REFERENCES

KENSLEY, B., 1980. Notes on *Axiopsis* (Axiopsis) *serratifrons* (A. Milne Edwards, (Crustacea: Decapoda: Thalassinidea). *Proceedings of the Biological Society of Washington 93* (4): 1253-1263.

LEMAITRE, R. & G. E. RAMOS, 1992. A collection of Thalassinidea (Crustacea: Decapoda) from the Pacific Coast of Colombia, with description of a new species and a checklist of Eastern Pacific species. *Proceedings of the Biological Society of Washington 105* (2): 343-358.

MANNING, R. B. & F. A. CHACE, JR., 1990. Decapod and stomatopod crustacea from Ascension Island, South Atlantic Ocean. *Smithsonian Contributions to Zoology 503*: 1-82.

SAKAI, K. & M. DE SAINT LAURENT, 1989. A checklist of Axiidae (Decapoda, Crustacea, Thalassinidea, Anomura), with remarks and in addition descriptions of one new subfamily, eleven new genera and two new species. *Naturalists 3*: 1-104.

Recibido: 23 de octubre de 2001.
Aceptado: 23 de abril de 2002.

A benthic mollusks checklist from laguna Cuyutlan, Colima, Mexico

Listado de moluscos bénticos de la laguna de Cuyutlán, Colima, México

Vania Serrano-Pinto
and Javier Caraveo-Patiño

Centro de Investigaciones Biológicas del Noroeste Apartado Postal No. 128. La Paz, 23090 B.C.S. México.

Serrano-Pinto, V. and J. Caraveo-Patiño, 2002. A benthic mollusks checklist from laguna Cuyutlan, Colima, Mexico. *Hidrobiológica 12* (2): 166-169.

Abstract. A malacological list of Laguna Cuyutlán in the state of Colima, Mexico and its surrounding area is provided. The list includes all species collected during the spring and fall of 1986. Inside the lagoon 54 species that belong to 38 genera, 26 families, and two classes were identified. In the sea surrounding the lagoon, 70 species were found that belong to 52 genera, 32 families, and 3 classes. The maximum number of species was found in the adjacent marine zone. In the surrounding sea, were found Gastropoda, Pelecypoda, and Scaphopoda classes. Inside the lagoon only Gastropoda and Pelecypoda classes were found.

Key words: Benthic mollusks, Laguna Cuyutlán Colima, Marine Ecology.

Resumen. En este trabajo se proporciona la lista malacológica de la Laguna de Cuyutlán, Colima, México y zona marina adyacente. La lista incluye las especies recolectadas durante las estaciones de primavera y otoño de 1986. En la laguna se identificaron 54 especies, pertenecientes a 2 Clases, 26 familias y 38 géneros. En el mar se encontraron 70 especies, pertenecientes a 3 Clases, 32 familias y 52 géneros. El mayor número de especies se presentó en la zona marina adyacente. En donde fueron encontradas las clases Gastropoda, Pelecypoda, y Scaphopoda. Dentro de la Laguna, solamente las clases Gastropoda y Pelecypoda, fueron halladas.

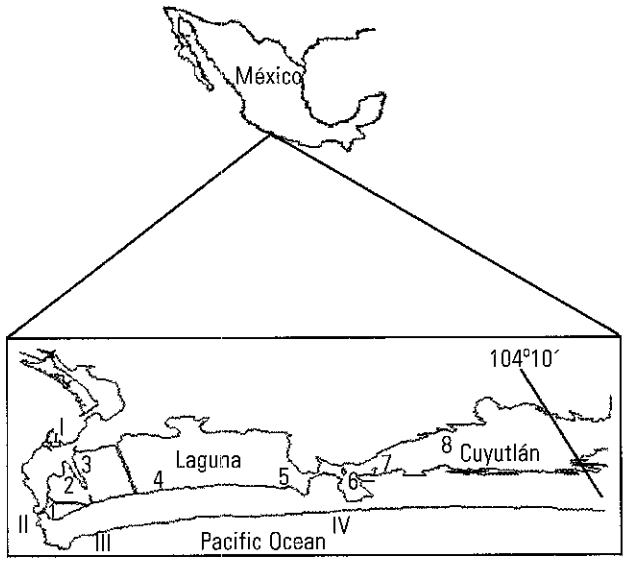
Palabras clave: Moluscos bénticos, laguna Cuyutlán, Colima, ecología marina.

It is well known that coastal lagoon contain considerable fishery resources (Hildebrand, 1946; Günther, 1969; Stuardo and Villarroel, 1976). For this reason, benthic resources, such as mollusks, are one of the most important groups to be surveyed prior to any proposal for a rational management inside lagoons (Yañez-Arancibia and Nugent, 1975).

The sessile characteristics of the benthic communities and its resilience cause such communities to be good ecological indicators of potential modifications by external influences. Benthic organisms are usually selected for this kind of studies because of their abundance, diversity, and trophic importance (Cobo, 1978).

Taxonomic lists are an important perspective on the biodiversity composition of a specific area. Taxonomic lists show a primary element for environmental assessments, as well as the basis for studies addressing the requirement of establishing rules for the rational use of natural resources (Cruz-Agüero, *et al.*, 1994).

There are very few studies on Laguna Cuyutlán (Cobo, 1978; Treviño and González, 1984; Ascencio, 1985). There is no study dealing with the Cuyutlán benthic communities, and there is not any taxonomic list of mollusks. For this reason, the Universidad Nacional Autonóma of México developed an environmental impact assessment study in the Laguna Cuyutlán in 1986.



1. Location of the sampling zone and sampling locations in Laguna Cuyutlán, Colima, Mexico. Lagoon stations (arabic numbers, 1-8). Sea stations (roman numbers, I-IV).

During this study, samples were taken from the benthic part of the lagoon and surrounding areas. The malacological list of the lagoon and marine environments are presented here.

Laguna Cuyutlán, situation is along the Pacific coast of the state of Colima, Mexico, between 18°56' and 19°03' N and 104°00' and 104°19 W. The lagoon is part of a coastal lowland between Bahía Manzanillo and Río Armería. The lagoon area is 7, 200 ha (Contreras, 1985; Fig. 1). Inside the lagoon, were established 8 sampling locations and 4 were established in the surrounding sea (Fig. 1). Sampling locations were selected where potential damages produced by proposed hydraulic activities in the lagoon. Two boats were used for sampling. Inside the lagoon, a 3-m flat-bottomed boat with a 7-hp motor was used. In the sea, a 7-m boat was used, with two 135-hp motors.

A "Van Veen" 1-l dredge was used for sampling. From each sampling location, were obtained 3-l samples, because, as a point study, this quantity is enough to determine the specific richness (Soto, pers. com.). Sampled material was placed in plastic bags. After each sample was sifted with a 0.5-mm sieve to separate the mollusks. Organisms were placed in glass jars filled with 10% formaldehyde. Each organism was identified and quantified in the laboratory with a stereoscopic microscope. For taxonomic identification, specimens were compared with photographs and schemes contained in the following books: Morris (1966), Keen (1971), Keen and Coan (1974), Abbott (1974), Lindner (1983), and Fisher *et al.* (1995). Shells were for the identification to the species level, when possible. The reference collection of this sampling has been deposited in the Instituto de Ingeniería, U.N.A.M.

For the inner part of the lagoon, were identified 54 species, belonging to 2 classes, 26 families, and 38 genera (Table 1). In the sea, were found 70 species that belong to 3 classes, 32 families, and 52 genera (Table 2). *Acteocina smirna* (Dall, 1919), *A. angustior*

Table 1. List of species found inside the lagoon.

PHYLUM MOLLUSCA
CLASS PELECYPODA
SUBCLASS PALAEOTAXODONTA
ORDER NUCULOIDA
FAMILY NUCULIDAE
Nucula chrysocome (Dall, 1908)
SUBCLASS PTERIOMORPHIA
ORDER ARCOIDA
FAMILY ARCIDAE
Subfamily Arcinae
Acar sp. 1
ORDER MYTILOIDA
FAMILY MYTILIDAE
Subfamily Mytilinae
Mytella strigata (Hanley, 1843)
SUBCLASS HETERODONTA
ORDER VENEROIDA
FAMILY VENERIDAE
Subfamily Chioninae
Protothaca metodon (Pilsbry y Lowe, 1932)
Chione squamosa (Carpenter, 1857)
Chione sp. 1
Subfamily Meretricinae
Tivela sp. 1
Subfamily Venerinae
Ventricolaria isocardia (Verrill, 1870)
Ventricolaria sp. 1
Ventricolaria sp. 2
FAMILY PETRICOLIDAE
Petricola sp. 1
FAMILY SOLECURTIDAE
Tagelus longisinuatus (Pilsbry y Lowe, 1932)
Tagelus peruvianus (Pilsbry y Olsson, 1941)
FAMILY TELLINIDAE
Tellina simulans (C.B. Adams, 1852)
Tellina pristiphora (Dall, 1900)
Tellina sp. 1
FAMILY CARDIIDAE
Fragum fragum (Rodan, 1798)
FAMILY CHAMIDAE
Chama corallina (Olsson, 1971)
CLASS GASTROPODA
SUBCLASS PROSOBRANCHIA
ORDEN ARCHEOGASTROPODA
FAMILIA PHENACOLEPADIDAE
Phenacolepas osculans (C.B. Adams, 1852)
FAMILIA NERITIDAE
Neritina latissima (Broderip, 1833)
Nerita sp. 1
ORDER MESOGASTROPODA
FAMILY RISSOELLIDAE
Rissoella bifasciata (Carpenter, 1857)
Rissoella sp. 1
FAMILY ASSIMINEIDAE
Assiminea californica (Tryon, 1865)
Assiminea sp. 1
FAMILY CAECIDAE
Elephantulum insculptum (Carpenter, 1857)
Elephantulum heptagonum (Carpenter, 1857)
FAMILY TURRITELLIDAE
Subfamilia Turritellinae
Turritella sp. 1
FAMILY EPITONIIDAE
Acirsa menesthoides (Carpenter, 1864)
Epitonium emydonesus (Dall, 1919)
FAMILY NATICIDAE
Polinices sp. 1
Natica unifasciata (Lamarck, 1822)
FAMILY CYMATIIDAE
Cymatium weigmanni (Anton, 1839)
FAMILY CAPULIDAE
Capulus sericeus (J. y R. Burch, 1961)
FAMILY CERITHIIDAE
Subfamily Cerithiopsinae
Cerithiopsis halia (Bartsch, 1911)
Bittium sp. 1
Subfamily Cerithiopsis
Alabina effusa (Carpenter, 1857)
FAMILY POTAMIDIDAE
Cerithidea albonodosa (Gould y Carpenter, 1857)
ORDER NEOGASTROPODA
FAMILY COLUMBELLIDAE
Anachis rugosa (Sowerby, 1832)
Anachis nigrofusca (Carpenter, 1852)
Cosmoconcha rehderi (Hertlein y Strong, 1951)
FAMILY TURRIDAE
Subfamily Crassispirinae
Crassispira sp. 1
ORDER ENTOMOTAENIATA
FAMILY PYRAMIDELLIDAE
Odostomia convexa (Carpenter, 1857)
Odostomia sp. 1
Turbonilla sanctorum (Dall y Bartsch, 1909)
Turbonilla nicholsi (Dall y Bartsch, 1909)
ORDER CEPHALASPIDEA
FAMILY SCAPHANDRIDAE
Acteocina smirna (Dall, 1919)
Acteocina carinata (Carpenter, 1857)
Acteocina angustior (Baker y Hanna, 1927)
Acteocina infrequens (C.B. Adams, 1852)
Acteocina sp. 1
Cylinchna inca (Dall, 1908)
FAMILY ATYIDAE
Atys chimera (Baker y Hanna, 1927)
Haminoea angelensis (Baker y Hanna, 1927)

Table 2. List of species found in the surrounding sea area.

PHYLUM MOLLUSCA
CLASS PELECYPODA
SUBCLASS PTERIOMORPHIA
ORDER ARCOIDA
FAMILY ARCIDAE
Subfamily Arcinae
Anadara sp. 1

ORDER MYTILOIDA
SUPERFAMILY MYTILACEA
FAMILY MYTILIDAE
Subfamily Mytilinae
Mytella strigata (Hanley, 1843)
Brachidontes sp. 1
Chromytilus palliopunctatus (Carpenter, 1857)

ORDER PTERIOIDA
FAMILY PECTINIDAE
Argopecten circularis (Sowerby, 1835)

SUBCLASS HETERODONTA
ORDER VENEROIDA
FAMILY VENERIDAE
Subfamily Chioninae
Protothaca asperrima (Sowerby, 1835)

Subfamily Meretricinae
Tivela sp. 1

Subfamily Chioninae
Chione subimbricata (Sowerby, 1835)
Chione squamosa (Carpenter, 1857)
Subfamily Venerinae
Ventricolaria sp. 1
Ventricolaria sp. 2

FAMILY DONACIDAE
Donax sp. 1

Subfamily Pitarinae
Pitar alternatus (Broderip, 1835)
Pitar sp. 1

FAMILY SOLECURTIDAE
Tagelus longisinuatus (Pilsbry y Lowe, 1932)
Tagelus sp. 1

FAMILY TELLINIDAE
Tellina sp. 1
Strigilla sp. 1

FAMILY CARDIIDAE
Fragum thrustoni (Rodan, 1798)
Fragum sp. 1

Subfamily Laevicardiinae
Laevicardium elenenses (Sowerby, 1840)
Subfamily Trachycardiinae
Trachycardium senticosum (Sowerby, 1833)
Trachycardium sp. 1

FAMILY LUCINIDAE
Subfamily Lucininae
Ctena clarionensis (Hertlein y Strong, 1946)

ORDER MYOIDA
SUBORDER MYINA
FAMILY CORBULIDAE
Corbula sp. 1

CLASS SCAPHOPODA
ORDEN DENTALIOIDA
FAMILY DENTALLIDAE
Dentallium agassizi (Pilsbry y Sharp, 1897)
Dentallium hancocki (Emerson, 1956)

CLASS GASTROPODA
SUBCLASS PROSOBRANCHIA
ORDEN ARCHAEOGASTROPODA
FAMILY FISSURELLIDAE
Subfamily Fissurellidinae
Diodora pusilla (Berry, 1959)
Diodora sp. 1

FAMILY ACMAEIDAE
Notoacmea fascicularis (Menke, 1851)
Acmaea sp. 1

ORDER MESOGASTROPODA
FAMILY ASSIMINEIDAE
Assiminea californica (Tryon, 1865)

FAMILY CAECIDAE
Elephantulum insculptum (Carpenter, 1857)
Caecum sp. 1
Fartulum bakeri (Bartsch, 1920)

FAMILY EPITONIIDAE
Epitonium tinctorium (Dall, 1919)
Epitonium willetti (Strong y Hertlein, 1937)
Epitonium oerstedianum (Hertlein y Strong, 1951)
Epitonium sp. 1

FAMILY NATICIDAE
Natica colima (Strong y Hertlein, 1937)
Natica sp. 1

FAMILY CALYPTRAEIDAE
Crepidula sp. 1
Crucibulum sp. 1
Calyptraea sp. 1

FAMILY CERITHIIDAE
Subfamily Cerithiopsinae
Seila assimilata (C.B. Adams, 1852)

Subfamily Triphorinae
Triphora hannai (Baker, 1926)
Subfamily Cerithiopsis
Alabina effusa (Carpenter, 1857)
Alabina sp. 1

FAMILY VITRINELLIDAE
Subfamily Vitrinellinae
Parviturboides monile (Carpenter, 1857)

FAMILY FICIDAE
Ficus ventricosa (Sowerby, 1825)

ORDER NEOGASTROPODA
FAMILY COLUMBELLIDAE
Anachis rugosa (Sowerby, 18320
Anachis sp. 1
Mitrela harfordi (Strong y Hertlein, 1937)

FAMILY BUCCINIDAE
Cantharus berryi (McLean, 1970)

FAMILY NASSARIIDAE
Nassarius sp. 1

FAMILY MITRIDAE
Subfamily Imbricariinae
Subcancilla sp. 1
Subfamily Vexillinae
Thala gratiosa (Reeve, 1845)

FAMILY TEREBRIDAE
Terebra brandi (Bratcher y Burch, 1970)
Terebra bridgesi (Dall, 1908)
Terebra sp. 1

FAMILY TURRIDAE
Subfamily Borsoniinae
Borsonella sp. 1
Subfamily Crassispirinae
Crassispira sp. 1

SUBCLASS OPISTHOBRANCHIA
ORDER ENTOMOTAENIATA
FAMILY PYRAMIDELLIDAE
Odostomia sp. 1
Turbonilla sanctorum (Dall y Bartsch, 1909)
Turbonilla sp. 1

ORDER CEPHALASPIDEA
FAMILY SCAPHANDRIDAE
Acteocina smirna (Dall, 1919)
Acteocina angustior (Baker y Hanna, 1927)

FAMILY ATYIDAE
Haminoea sp. 1

FAMILY BULLIDAE
Bulla sp. 1
FAMILY ACTEONIDAE
Acteon sp. 1
CLASS SCAPHOPODA
ORDEN DENTALIOIDA
FAMILY DENTALLIDAE
Dentallium agassizi (Pilsbry y Sharp, 1897)
Dentallium hancocki (Emerson, 1956)

(Baker and Hanna, 1927), *Assiminea californica* (Tryon, 1865), *Elephantulum insculptum* (Carpenter, 1857), *Alabina effusa* (Carpenter, 1852), *Mytella strigata* (Hanley, 1843), *Chione squamosa* (Carpenter, 1857) and *Tagelus longisinuatus* (Pilsbry and Lowe, 1932) were species founded inside and outside the lagoon.

Mexico is a country, with a high biodiversity richness in plant and animal species because of an overlap of the Nearctic and Neotropical biogeographic regions (Wilson, 1988; Reguero-Reza and García-Cubas, 1993). Mexico is one of the five nations with the greatest species richness (Navarro and Llorente, 1991; Reguero-Reza and García Cubas, 1993).

Results from the sampling project confirm such a great species richness in both marine and lagoon environments (Morris, 1966; Keen, 1971; Keen and Coan, 1974; Abbott, 1974; Lindner, 1993). However, neritic species are more abundant in the surrounding sea than inside the lagoon, not only in species, but also in classes Gastropoda, Pelecypoda, and Scaphopoda. Inside the lagoon, only were found Gastropoda and Pelecypoda classes. According to Morton (1971), the mollusks group can be defined as a *phylum* characterized with great diversity and adaptative plasticity (Reguero-Reza and García-Cubas, 1993).

Of the species found in the lagoon and the sea, the only marine-euryhaline species is *Tagelus longisinuatus*. However, Stuardo and Villarroel (1976) report such species as endemic inhabitants of estuaries, inlets, and coastal lagoons. It is more appropriate to include such species in the estuarine component. Stuardo and Villarroel (1976) consider *Mytella strigata* exclusively as part of the estuarine component. However, *M. strigata* was found inside and outside the lagoon.

The results of this study will be a key element for future environmental impact assessments prepared for this region.

We appreciate the support provideded by the Universidad Nacional Autónoma de México and M. en C. Luis Treviño-Acuña. To Dra. Celia Vázquez and the Centro de Investigaciones Biológicas del Noroeste, S. C. (CIBNOR for logistic support. Ira Fogel of CIBNOR edited the English-language text.

REFERENCES

ABBOTT, R. T., 1974. American Sea shells. Van Nostrand Reinhold Co., New York. 541 p.

ASCENCIO, F., 1985. Situación actual de la Laguna de Cuyutlán, Colima en sus aspectos de aprovechamiento pesquero y calidad de agua. Centro Regional de Investigaciones Pesqueras, Instituto Nacional de la Pesca, Manzanillo. 11 p.

ASCENCIO, F., 1985. Producción de camarón (*Penaeus* sp.) en el tapo experimental de la laguna de Cuyutlán, Colima durante la temporada 84-85. *Boletín Informativo No. 2 del Centro regional de Investigación Pesquera.* Manzanillo, Colima, Instituto Nacional de Pesca. 21 p.

COBO, D., 1978. Determinación de los efectos de la Termoeléctrica de Manzanillo en la flora y fauna de la laguna de Cuyutlán. Instituto de Ingeniería, UNAM. 250 p.

CONTRERAS, F., 1985. *Las lagunas costeras mexicanas.* Centro de Ecodesarrollo. Secretaría de Pesca. 253 p.

CRUZ-AGÜERO, J. DE LA, F. GALVÁN-MAGAÑA, L. A. ABITIA-CÁRDENAS, J. RODRÍGUEZ-ROMERO y F. L. GUTIÉRREZ-SÁNCHEZ, 1994. Lista sistemática de los peces marinos de Bahía Magdalena, Baja California Sur, México. *Ciencias Marinas 20* (1): 17-31.

FISHER, W., F. KRUPP, C. SCHNEIDER, K. E. CARPENTER y V. H. NIEM, 1995. *Guía FAO para la identificación de especies para los fines de la pesca. Pacífico Centro Oriental.* Vol. 1. 646 p.

GÜNTHER, A. C., 1969. Catalogue of the fishes. *The collection of the British Museum 1*: 1-523.

HILDEBRAND, S. F., 1946. A descriptive catalogue of the shore fishes of Peru. *Bul. U.S. Natural Museum. 189*: 1-530.

KEEN, A., 1971. *Sea shells of tropical West America.* Stanford University Press, 2nd Ed. 1064 p.

KEEN, A. M. y E. COAN. 1974. *Marine mollusca genera of Western North America.* Stanford University Press. 208 p.

LINDNER, G., 1983. *Moluscos y caracoles de los mares del mundo.* Edit. Omega, S. A., Barcelona, 6ta. Ed. 255 p.

MORRIS, P., 1966. *A field guide to Pacific coast shells.* Houghton Mifflin Company, Yale University, 2nd Ed. 297 p.

MORTON, J. E., 1971. *Mollusca.* Hutchinsons University. Library. 232 p.

NAVARRO, S. A. G. y B. J. E. LLORENTE, 1991. Museos, colecciones biológicas y la conservación de la biodiversidad: Una perspectiva para México. *Memorias. Seminario sobre la conservación y diversidad biológica de México. 3:* 1-31.

REGUERO-REZA, M. y A. GARCÍA-CUBAS, 1993. Estado actual de la investigación sobre diversidad de moluscos en México. Vol. Esp. (XLIV) *Rev. Soc. Mex. Hist. Nat.*: 191-207.

STUARDO, J. y M. VILLARROEL, 1976. Aspectos ecológicos y distribución de los moluscos en las lagunas costeras de Guerrero, México. *Anales del Instituto de Ciencias del Mar y Limnología, UNAM. 3*(1): 65-92.

TREVIÑO, L. y GONZALEZ S., 1984. Rehabilitación y adecuación pesquera de la laguna de Cuyutlán, Colima, México. Inst. de Ingeniería, UNAM. 18 p.

WILSON, E. O., 1988. *Biodiversity.* National Academy Press, Washington, D.C., 521 p.

YAÑEZ, A. y C. NUGENT, 1975. El papel ecológico y variación cíclica de la estructura trófica de las comunidades nectónicas. *Anales del Instituto de Ciencias del Mar y Limnología, UNAM. 4*(1): 107-114.

Recibido: 30 de enero de 2002.

Aceptado: 22 de octubre de 2002.