have a greater variety in size and shell architecture. The most abundant bivalve species is *Arca pacifica* (30.3 %). All these gastropods and bivalves species were collected in depths between 24 and 83 m. The species collected were bigger than 10 cm, and have been reported as an important component of the fauna accompanying commercial shrimp fisheries in the Mexican Pacific (García-Cubas 1961).

The following is a brief description of the distribution with respect to depth and type of substratum of the six most abundant species in the area of study. Information on the general characteristics and use of these species is also provided:

1) *Cantharus (Solenosteira) pallidus* (Broderip and Sowerby, 1829). This species was formerly known as *Cantharus (S.) capitanea* (Berry, 1957) (Skoglund 1992) (family Buccinidae). This is the largest snail found in our collections, with specimens reaching 28 cm of length. The species was mostly found in areas between 36-83 m with sandy silt and silty clay substrata. The muscular foot is used for human consumption. This whelk snail is commonly known as "caracol burro" in the Mexican Pacific. It has good flavor steamed, in cocktails, fried or in soups. It is quite attractive for shell collectors and it is commonly seen in tourist centers.

2) *Ficus ventricosa* (Sowerby, 1825). The "fig shell" *F. ventricosa* (family Ficidae) was found from shallow to moderately deep sampling stations (24-83 m) in medium sand, sandy silt and silty clay substrata. Most individuals collected were about 10 cm in length. A few smaller juveniles were also collected. This species is seldom used as food but the shell is commonly sold in souvenir shops.

3) *Fusinus dupetitthouarsi* (Kiener, 1846). The commonly called spindle conch (family Fasciolaridae), has a large, pyriform shell with a good periostracum of yellowish brown color. It was found in moderately deep waters between 49-73 m, in sandy silt and silty clay substrata. Most organisms collected were live

specimens, some of them reaching a height of 22 cm. This handsome shell is most esteemed by shell collectors. The meat is locally used for fish bait but seldom eaten by man.

4) *Harpa conoidalis* (Lamarck, 1822). The family Harpidae includes at least two dozen species, which are commonly named harp shells. The whole shell is rather polished, and is one of the most attractive of the marine shells from the Pacific coast of Mexico. Colors range from pinkish gray to bluish white, with square spots of violet in the ribs. This species was collected over a wide range of distribution with respect to depth (36-73 m) and the three types of substrata found in the area of study. The height of the shells collected ranged from 5-8 cm. It is seldom used for human consumption.

5) *Hexaplex brassica* (Lamarck, 1822). Murex shells (family Murcidae) belong to a large and very diverse family, including the cabbage murex, *H. brassica*, which is one of the largest members of the genus. This beautiful shell, commonly known as "caracol chino", always attracts the attention of collectors. The species was collected from shallow (24 m) to moderately deep waters (83 m) in medium sand, sandy silt and silty clay substrata. Some of the shells collected reached a length of 18 cm. It is primarily used as food and sometimes as fish bait.

6) *Arca pacifica* (Sowerby, 1833). Ark shells include several genera of the family Arcidae distributed from the Gulf of California to Peru. The most common are *Arca*, *Arcopsis*, *Barbatia*, and *Anadara*. At least two species of *Arca*, *A. pacifica* and *A. mutabilis*, are found in the Pacific coast of Mexico. Their common name in Mexico is "pata de mula". *Arca pacifica* is large and with a broad flat area on the top that keeps the beaks well separated. It is highly esteemed for food. The heavy shell of this organism has been used as a source of lime (Cifuentes-Lemus *et al.* 1990). This species was found only in the sampling station 24 (24 m, sandy silt substratum) but in relatively high density (13 ind./ha). This high dominance may be related to the substratum characteristics of the sampling station (sand with rocks) where the

species aggregates. Keen (1974) mentions that this species may be found adhering to the undersides of rocks in the intertidal zones or dredged in depths to 137 m; while Fischer *et al.* (1995) indicate these rocks with attached specimens may be on soft bottoms down to 150 m.

## RESUMEN

La distribución y abundancia con respecto a la profundidad y el tipo de sustrato de 20 especies de gasterópodos y cuatro especies de bivalvos de importancia económica fueron examinados en la plataforma continental de las costas de Jalisco y Colima, México. Las especies fueron recolectadas con red de arrastre a profundidades de 24 a 83 m en agosto de 1988. La mayoría de los individuos y especies de gasterópodos fueron recolectados en estaciones con sustrato limo arenoso. Los bivalvos fueron colectados en sustratos limo arenoso y arena media. Las seis especies más abundantes representaron el 81.2 % del total de gasterópodos y bivalvos recolectados. Estas especies son: *Cantharus pallidus*, *Fusinus dupetitouarsi*, *Ficus ventricosa*, *Hexaplex brassica*, *Harpa conoidalis* y *Arca pacifica*.

## REFERENCES

- Cifuentes-Lemus, J.L., P. Torres-García & M. Frias. 1990. El océano y sus recursos, X Pesquerías. Fondo Cult. Econ. México, D.F. 228 p.
- Esqueda, M.C., E. Ríos-Jara, J.E. Michel-Morfín & V. Landa-Jaime. 2000. The vertical distribution and abundance of gastropods and bivalves from rocky beaches of Cuastecomate Bay, Jalisco. *Rev. Biol. Trop.* 48: 765-776.
- Fischer, W., F. Krupp, W. Schneider, C. Sommer, K.E. Carpenter & V.H. Niem. 1995. Guía FAO para la identificación de especies para los fines de la pesca. Pacífico Centro-Oriental. Volumen I. Plantas e invertebrados. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Roma. 646 p.
- García-Cubas, A. 1961. Contribución al estudio de los moluscos de valor económico de las costas de Mazatlán, Sinaloa, México. Tesis de Licenciatura, Universidad Nacional Autónoma de México, México.
- Guzmán-Arroyo, M. & E. Flores-Rosas. 1988. Campaña oceanográfica Atlas V Jalisco-Colima: Informe de actividades del Instituto de Limnología. Universidad de Guadalajara, Guadalajara, México. 9 p.
- Holguín Quiñones, O.E. & A.C. González Pedraza. 1994. Moluscos de la franja costera de Michoacán, Colima y Jalisco, México. Inst. Politécnico Nal., México, D.F. 133 p.
- Keen, M.A. 1971. Sea shells of tropical west America. Stanford Univ., Stanford. 1064 p.
- Lankford, R.R. 1977. Coastal lagoons of Mexico: Their origin and classification. *Mar. Geol.*: 182-215.
- Morris, P.A. 1966. A field guide to shells of the Pacific coast and Hawaii. Houghton Mifflin, Boston. 297 p.
- Pérez-Peña, M. & E. Ríos-Jara. 1998. Gastropod mollusks from the continental shelf off Jalisco and Colima, México: Species collected with a trawl net. *Cien. Mar.* 24: 425-442.
- Ríos-Jara, E., H.G. León-Alvarez, L. Lizárraga-Chávez & J.E. Michel-Morfín. 1994. Producción y tiempo de recuperación del tinte de *Plicopurpura patula pansa* (Neogastropoda: Muricidae) en Jalisco, México. *Rev. Biol. Trop.* 42: 537-545.
- Ríos-Jara, E., M. Pérez-Peña, L. Lizárraga-Chávez. & J.E. Michel-Morfín. 1996. Additional gastropod records from the continental shelf off Jalisco and Colima, México. *Cien. Mar.* 22: 347-359.
- Ruiz-Durán, M.F. 1985. Recursos pesqueros de las costas de México. Limusa, México, D.F. 135 p.
- Skoglund, C. 1991. Additions to the Panamic Province Bivalve (Mollusca) literature 1971-1990. *Festivus.* 74 p.
- Skoglund, C. 1992. Additions to the Panamic Province Gastropod (Mollusca) literature 1971-1992. *Festivus.* 169 p.

