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Marine biodiversity of Bahía Culebra, Guanacaste, Costa Rica: published records

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Abstract: A survey of the published records of marine organisms of Bahía Culebra, an enclosed embayment on the north Pacific coast of Costa Rica, is analyzed resulting in a list of 577 species representing 22 phyla. The most diverse groups documented were crustaceans, cnidarians and mollusks in order of species number. The first published record of any marine organism from the area, a polychaete, occurred in 1922, with a peak of published records of species between 1940 and 1949 and, more recently, from 2000 to the present. Several additional taxa are known from the region but there are no published records of their occurrence. This is especially evident for such groups as the free living flatworms and black corals. Additionally, several habitats, including soft bottom sediments, have not been sampled. Because of the paucity of knowledge on the biodiversity of Bahía Culebra, much more research is needed in order to evaluate and understand the effect of climate change and increasing anthropogenic activities. *Rev. Biol. Trop.* 60 (Suppl. 2): 39-71. Epub 2012 April 01.

Key words: Bahía Culebra, marine biodiversity, Costa Rica, Eastern Pacific, upwelling area.

Bahía Culebra (10°36'N-85°39'W) is located on the north Pacific coast of Costa Rica. It is a relatively deep (30 m) and enclosed bay covering about 24 km². This region of Costa Rica is undergoing the greatest coastal alteration due to tourism and other anthropogenic activities (Jiménez 2001, Fernández-García 2007). The bay is protected and deep enough to serve as an anchorage for US battleships between 1933 and 1937 (Sánchez -Noguera 2012). Based on his review of the history of marine research in Bahía Culebra by Cortés (2012a) the first period of active research in the area occurred between 1933 and 1938. During 1933 and 1934 the motor yacht *Velero III* on an expedition sponsored by the Allan Hancock Foundation, visited the bay (Fraser 1943). These expeditions have resulted in a significant number of publications and reports. In 1933, core samples

were taken with the USS *Hannibal*, deposited at Scripps Oceanographic Institution, and the foraminifera analyzed (Bandy & Arnal 1957). The other important expedition was conducted by the New York Zoological Society as part of their eastern Pacific Expeditions. The steam yacht *Zaca*, visited Bahía Culebra in 1938 (Beebe 1938) and resulted in a significant number of publications. Few studies subsequently occurred until the 1950's when individual researchers studied the bay's fauna and flora, e.g., Elmer Y. Dawson who collected algae (Dawson 1960).

Since the mid 1980's scientists from the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR: Marine Science and Limnology Research Center), Universidad de Costa Rica, have been carrying out research on the marine environments of Bahía Culebra,

mainly on the coral reefs (Cortés & Murillo 1985). This work has been later expanded by Carlos E. Jiménez in the 1990s (Jiménez 1998) and also included studies of the diversity of marine organisms. The contributions by Arturo Dominici-Arosemena and co-workers (2001) added an important number of fishes to the list of Bahía Culebra. Karina Rodríguez (Rodríguez-Sáenz 2005, Rodríguez-Sáenz & Gasca 2009, Rodríguez-Sáenz & Segura-Puertas 2009) significantly increased the knowledge on the diversity of the gelatinous zooplankton of Bahía Culebra. Jorge Cabrera-Peña and his team from the Universidad Nacional, Heredia, Costa Rica, published three ecological papers in which marine species were mentioned (Madrigal-Castro *et al.* 1984, Cabrera-Peña *et al.* 1994, Cabrera-Peña & Solano-López 1996). Ángel Valdés and Yolanda E. Camacho-García (2004) add seven species of gastropods to the list of species of Bahía Culebra.

As emphasized by Knowlton and Jackson (2008) baseline information is fundamental to evaluate changes. This is important for regions rich in coralline environments (Cortés & Jiménez 2003) with high marine biodiversity (this paper), and applies especially for areas that are being altered at a rapid rate such as Bahía Culebra. For this reason we have compiled this list of published records as a historical document and as baseline for other papers published both in this issue and in the future.

MATERIALS AND METHODS

We have compiled all reports of marine species and related topics dealing with Bahía Culebra (Cortés 2012b) and a list of all the species reported, organized by taxonomic group, has been organized. The numbers of species per taxa and the year they were reported were recorded. For the algae we used the classification and updated names proposed by Guiry and Guiry (2010). For marine animals we referred mostly to WoRMS (World Register of Marine Species, <http://www.marinespecies.org>) and ITIS (Integrated Taxonomic Information System, <http://www.itis.gov>).

RESULTS AND DISCUSSION

The published records of marine species of Bahía Culebra are listed in Table 1 together with their references. A total of 577 species have been documented, in 22 phyla (Table 1 and 2). The Crustacea had the most species reported (147 spp., mostly decapods: 94 spp.); followed by the cnidarians (100 spp., mostly hydroids: 75 spp.); mollusks (93 spp., mostly bivalves: 55 spp.); and chordates (92 spp., mostly fishes: 82 spp.) (Table 2). These numbers is a reflection of marine biodiversity in general (IUCN 2010) but also the interest and dedication of certain researchers such as is the case of the hydroids by Charles McLean Fraser and Karina Rodríguez-Sáenz, or bivalves where most reports are by Leo G. Hertlein and Archibald M. Strong.

Most reports were published in the 1940's and 2000's (Fig. 1). The first pulse of publications resulted from the support of the Allan Hancock Foundation based on collections made aboard the *Velero III* (Fraser 1943), and the American Museum based on the collections of the New York Zoological Society Pacific expeditions aboard the *Zaca* (Beebe 1938). The second pulse of publications has occurred in the last ten years based on investigations sponsored by the Universidad de Costa Rica through the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR: Marine Science and Limnology Research Center) and the Museo de Zoología (Zoology Museum).

Though known to be present in Bahía Culebra there are no published accounts for several groups of marine organisms, including the black corals, flatworms and nemertean. Furthermore, conspicuous species such as marine turtles have been seen in the bay but not reported anywhere. Even important ecosystems, such as the soft bottom benthos as well as the rocky intertidal communities have not been studied and much more work needs to be done in the mangrove forests.

At present corals reefs, coral communities, sea urchins and some environmental parameters are being monitored by CIMAR, but

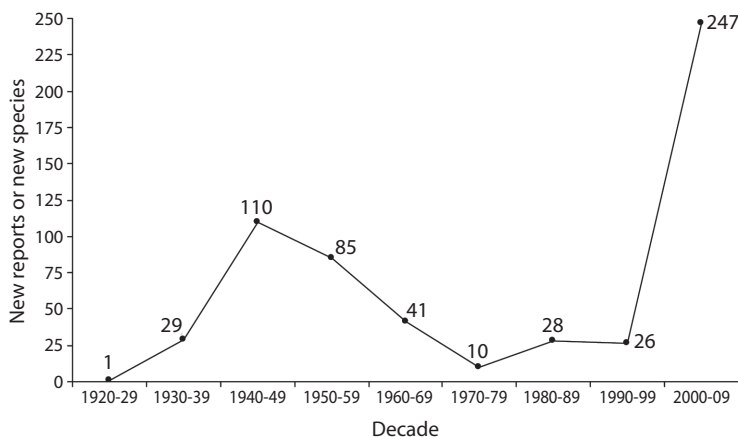


Fig. 1. New reports or species described of marine species for Bahía Culebra per decade.

other environments and organisms should be assessed periodically. The only way to determine changes due to anthropogenic and natural effects is through monitoring.

ACKNOWLEDGMENTS

We thank Cindy Fernández for help with the algae, Juan José Alvarado with the echinoderms, Harlan Dean with the polychaetes. We appreciate the review of the manuscript by Richard Heard, Harlan Dean and Juan José Alvarado. Projects in Bahía Culebra have been funded over the years by the Vicerrectoría de Investigación (Universidad de Costa Rica), Ecodesarrollo Papagayo, USAID-CDR program, and the Centro de Investigación en Ciencias del Mar y Limnología (CIMAR).

RESUMEN

Bahía Culebra es una bahía semicerrada en el Pacífico norte de Costa Rica. Se recopilaron y analizaron publicaciones en que se mencionan especies marinas de la Bahía. Un total de 577 especies en 22 filos han sido registradas, la mayoría crustáceos, cnidarios y moluscos. El primer informe de una especie marina de Bahía Culebra fue en 1922, un poliqueto. Entre 1940 y 1949 hay un pico de publicaciones con especies de la Bahía, al igual que del 2000 al presente. Se han observado algunos grupos de animales de los cuales no hay publicaciones, por ejemplo corales negros y gusanos planos de vida libre. Igualmente, tampoco hay publicaciones sobre los organismos del bentos blando. Más investigación en Bahía Culebra como también continuar y ampliar el monitoreo de ecosistemas y organismos marinos, es necesario para poder evaluar los impactos por la actividad humana y los naturales, incluyendo el cambio climático.

Palabras claves: Bahía Culebra, biodiversidad marina, Costa Rica, Pacífico Oriental, zona de afloramiento

TABLE 1
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cyanobacteria: Cyanophyceae: Chroococcales: Microcystaceae	<i>Merismopoedia glauca</i> (Ehrenberg) Kützing, 1845	Drouet 1936
Cyanobacteria: Cyanophyceae: Nostocales: Rivulariaceae	<i>Isactis plana</i> (Harvey) Thuret ex Bornet & Flahault, 1886	Taylor 1945
Cyanobacteria: Cyanophyceae: Oscillatoriales: Oscillatoriaceae	<i>Blennothrix cantharidosma</i> (Gomont) Anagnostidis & Komárek, 1988 as <i>Hydrocoleum cantharidosmum</i>	Drouet 1936

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cyanobacteria: Cyanophyceae: Oscillatoriales: Phormidiaceae	<i>Phormidium monile</i> Setchell & Gardner, 1930 as <i>Lyngbya gracilis</i> <i>Trichodesmium erythraeum</i> Ehrenberg ex Gomont 1892 <i>Tas Trichodesmium erythraeum</i>	Taylor 1945 Vargas-Montero 2004
Bacillariophyta: Bacillariophyceae: Bacillariales: Bacillariaceae	<i>Pseudo-nitzschia pungens</i> (Grunow ex P.T. Cleve, 1897) Hasle, 1993 <i>Pseudo-nitzschia</i> spp.	Vargas-Montero 2004 Vargas-Montero 2004
Bacillariophyta: Coscinodiscophyceae: Rhizosoleniales: Rhizosoleniaceae	<i>Guinardia</i> sp.	Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Dinophysiales: Dinophyceae	<i>Dinophysis caudata</i> Saville-Kent, 1881	Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Gonyaulacales: Ceratiaceae	<i>Ceratium dens</i> Ostenfeld & Schmidt, 1859 <i>Ceratium furca</i> (Ehrenberg, 1833)	Vargas-Montero 2004 Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Gonyaulacales: Goniodomataceae	<i>Alexandrium</i> cf. <i>ostenfeldii</i> <i>Alexandrium monilatum</i> (Howell, 1953)	Vargas-Montero 2004 Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Gonyaulacales: Gonyaulacaceae	<i>Gonyaulax spinifera</i> (Claparède & Lachmann, 1859) <i>Lingulodinium polyedrum</i> (Stein, 1883)	Vargas-Montero 2004 Morales-Ramírez <i>et al.</i> 2001
Dinoflagellata: Dinophyceae: Gymnodiniales: Gymnodiniaceae	<i>Cochlodinium polykrikoides</i> Margalef, 1961 <i>Gymnodinium catenatum</i> Grahm, 1943	Vargas-Montero 2004 Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Noctilucales: Noctilucaeae	<i>Noctiluca scintillans</i> (Macartney) Kofoid & Swezy, 1921	Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Peridiniales: Peridinaceae	<i>Peridinium quinquecorne</i> Abé, 1927 <i>in lit</i> <i>Protoperidinium quinquecrones</i>	Vargas-Montero 2004
Dinoflagellata: Dinophyceae: Protocentrales: Protocentraceae	<i>Prorocentrum lima</i> (Ehrenberg) Dodge, 1975 <i>Prorocentrum micans</i> Ehrenberg, 1834 <i>Prorocentrum</i> spp.	Vargas-Montero 2004 Vargas-Montero 2004 Vargas-Montero 2004
Chlorophyta: Bryopsidophyceae: Bryopsidales: Caulerpaceae	<i>Caulerpa sertularioides</i> (S. Gmelin) Howe, 1905	Fernández & Cortés 2005
Chlorophyta: Bryopsidophyceae: Bryopsidales: Halimedaceae	<i>Halimeda discoidea</i> Descaine, 1842	Fernández & Alvarado 2008
Chlorophyta: Ulvophyceae: Cladophorales: Cladophoraceae	<i>Rhizoclonium lubricum</i> Setchell & Gardner, 1819 as <i>Lola lubrica</i> <i>Cladophora crystallina</i> (Roth) Kützing, 1843	Taylor 1945, Dawson 1961 Dawson 1960, 1961

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Chlorophyta: Ulvophyceae: Dasycladales: Polyphysaceae	<i>Parvocaulis parvulus</i> (Solms-Laubach) Berger, Fettweiss, Gleissberg, Liddle, Richter, Sawitsky & Zuccarello, 2003	Fernández & Alvarado 2008
Chlorophyta: Ulvophyceae: Siphonocladales: Boodleaceae	<i>Cladophoropsis gracillima</i> Dawson, 1950 <i>Phyllodictyon</i> sp. as <i>Struvea</i> sp.	Dawson 1960 Tsuda 1968
Chlorophyta: Ulvophyceae: Ulvales: Ulvaceae	<i>Ulva fasciata</i> Delile, 1813 <i>Ulva flexuosa</i> Wulfen, 1803 as <i>Enteromorpha</i> <i>lingulata</i> <i>Ulva lactuca</i> Linnaeus, 1753	Tsuda 1968 Taylor 1945, Fernández & Alvarado 2008 Fernández & Alvarado 2008
Rhodophyta: Florideophyceae: Acrochaetiales: Acrochaetiaceae	<i>Acrochaetium infestans</i> Howe & Hoyt, 1916	Dawson 1960, 1961
Rhodophyta: Florideophyceae: Ceramiales: Ceramiaceae	<i>Ceramium avalonae</i> Dawson, 1949 <i>Antithamnionella breviramosa</i> (Dawson) Wollaston, 1970 as <i>Antithamnion breviramosus</i>	Dawson 1960, 1961 Dawson 1960, 1961
Rhodophyta: Florideophyceae: Ceramiales: Delesseriaceae	<i>Hypoglossum attenuatum</i> var. <i>abyssicola</i> (Taylor) Dawson, 1962 as <i>Hypoglossum abyssicolum</i>	Taylor 1945, Dawson 1961
Rhodophyta: Florideophyceae: Ceramiales: Rhodomelaceae	<i>Acanthophora spicifera</i> (M.Vahl) Børgesen, 1910 as <i>Acanthophora spicifera</i> <i>Chondria acrorhizophora</i> Setchell & Gardner, 1924 as <i>Chondria californica</i> <i>Chondria platyclada</i> Taylor, 1945	Cortés 2001 Taylor 1945, Dawson 1961 Taylor 1945, Dawson 1957
Rhodophyta: Florideophyceae: Ceramiales: Spyridiaceae	<i>Spyridia filamentosa</i> (Wulfen) Harvey, 1833 <i>Spyridia</i> sp.	Dawson 1961 Dawson & Beaudette 1959
Rhodophyta: Florideophyceae: Corallinales: Corallinaceae	<i>Amphiroa</i> sp. <i>Jania tenella</i> var. <i>zaciae</i> Dawson, 1953 <i>Jania ungulata</i> (Yendo) Yendo, 1905	Dawson & Beaudette 1959 Dawson 1957 Tsuda 1968
Rhodophyta: Florideophyceae: Corallinales: Hapalidiaceae	<i>Lithothamnion validum</i> Foslie, 1906 as <i>Lithothamnium validum</i>	Taylor 1945, Dawson 1957
Rhodophyta: Florideophyceae: Gigartinales: Areschougaceae	<i>Sarcoditheca ecuadoreana</i> Taylor, 1945 <i>Sarcoditheca furcata</i> (Setchell & Gardner) Kylin, 1925	Taylor 1945, Dawson 1957 Dawson 1961
Rhodophyta: Florideophyceae: Gracilariales: Gracilariaceae	<i>Gracilaria symmetrica</i> Dawson, 1949 <i>Gracilaria tepocensis</i> (Dawson) Dawson, 1940 as <i>Gracilaria crockery</i> <i>Gracilariopsis costaricensis</i> Dawson, 1949 <i>Gracilariopsis panamensis</i> (Taylor) Dawson, 1949	Dawson 1961 Dawson 1957 Dawson 1957, 1961 Taylor 1945, Dawson 1961

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Rhodophyta: Florideophyceae: Halymeniales: Halymeniaceae	<i>Crytonemia angustata</i> (Setchell & Gardner) Dawson, 1954	Dawson 1960, 1961
	<i>Crytonemia limensis</i> (Kützing) Lewis, 1990 <i>in lit</i> <i>Crytonemia guaymasensis</i>	Dawson 1960, 1961
Rhodophyta: Florideophyceae: Nemaliales: Galaxauraceae	<i>Galaxaura filamentosa</i> Taylor, 1945	Taylor 1945
Rhodophyta: Florideophyceae: Nemaliales: Liagoraceae	<i>Liagora</i> sp.	Dawson & Beaudette 1959
Rhodophyta: Florideophyceae: Nemaliales: Scinaiceae	<i>Scinaia complanata</i> (Collins) Cotton, 1907	Taylor 1945, Dawson 1961
	<i>Scinaia confusa</i> (Setchell) Huisman, 1985 as <i>Gloiphloea confuse</i>	Dawson 1960
	<i>Scinaia johnstoniae</i> Setchell, 1914	Taylor 1945, Dawson 1957
Rhodophyta: Florideophyceae: Rhodymeniales: Lomentariaceae	<i>Lomentaria baileyana</i> (Harvey) Farlow, 1876	Taylor 1945, Dawson 1961
	<i>Lomentaria hakodatensis</i> Yendo, 1920	Dawson 1960, 1961
Ochrophyta: Phaeophyceae: Dictyotales: Dictyotaceae	<i>Dictyota crenulata</i> J. Agardh, 1847	Taylor 1945, Dawson 1961
	<i>Dictyota flabellata</i> (Collins) Setchell & Gardner, 1924	Taylor 1945, Dawson 1957
	<i>Padina durvillei</i> Bory Saint-Vincent, 1827	Taylor 1945
	<i>Padina</i> sp.	Dawson & Beaudette 1959
Ochrophyta: Phaeophyceae: Ectocarpales: Actinetosporaceae	<i>Feldmannia indica</i> (Sonder) Womersley & Bailey, 1970 as <i>Ectocarpus indicus</i>	Tsuda 1968
Ochrophyta: Phaeophyceae: Scytothamiales: Scytothamnaceae	<i>Asteronema breviarticulatum</i> (J. Agardh) Ouriques & Bouzon, 2000 as <i>Ectocarpus breviarticulatus</i>	Tsuda 1968
Magnoliophyta: Liliopsida: Najadales: Ruppiaceae	<i>Ruppia maritima</i> Linnaeus, 1753	Cortés 2001
Magnoliophyta: Liliopsida: Alismatales: Hydrocharitaceae	<i>Halophila baillonis</i> Ascherson, 1874	Cortés 2001
Magnoliophyta: Magnoliopsida: Lamiales: Verbenaceae:	<i>Avicennia</i> sp.	Cabrera-Peña <i>et al.</i> 1994
Magnoliophyta: Magnoliopsida: Myrtales: Combretaceae	<i>Laguncularia</i> sp.	Cabrera-Peña <i>et al.</i> 1994
Magnoliophyta: Magnoliopsida: Rhizophorales: Rhizophoraceae	<i>Rhizophora</i> sp.	Cabrera-Peña <i>et al.</i> 1994
Protozoa: Sarcodina: Foraminiferida: Bolivinitidae	<i>Bolivina vaughani</i> (Natland, 1938)	Bandy & Arnal 1957
	<i>Brizalina pygmaea</i> (Brady, 1881) as <i>Bolivina</i> <i>pygmaea</i>	Cushman & McCulloch 1942

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Protozoa: Sarcodina: Foraminiferida: Buliminidae	<i>Buliminella parallela</i> Cushman & Parker, 1931 <i>Bulimina pagoda</i> var. <i>denudata</i> Cushman, 1927 as <i>Bulimina denudata</i>	Cushman & McCulloch 1948 Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Cibicididae	<i>Cibicides fletcheri</i> Galloway & Wissler, 1927	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Elphidiidae	<i>Elphidium crispum</i> (Linnaeus, 1758)	Cushman & McCulloch 1940
Protozoa: Sarcodina: Foraminiferida: Eponididae	<i>Eponides antillarum</i> (d'Orbigny, 1839)	Crouch & Poag 1987
Protozoa: Sarcodina: Foraminiferida: Fusenokoinidae	<i>Virgulina schreibersiana</i> Czjzek, 1848	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Globigerinidae	<i>Globigerina bulloides</i> D'Orbigny, 1826 <i>Globigerina subcretacea</i> Chapman, 1902 <i>Globigerinella siphonifera</i> (d'Orbigny, 1839) as <i>Globigerinella aequilateralis</i> <i>Globigerinoides ruber</i> (d'Orbigny, 1839) as <i>Globigerinaoides rubra</i>	Bandy & Arnal 1957 Bandy & Arnal 1957 Bandy & Arnal 1957 Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Globorotaliidae	<i>Globorotalia menardii</i> (d'Orbigny, 1826)	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Haplophragmoididae	<i>Haplophragmoides</i> sp.	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Loxostomatidae	<i>Loxostomum limbatum</i> (Brady, 1881) as <i>Loxostoma limbatum</i>	Cushman & McCulloch 1942
Protozoa: Sarcodina: Foraminiferida: Miliolidae	<i>Quinqueloculina dutemplei</i> (d'Orbigny, 1846) <i>Quinqueloculina lamarckiana</i> (d'Orbigny, 1839) <i>Massilina inaffecta</i> ^a <i>Massilina patula</i> ^a <i>Massilina robustior</i> Cushman & Valentine, 1930	Bandy & Arnal 1957 Bandy & Arnal 1957 Crouch & Poag 1987 Crouch & Poag 1987 Crouch & Poag 1987
Protozoa: Sarcodina: Foraminiferida: Nonionidae	<i>Nonionella atlantica</i> (Cushman, 1947)	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Nouridae	<i>Nouria polymorphinoides</i> Heron-Allen & Earland, 1914	Cushman & McCulloch 1939
Protozoa: Sarcodina: Foraminiferida: Planorbulinidae	<i>Planorbulina mediterraneensis</i> (d'Orbigny, 1826)	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Reussellidae	<i>Reussella aequa</i> Cushman & McCulloch, 1948 <i>Reussella pacifica</i> Cushman & McCulloch, 1948	Cushman & McCulloch 1948 Cushman & McCulloch 1948
Protozoa: Sarcodina: Foraminiferida: Sphaeroidinidae	<i>Rectobolivina hancocki</i> (Cushman & McCulloch, 1942)	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Spiroloculinidae	<i>Spiroloculina dentata</i> Cushman & Tood, 1944	Bandy & Arnal 1957

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Protozoa: Sarcodina: Foraminiferida: Textulariidae	<i>Poritextularia panamensis</i> ^a	Crouch & Poag 1987
	<i>Textularia candeiana</i> d'Orbigny, 1839	Lalicker & McCulloch 1940
	<i>Textularia foliacea</i> Cushman, 1922	Lalicker & McCulloch 1940, Bandy & Arnal 1957
	<i>Textularia secasensis</i> Lalicker & McCulloch, 1940	Lalicker & McCulloch 1940
	<i>Textularia vola</i> Lalicker & McCulloch, 1940	Bandy & Arnal 1957
Protozoa: Sarcodina: Foraminiferida: Trochamminidae	<i>Trochammina pacifica</i> Cushman, 1925	Cushman & McCulloch 1939
Cnidaria: Anthozoa: Alcyonacea: Clavulariidae	<i>Carijoa</i> sp. as <i>Telesto</i> sp.	Jiménez 1997
Cnidaria: Anthozoa: Alcyonacea: Gorgoniidae	<i>Leptogorgia alba</i> Duchassaing & Michelotti, 1864	Breedy & Guzmán 2007, Breedy 2009
	<i>Leptogorgia cofrini</i> Breedy & Guzmán, 2005	Breedy & Guzmán 2005
	<i>Leptogorgia cuspidata</i> Verrill, 1865	Breedy & Guzmán 2007
	<i>Pacificogorgia firma</i> Breedy & Guzmán, 2003	Breedy & Guzmán 2003
Cnidaria: Anthozoa: Alcyonacea: Plexauridae	<i>Heterogorgia verrucosa</i> Verrill, 1868	Breedy & Guzmán 2011
Cnidaria: Anthozoa: Scleractinia: Agariciidae	<i>Leptoseris papyracea</i> (Dana, 1846)	Cortés & Murillo 1985
	<i>Pavona clavus</i> (Dana, 1846)	Cortés & Murillo 1985
	<i>Pavona gigantea</i> Verrill, 1869	Cortés & Murillo 1985
	<i>Pavona maldivensis</i> (Gardiner, 1905)	Cortés & Guzmán 1998
	<i>Pavona varians</i> Verrill, 1864	Cortés & Guzmán 1998
Cnidaria: Anthozoa: Scleractinia: Fungiidae	<i>Fungia (Cycloseris) curvata</i> (Verrill, 1870)	Cortés & Guzmán 1998
	<i>Fungia (Cycloseris) distorta</i> Michelin, 1842	Cortés & Guzmán 1998
Cnidaria: Anthozoa: Scleractinia: Pocilloporidae	<i>Pocillopora capitata</i> Verrill, 1864	Cortés & Guzmán 1998
	<i>Pocillopora damicornis</i> (Linnaeus, 1758)	Glynn <i>et al.</i> 1983
	<i>Pocillopora elegans</i> Dana, 1846	Jiménez 1997
	<i>Pocillopora eydouxi</i> Milne Edwards & Haime, 1860	Cortés & Murillo 1985
	<i>Pocillopora meandrina</i> Dana, 1846	Cortés & Murillo 1985
Cnidaria: Anthozoa: Scleractinia: Poritidae	<i>Porites lobata</i> Dana, 1840	Cortés & Murillo 1985
	<i>Porites panamensis</i> Verrill, 1866	Cortés & Guzmán 1998
Cnidaria: Anthozoa: Scleractinia: Rhizangiidae	<i>Oulangia bradleyi</i> (Verrill, 1866)	Cortés & Murillo 1985
Cnidaria: Anthozoa: Scleractinia: Siderastreaeidae	<i>Psammocora stellata</i> (Verrill, 1866)	Glynn <i>et al.</i> 1983
	<i>Psammocora superficialis</i> Gardiner, 1898	Jiménez 1997

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cnidaria: Scyphozoa: Coronatae: Nausithoidae	<i>Nausithoe punctata</i> K�lliker, 1853	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Scyphozoa: Semaestomae: Pelagiidae	<i>Pelagia noctiluca</i> P�ron and Lesueur, 1810	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Bougainvilliidae	<i>Bougainvillia crassa</i> Fraser, 1938	Fraser 1938
	<i>Bougainvillea fulva</i> Agassiz & Mayer, 1899	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Bougainvillea muscus</i> Allmar, 1863	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Garveia gracilis</i> (Clark, 1876) as <i>Bimeria gracilis</i>	Fraser 1938
	<i>Koellikerina fasciculata</i> (P�ron & Lesueur, 1810)	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Koellikerina multicirrata</i> (Kramp, 1928)	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Bythotiaridae	<i>Leuckartiara octona</i> (Fleming, 1823) as <i>Perigonimus repens</i>	Fraser 1938
	<i>Heterotiar minor</i> Vanh�ffen, 1911	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Corymorphidae	<i>Kanaka pelagica</i> Uchida, 1947 <i>incerta sedis</i>	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Vannucia forbesii</i> (Mayer, 1894)	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Corynidae	<i>Dipurena ophiogaster</i> Haeckel, 1879	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Sarsia coccometra</i> Bigelow, 1909	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Sarsia</i> spp.	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Euphysidae	<i>Euphysa aurata</i> Forbes, 1848	Rodr�guez-S�enz & Segura-Puertas 2009
	<i>Euphysilla pyramidata</i> Kramp, 1955	Rodr�guez-S�enz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Hydractiniidae	<i>Hydractinia carolinae</i> Fraser, 1912	Fraser 1938
	<i>Hydractinia disjuncta</i> Fraser, 1938	Fraser 1938
Cnidaria: Hydrozoa: Anthoathecata: Oceaniidae	<i>Turritopsis nutricula</i> McCrady, 1857	Fraser 1938

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cnidaria: Hydrozoa: Anthoathecata: Pandeidae	<i>Amphinema australis</i> (Mayer, 1900)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Amphinema dilema</i> (Péron & Lesueur, 1810)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Haliolitholus intermedius</i> (Browne, 1902)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Haliolitholus pauper</i> Hartlaub, 1913	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Leukartiara hoepflii</i> Hsu, 1928	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Leukartiara octona</i> (Fleming, 1823)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Pandeopsis ikarii</i> Kramp, 1959	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Pennariidae	<i>Pennaria disticha</i> (Goldfuss, 1820) as <i>Pennaria tiarella</i>	Fraser 1938, Kelmo & Vargas 2002
	Cnidaria: Hydrozoa: Anthoathecata: Porpitiidae	<i>Porpita porpita</i> (Linnaeus, 1758)
Cnidaria: Hydrozoa: Anthoathecata: Protariidae	<i>Halitiara formosa</i> Fewkes, 1882	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Trichydridae	<i>Trichydra pudica</i> Wright, 1858	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Anthoathecata: Tubulariidae	<i>Ectopleura dumortieri</i> (van Beneden, 1844)	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Calycophorae: Abylidae	<i>Abylopsis eschscholtzi</i> (Huxley, 1859)	Rodríguez-Sáenz & Gasca 2009
	<i>Abylopsis tetragona</i> (Otto, 1823)	Rodríguez-Sáenz & Gasca 2009
Cnidaria: Hydrozoa: Calycophorae: Dyphidae	<i>Sulculeolaria chuni</i> (Lens & van Riemsdijk, 1908)	Rodríguez-Sáenz & Gasca 2009
	<i>Sulculeolaria quadrivalvis</i> Blainville, 1834	Rodríguez-Sáenz & Gasca 2009
	<i>Chelophyes contorta</i> (Lens & van Riemsdijk, 1908)	Rodríguez-Sáenz & Gasca 2009
	<i>Diphyes bojani</i> (Eschscholtz, 1829)	Rodríguez-Sáenz & Gasca 2009
	<i>Diphyes dispar</i> Chamisso & Eysenhardt, 1821	Rodríguez-Sáenz & Gasca 2009
	<i>Eudoxoides mitra</i> Huxley, 1859	Rodríguez-Sáenz & Gasca 2009
	<i>Muggiaea atlantica</i> Cunningham, 1892	Rodríguez-Sáenz & Gasca 2009
	<i>Rosacea cymbiformis</i> (Chiaje, 1822)	Rodríguez-Sáenz & Gasca 2009
Cnidaria: Hydrozoa: Calycophorae: Prayidae	<i>Rosacea flaccida</i> Biggs, Pugh & Carré, 1978	Rodríguez-Sáenz & Gasca 2009
	Cnidaria: Hydrozoa: Leptothecata: Aequoridae	<i>Aequorea coeruleascens</i> (Brandt, 1838)
<i>Aequorea macrodactyla</i> (Brandt, 1834)		Rodríguez-Sáenz & Segura-Puertas 2009

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cnidaria: Hydrozoa: Leptothecata: Campanulariidae	<i>Clytia brunescens</i> (Bigelow, 1904)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Clytia hemisphaerica</i> (Linnaeus, 1767)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Clytia simplex</i> (Browne, 1902)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Clytia uchidai</i> Kramp, 1961	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Obelia</i> spp.	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Dipleurosomatidae	<i>Dipleurosoma pacificum</i> Agassiz & Mayer, 1902	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Eutimidae	<i>Eutima curva</i> Browne, 1905	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Eutima orientales</i> (Browne, 1905)	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Haleciidae	<i>Halecium delicatulum</i> Coughtrey, 1876 as <i>Halecium gracile</i>	Fraser 1938
	<i>Halecium nanum</i> Alder, 1849	Fraser 1938
Cnidaria: Hydrozoa: Leptothecata: Laodiceidae	<i>Laodicea marana</i> Agassiz & Mayer, 1899	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Lovenellidae	<i>Eucheilota comata</i> (Bigelow, 1909)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Eucheilota menoni</i> Kramp, 1959	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Malagazziidae	<i>Octophiallucium bigelowi</i> Kramp, 1955	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Melicertidae	<i>Melicetum</i> sp.	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Limnomedusae: Olindiidae	<i>Olindias singulares</i> Browne, 1905	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Phialellidae	<i>Phialella</i> sp.	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Leptothecata: Plumulariidae	<i>Lytocarpus phillippinus</i> (Kirschenpauer, 1872)	Fraser 1938
Cnidaria: Hydrozoa: Leptothecata: Sertulariidae	<i>Sertularia exigua</i> Allman, 1877	Fraser 1938
	<i>Thuiaria crisiodes</i> (Lamouroux, 1824)	Fraser 1948
Cnidaria: Hydrozoa: Narcomedusae: Aeginidae	<i>Solmundella bitentaculata</i> (Quoy & Gaimard, 1833)	Rodríguez-Sáenz & Segura-Puertas 2009

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Cnidaria: Hydrozoa: Narcomedusae: Cuninidae	<i>Cunina octonaria</i> McCrady, 1859	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Solmaris rhodoloma</i> (Brandt, 1838)	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Physonectae: Agalmidae	<i>Agalma elegans</i> (Sars, 1846)	Rodríguez-Sáenz & Gasca 2009
	<i>Agalma okeni</i> Eschscholtz, 1825	Rodríguez-Sáenz & Gasca 2009
	<i>Nanomia bijuga</i> (Chiaje, 1841)	Rodríguez-Sáenz & Gasca 2009
Cnidaria: Hydrozoa: Physonectae: Forskaliidae	<i>Forskalia edwardsi</i> Kolliker, 1853	Rodríguez-Sáenz & Gasca 2009
Cnidaria: Hydrozoa: Trachymedusae: Geryoniidae	<i>Liriope tetraphylla</i> (Chamisso & Eysenhardt, 1821)	Rodríguez-Sáenz & Segura-Puertas 2009
Cnidaria: Hydrozoa: Trachymedusae: Rhopalonematidae	<i>Aglantha</i> sp.	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Aglantha digitale</i> (Muller, 1766)	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Aglaura hemistoma</i> Péron & Lesueur, 1810	Rodríguez-Sáenz & Segura-Puertas 2009
	<i>Rhopalonema velatum</i> Gegenbaur, 1857	Rodríguez-Sáenz & Segura-Puertas 2009
Ctenophora	Unidentified species	Bednarski & Morales-Ramírez 2004
Platyhelminthes: Cestoda: Rhinebothriidea: Rhinobothriidae	<i>Rhinebothrium geminum</i> Marques, Brooks & Molina-Ureña, 1996	Marques <i>et al.</i> 1996
Platyhelminthes: Cestoda: Tetrathyllidae: Onchobothriidae	<i>Acanthobothroides pacificus</i> Marques, Brooks & Molina-Ureña, 1996	Marques <i>et al.</i> 1996
Platyhelminthes: Monogenea: Polyopisthocotylea: Protomicrocotylidae	<i>Neomicrocotyle pacifica</i> (Meserve, 1938) as <i>Protomicrocotyle pacifica</i>	Meserve 1938, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Bucephalidae	<i>Bucephalus introversus</i> Manter, 1940	Manter 1940, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Didymozoidae	Larval Didymozoidae not identified (metacercariae)	Pérez-Ponce de León <i>et al.</i> 1998, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Fellodistomidae	<i>Tergestia laticollis</i> (Rudolphi, 1819)	Manter 1940, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Lepocreadiidae	<i>Bianium simonei</i> (Travassos, Freitas & Buhenheim, 1965)	Pérez-Ponce de León <i>et al.</i> 1998, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Monorchiiidae	<i>Lasiotocus costaricae</i> (Manter, 1940) as <i>Proctotrema costaricae</i>	Manter 1940, Rodríguez-Ortíz <i>et al.</i> 2004
Platyhelminthes: Trematoda: Plagiorchiida: Opcoelidae	<i>Helicometra sinuata</i> (Rudolphi, 1819)	Manter 1940, Rodríguez-Ortíz <i>et al.</i> 2004

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List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Acanthocephala: Palaeacanthocephala: Echinorhynchida: Illiosentidae	<i>Koronacantha pectinaria</i> (Van Cleave, 1940) as <i>Microlepidotus brevipinnis</i> <i>Tegorhynchus pectinarius</i> Van Cleave, 1940	Van Cleave 1940, Monks <i>et al.</i> 1997 Van Cleave 1940
Nematoda: Secernentea: Spirurida: Gnathostomatidae	<i>Echinocephalus janzeni</i> Hoberg, Brooks, Molina-Ureña & Erbe, 1998	Hoberg <i>et al.</i> 1998
Annelida: Polychaeta: Amphinomida: Amphinomidae	<i>Chloeia pseudeuglochis</i> Augener, 1924 <i>Eurythoe complanata</i> (Pallas, 1766)	Augener 1922, Dean 2004 Hartman 1940, Dean 2004
Annelida: Polychaeta: Eunicida: Lumbrineridae	<i>Lumbrineris latreilli</i> Audouin & Milne Edwards, 1834	Hartman 1944b, Dean 2004
Annelida: Polychaeta: Sabellida: Sabellariidae	<i>Idanthyrus cretus</i> Chamberlin, 1919 as <i>Idanthyrus pennatus</i>	Hartman 1944a, Dean 2004
Sipunculida: Phascolosomatidea: Phascolosomatida: Phascolosomatidae	<i>Antillesoma antillarum</i> (Grube, 1858) <i>Phascolosoma perlucens</i> Baird, 1868	Spongberg 2006 Spongberg 2006
Mollusca: Bivalvia: Arcoida: Arcidae	<i>Acar bailyi</i> Bartsch, 1931 <i>Anadara concinna</i> (Sowerby, 1833) as <i>Anadara (Scapharca) cumingiana</i> <i>Anadara formosa</i> (Sowerby, 1833) as <i>Arca (Anadara) Formosa</i> <i>Anadara multicosata</i> (Sowerby, 1833) as <i>Arca (Larkinia) multicosata</i> <i>Anadara (Cunearca) nux</i> (Sowerby, 1833) <i>Anadara similis</i> (Adams, 1852) as <i>Arca (Anadara) similis</i> <i>Anadara tuberculosa</i> (Sowerby, 1833) as <i>Arca (Anadara) tuberculosa</i> <i>Arca mutabilis</i> Sowerby, 1833 as <i>Arca (Arca) mutabilis</i>	Rost 1955 Rost 1955 Hertlein & Strong 1943 Hertlein & Strong 1943 Hertlein & Strong 1943, Rost 1955 Hertlein & Strong 1943 Hertlein & Strong 1943, Rost 1955 Hertlein & Strong 1943, Rost 1955
Mollusca: Bivalvia: Arcoida: Glycymerididae	<i>Glycymeris strigilata</i> (Sowerby, 1833) as <i>Glycymeris (Tuceta) tessellata</i>	Hertlein & Strong 1943
Mollusca: Bivalvia: Myoidea: Corbulidae	<i>Corbula (Caryocorbula) ovulata</i> Sowerby, 1833 as <i>Aloidis (Caryocorbula) ovulate</i>	Hertlein & Strong 1950

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Mollusca: Bivalvia: Myoidea: Mytilidae	<i>Amygdalum americanum</i> Soot-Ryen, 1955	Soot-Ryen 1955
	<i>Crenella divaricata</i> (d'Orbigny, 1842)	Soot-Ryen 1955
	<i>Lioberus salvadoricus</i> Hertlein & Strong, 1946	Soot-Ryen 1955
	<i>Lithophaga (Diberus) plumula</i> (Hanley, 1844)	Soot-Ryen 1955
	<i>Lithophaga (Myoforceps) aristata</i> (Dillwyn, 1817)	Soot-Ryen 1955
	<i>Modiolus eiseni</i> Hertlein & Strong, 1937	Soot-Ryen 1955
	<i>Septifer zeteki</i> Hertlein & Strong, 1946	Soot-Ryen 1955
Mollusca: Bivalvia: Veneroidea: Cardiidae	<i>Cardita affinis</i> (Sowerby, 1833)	Hertlein & Strong 1946b
	<i>Lophocardium annettae</i> (Dall, 1889) as <i>Cardium annettae</i>	Hertlein & Strong 1947
	<i>Trigoniocardia guanacastense</i> (Hertlein & Strong, 1947) as <i>Cardium (Americardia) guanacastense</i>	Hertlein & Strong 1947
Mollusca: Bivalvia: Veneroidea: Donacidae	<i>Donax asper</i> Hanley, 1845	Hertlein & Strong 1949b
	<i>Donax assimilis</i> Hanley, 1845	Hertlein & Strong 1949b
	<i>Iphigenia altior</i> (Sowerby, 1833)	Hertlein & Strong 1949b
Mollusca: Bivalvia: Veneroidea: Lasaeidae	<i>Cymatinoa electilis</i> Berry, 1963	Skoglund 2001
	<i>Rochefortia compressa</i> Dall, 1913	Skoglund 2001
	<i>Solecardia eburnea</i> Conrad, 1849	Skoglund 2001
Mollusca: Bivalvia: Veneroidea: Psammobiidae	<i>Heterodonax bimaculata</i> Linnaeus, 1758	Hertlein & Strong 1950
Mollusca: Bivalvia: Veneroidea: Solecurtidae	<i>Tagelus (Tagelus) affinis</i> (Adams, 1852)	Hertlein & Strong 1950
	<i>Tagelus (Tagelus) californianus</i> (Conrad, 1837)	Hertlein & Strong 1950
	<i>Tagelus (Mesopleura) peruvianus</i> Pilsbry & Olsson, 1941	Hertlein & Strong 1950
	<i>Tagelus (Tagelus) violascens</i> Carpenter, 1857	Hertlein & Strong 1950
Mollusca: Bivalvia: Veneroidea: Tellinidae	<i>Tellina cumingii</i> Hanley, 1844 as <i>Tellina (Tellinella)</i> <i>cumingii</i>	Hertlein & Strong 1949a
	<i>Tellina laceridens</i> Hanley, 1844 as <i>Tellina</i> (<i>Eurytellina</i>) <i>laceridens</i>	Hertlein & Strong 1949a
	<i>Tellina simulans</i> Adams, 1852 as <i>Tellina</i> (<i>Eurytellina</i>) <i>simulans</i>	Hertlein & Strong 1949a
Mollusca: Bivalvia: Veneroidea: Ungulinidae	<i>Diplodonta sericata</i> (Reeve, 1850) as <i>Taras</i> <i>sericatus</i>	Hertlein & Strong 1947
	<i>Diplodonta subquadrata</i> (Carpenter, 1856) as <i>Taras</i> <i>subquadrata</i>	Hertlein & Strong 1947

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List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Mollusca: Bivalvia: Veneroidea: Veneridae	<i>Chione subimbricata</i> (Sowerby, 1835) as <i>Anomalocardia subimbricata</i>	Hertlein & Strong 1948
	<i>Chione subrugosa</i> (Wood, 1828) as <i>Anomalocardia subrugosa</i>	Hertlein & Strong 1948
	<i>Cyclinella subquadrata</i> (Hanley, 1845)	Hertlein & Strong 1948
	<i>Dosinia (Dosinidia) dunkeri</i> (Philippi, 1844)	Hertlein & Strong 1948
	<i>Megapitaria aurantiaca</i> (Sowerby, 1831)	Hertlein & Strong 1948
	<i>Megapitaria squalida</i> (Sowerby, 1835)	Hertlein & Strong 1948
	<i>Periglypta multicostata</i> (Sowerby, 1835) as <i>Antigona (Periglypta) multicostata</i>	Hertlein & Strong 1948
	<i>Pitar mexicanus</i> Hertlein & Strong, 1948	Hertlein & Strong 1948
	<i>Pitar unicolor</i> (Sowerby, 1835)	Hertlein & Strong 1948
	<i>Protothaca grata</i> (Say, 1830)	Hertlein & Strong 1948
<i>Ventricolaria isocardia</i> (Verrill, 1870) as <i>Antigona</i> (<i>Ventricola</i>) <i>isocardia</i>	Hertlein & Strong 1948	
Mollusca: Bivalvia: Ostreoida: Ostreidae	<i>Striostrea prismatica</i> (Gray, 1825) as <i>Ostrea</i> <i>iridescens</i>	Hertlein & Strong 1946a
Mollusca: Bivalvia: Pectinoidea: Pectinidae	<i>Nodipecten subnodosus</i> (Sowerby, 1833) as <i>Pecten</i> (<i>Lyropecten</i>) <i>subnodosus</i>	Hertlein & Strong 1946a
	<i>Argopecten irradians concentricus</i> (Say, 1822) as <i>Pecten (Plagioctenium) circularis</i>	Hertlein & Strong 1946a
	<i>Euvola vogdesi</i> (Arnold, 1906) as <i>Pecten (Pecten)</i> <i>vogdesi</i>	Hertlein & Strong 1946a
Mollusca: Bivalvia: Pectinoidea: Spondylidae	<i>Spondylus princeps</i> Broderip, 1833	Hertlein & Strong 1943
Mollusca: Bivalvia: Pterioidea: Pinnidae	<i>Pinna rugosa</i> (Sowerby, 1835)	Cortés 2001
	<i>Pinna</i> sp.	Dawson & Beaudette 1959
Mollusca: Bivalvia: Pterioidea: Pteriidae	<i>Pinctada mazatlanica</i> (Hanley, 1855)	Hertlein & Strong 1943
Mollusca: Gastropoda: Cephalaspidea: Bullidae	<i>Bulla punctulata</i> A. Adams in Sowerby, 1850	Valdés y Camacho-García 2004
	Mollusca: Gastropoda: Cephalaspidea: Cylichnidae	<i>Acteocina carinata</i> (Carpenter, 1857)
Mollusca: Gastropoda: Cephalaspidea: Cylichnidae	<i>Cylichnella tabogaensis</i> (Strong & Hertlein, 1939)	Valdés y Camacho-García 2004
Mollusca: Gastropoda: Cephalaspidea: Haminoeidae	<i>Atys defuncta</i> (Baker & Hanna, 1927)	Valdés y Camacho-García 2004
Mollusca: Gastropoda: Cephalaspidea: Retusidae	<i>Retusa paziana</i> Dall, 1919	Valdés y Camacho-García 2004

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List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Mollusca: Gastropoda: Cephalaspidea: Rhizoridae	<i>Volvulella cylindrica</i> (Carpenter, 1864)	Valdés y Camacho-García 2004
Mollusca: Gastropoda: Cephalaspidea: Rhizoridae	<i>Volvulella panamica</i> Dall, 1919	Valdés y Camacho-García 2004
Mollusca: Gastropoda: Littorinimorpha: Caecidae	<i>Caecum richthofeni</i> Strong & Hertlein, 1939	Skoglund 2002
	<i>Elephantulum mirificum</i> (de Folin, 1867)	Skoglund 2002
Mollusca: Gastropoda: Littorinimorpha: Littorinidae	<i>Echinolittorina fuscolineata</i> (Reid, 2002) as <i>Nodilittorina fuscolineata</i>	Reid 2002
Mollusca: Gastropoda: Littorinimorpha: Strombidae	<i>Strombus gracilior</i> G.B. Sowerby I, 1825	Cortés 2001
Mollusca: Gastropoda: Littorinimorpha: Tornidae	<i>Cyclostremiscus salvatierrensis</i> Herts, Myers & Gemmell, 1992	Skoglund 2002
Mollusca: Gastropoda: Neogastropoda: Columbelloidea	<i>Cotonopsis hirundo</i> (Gaskoin, 1852)	Jung 1989
	<i>Sincola dorsata</i> (Sowerby, 1832)	Jung 1989
	<i>Sincola gibberula</i> (Sowerby, 1832)	Jung 1989
	<i>Strombina elegans</i> (Sowerby, 1832)	Jung 1989
	<i>Strombina maculosa</i> (Sowerby, 1832)	Jung 1989
	<i>Strombina recurva</i> (Sowerby, 1832)	Jung 1989
Mollusca: Gastropoda: Neogastropoda: Conidae	<i>Conus archon</i> Broderip, 1833	Hanna & Strong 1949
	<i>Conus arcuatus</i> Broderip & Sowerby, 1829	Hanna & Strong 1949
	<i>Conus brunneus</i> Wood, 1828	Hanna & Strong 1949
	<i>Conus lucidus</i> Wood, 1828	Hanna & Strong 1949
	<i>Conus mahogani</i> Reeve, 1843	Hanna & Strong 1949
	<i>Conus nux</i> Broderip, 1833	Hanna & Strong 1949
	<i>Conus perplexus</i> Sowerby, 1857	Hanna & Strong 1949
	<i>Conus recurvus</i> Broderip, 1833	Hanna & Strong 1949
	<i>Conus regularis</i> Sowerby, 1833	Hanna & Strong 1949
	<i>Conus tiaratus</i> Sowerby, 1833	Hanna & Strong 1949
	<i>Strombinoturris crockeri</i> Hertlein & Strong, 1951	Hertlein & Strong 1951
Mollusca: Gastropoda: Neogastropoda: Fasciolaridae	<i>Pustulatirus hemphilli</i> (Hertlein & Strong, 1951) as <i>Latirus hemphilli</i>	Hertlein & Strong 1951
Mollusca: Gastropoda: Neogastropoda: Mitridae	<i>Mitra (Strigatella) tristis</i> Broderip, 1836	Cernohorsky 1976
Mollusca: Gastropoda: Neogastropoda: Muricidae	<i>Muricanthus ambiguus</i> (Reeve, 1845) as <i>Muricanthus callidinus</i>	Berry 1958
Mollusca: Gastropoda: Neogastropoda: Muricidae	<i>Thais brevidentata</i> (Wood, 1828) as <i>Acanthina brevidentata</i>	Madrigal-Castro <i>et al.</i> 1984, Gravel <i>et al.</i> 2006
Mollusca: Gastropoda: Neogastropoda: Terebridae	<i>Terebra</i> sp.	Dawson & Beaudette 1959

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Mollusca: Gastropoda: Neogastropoda: Turridae	<i>Crassispira coracina</i> McLean & Poorman, 1971	McLean & Poorman 1971
	<i>Crassispira ballenaensis</i> Hertlein & Strong, 1951 as <i>Crassispira turricula ballanaensis</i>	Hertlein & Strong 1951
Mollusca: Gastropoda Neotaenioglossa: Litiopidae	<i>Alaba supralirata</i> Carpenter, 1856	Cortés 2001
Mollusca: Gastropoda: Nudibranchia: Scyllaeidae	<i>Crosslandia daedali</i> Poorman & Mulliner, 1981	Ajtai <i>et al.</i> 2003
Arthropoda: Crustacea: Malacostraca: Amphipoda: Ampeliscidae	<i>Ampelisca pugetica</i> Stimpson, 1864	Barnard 1954
Arthropoda: Crustacea: Malacostraca: Amphipoda: Phoxocephalidae	<i>Foxiphalus golfensis</i> Barnard & Barnard, 1982	Barnard & Barnard 1982
Arthropoda: Crustacea: Malacostraca: Decapoda: Anomura: Diogenidae	<i>Paguristes digueti</i> Bouvier, 1893	Vargas & Cortés 2006
	<i>Trizopagurus magnificus</i> (Bouvier, 1898)	Vargas & Cortes 2006
Arthropoda: Crustacea: Malacostraca: Decapoda: Anomura: Paguridae	<i>Phimochirus californiensis</i> (Benedict, 1892)	McLaughlin 1981
Arthropoda: Crustacea: Malacostraca: Decapoda: Anomura: Porcellanidae	<i>Pachycheles biocellatus</i> (Lockington, 1878)	Haig 1960
	<i>Pachycheles spinidactylus</i> Haig, 1957	Haig 1960
	<i>Pachycheles vicarius</i> Nobili, 1901	Haig 1960
	<i>Petrolisthes armatus</i> (Gibbes, 1850)	Haig 1968
	<i>Petrolisthes edwardsii</i> (de Saussure, 1853)	Haig 1968
	<i>Petrolisthes glasselli</i> Haig, 1957	Haig 1960, 1968
	<i>Petrolisthes haigae</i> (Chace, 1962)	Haig 1968, Gore 1982
	<i>Petrolisthes hians</i> Nobili, 1901	Haig 1960, 1968
	<i>Petrolisthes ortmanni</i> Nobili, 1901	Haig 1960
	<i>Petrolisthes tonsorius</i> Haig, 1960	Haig 1960
	<i>Petrolisthes tridentatus</i> Stimpson, 1859	Haig 1960
	<i>Pisidia magdalenensis</i> (Glassell, 1936)	Haig 1960, 1968
	<i>Porcellana cancrisocialis</i> Glassell, 1936	Haig 1960, 1968
	<i>Porcellana paguriconviva</i> Glassell, 1936	Haig 1960, 1968
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Aethridae	<i>Hepatus kossmanni</i> Neumann, 1878	Rathbun 1937
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Calappidae	<i>Cryptosoma bairdii</i> (Stimpson, 1870) as <i>Cycloes bairdii</i>	Garth 1966
	<i>Calappa convexa</i> Saussure, 1853	Rathbun 1937

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Dairidae	<i>Daira americana</i> Stimpson, 1860	Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Dromiidae	<i>Hypoconcha panamensis</i> Smith, in Verrill, 1869	Rathbun 1937
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Epialtidae	<i>Herbstia pubescens</i> Stimpson, 1871 <i>Herbstia tumida</i> (Stimpson, 1871) <i>Microliassa aurivillium</i> (Rathbun, 1898) as <i>Lissa aurivillium</i> <i>Pitho picteti</i> (Saussure, 1856)	Garth 1958, 1959 Garth 1958 Garth 1958 Garth 1958
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Ethusidae	<i>Ethusa lata</i> Rathbun, 1894 <i>Ethusa panamensis</i> Finnegan, 1931 as <i>Ethusa mascarone panamensis</i>	Garth 1966 Rathbun 1937
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Gecarcinidae	<i>Gecarcinus lateralis</i> (Fréminville, 1835) as <i>Gecarcinus (Gecarcinus) lateralis quadratus</i> <i>Ucides occidentalis</i> (Ortmann, 1897)	Türkay 1970 Cabrera-Peña <i>et al.</i> 1994
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Grapsidae	<i>Geograpsus lividus</i> (H. Milne Edwards, 1837) <i>Goniopsis pulchra</i> (Lockington, 1877) <i>Grapsus grapsus</i> Linnaeus, 1758 <i>Pachygrapsus transversus</i> (Gibbes, 1850)	Crane 1947 Crane 1947 Crane 1947 Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Inachidae	<i>Eucinetops panamensis</i> Rathbun, 1923 <i>Ericerodes angulatus</i> (Finnegan, 1931) <i>Stenorhynchus debilis</i> (Smith, 1871)	Garth 1958 Garth 1958 Garth 1958, 1959
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Inachoididae	<i>Collodes tenuirostris</i> Rathbun, 1894 <i>Euprognatha bifida</i> Rathbun, 1894 <i>Inachoides laevis</i> Stimpson, 1870 <i>Paradasygyius depressus</i> (Bell, 1835)	Garth 1958 Garth 1958 Garth 1958 Garth 1958, 1959
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Leucosiidae	<i>Ebalia magdalenensis</i> Rathbun, 1933 <i>Iliacantha hancocki</i> Rathbun, 1935 <i>Lithadia cumingii</i> Bell, 1855 <i>Randallia agaricias</i> Rathbun, 1898 <i>Randallia bulligera</i> Rathbun, 1898 <i>Randallia minuta</i> Rathbun, 1935	Rathbun 1937 Rathbun 1937 Rathbun 1937 Rathbun 1937 Rathbun 1937 Garth 1966

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Majidae	<i>Ala cornuta</i> (Stimpson, 1860)	Garth 1958
	<i>Hemus finneganae</i> Garth, 1958	Garth 1958
	<i>Microphrys branchialis</i> Rathbun, 1898	Garth 1958
	<i>Mithraculus denticulatus</i> (Bell, 1835) as <i>Mitrax (Mitrax) denticulatus</i>	Garth 1958
	<i>Mithrax pygmaeus</i> Bell, 1835	Garth 1958
	<i>Stenocionops ovatus</i> (Bell, 1835)	Garth 1958
	<i>Teleophrys cristulipes</i> Stimpson, 1860	Garth 1958
	<i>Thoe panamensis</i> Nobili, 1901 as <i>Thoe sulcata panamensis</i>	Garth 1958
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Ocypodidae	<i>Ocypode gaudichaudii</i> H. Milne Edwards & Lucas, 1843	Crane 1941b
	<i>Ocypode occidentalis</i> Stimpson, 1860	Crane 1941b
	<i>Uca latimanus</i> (Rathbun, 1894)	Crane 1975
	<i>Uca panamensis</i> (Stimpson, 1859)	Crane 1941a, 1975
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Oziidae	<i>Ozius tenuidactylus</i> (Lockington, 1877)	Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Parthenopidae	<i>Celatopesia hassleri</i> (Rathbun, 1925) as <i>Cryptopodia hassleri</i>	Garth 1958
	<i>Daldorfia glasselli</i> (Garth, 1958) as <i>Thyrolambrus</i> <i>glasselli</i>	Garth 1958
	<i>Daldorfia trigona</i> (A. Milne-Edwards, 1869) as <i>Daldorfia garthi</i>	Garth 1959
	<i>Heterocrypta macrobrachia</i> Stimpson, 1871	Garth 1958
	<i>Ochtholambrus stimpsoni</i> (Garth, 1958) as <i>Pathenope (Pseudolambrus) stimpsoni</i>	Garth 1958
	<i>Solenolambrus arcuatus</i> Stimpson, 1891	Garth 1958
	<i>Eurypanopeus transversus</i> (Stimpson, 1860)	Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Panopeidae	<i>Eurytium tristani</i> Rathbun, 1906	Crane 1947
	<i>Hexapanopeus costaricensis</i> Garth, 1940	Garth 1940, 1961
	<i>Malacoplax californiensis</i> (Lockington, 1877) as <i>Speocarcinus californiensis</i>	Garth 1961, 1966
	<i>Panopeus chilensis</i> H. Milne-Edwards & Lucas, 1843	Crane 1947
	<i>Panopeus purpureus</i> Lockington, 1877	Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Pilumnidae	<i>Pilumnus pygmaeus</i> Boone, 1927	Crane 1947
	<i>Pilumnus xantusii</i> Stimpson, 1860	Crane 1947

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Portunidae	<i>Callinectes arcuatus</i> Ordway, 1863	Garth 1961, 1966
	<i>Cronius ruber</i> (Lamarck, 1818)	Garth 1961, 1966
	<i>Euphyllax robustus</i> Stimpson, 1860	Garth 1961, 1966
	<i>Portunus acuminatus</i> (Stimpson, 1871)	Garth 1961, 1966
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Raninidae	<i>Raninoides benedicti</i> Rathbun, 1935	Rathbun 1937
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Trapeziidae	<i>Trapezia bidentata</i> (Forskål, 1775) as <i>Trapezia ferruginea</i>	Crane 1947, Castro 1996
	<i>Trapezia corallina</i> Gerstaecker, 1857	Castro 1996
	<i>Trapezia formosa</i> Stimpson, 1869	Castro 1996
Arthropoda: Crustacea: Malacostraca: Decapoda: Brachyura: Xanthidae	<i>Edwardsium lobipes</i> (Rathbun, 1898) as <i>Medaeus lobipes</i>	Garth 1961, 1966
	<i>Heteractaea lunata</i> (Lucas in H. Milne Edwards & Lucas, 1844)	Crane 1947
	<i>Liomera cinctimana</i> (White, 1847)	Crane 1947
	<i>Microcassiope xantusii</i> (Stimpson, 1871)	Crane 1947
	<i>Platyactaea dovii</i> (Stimpson, 1871)	Crane 1947
Arthropoda: Crustacea: Malacostraca: Decapoda: Caridea: Alpheidae	<i>Alpheus cylindricus</i> Kingsley, 1878	Kim & Abele 1988
Arthropoda: Crustacea: Malacostraca: Decapoda: Caridea: Palaemonidae	<i>Macrobrachium tenellum</i> (Smith, 1871)	Wicksten 1983
	<i>Neopontonides henryvonprahli</i> Ramos, 1995	Wehrtmann & Vargas 2003
	<i>Periclimenes spinosus</i> Holthuis, 1951	Wicksten & Hendrickx 1992
	<i>Pontonia margarita</i> Smith, 1869	Cabrera-Peña & Solano-López 1996
	<i>Pontonia simplex</i> Holthuis, 1951	Wicksten & Hendrickx 1992
Arthropoda: Crustacea: Malacostraca: Decapoda: Caridea: Pandalidae	<i>Plesionika mexicana</i> Chace, 1937	Hendrickx & Wicksten 1989
Arthropoda: Crustacea: Malacostraca: Isopoda: Cirolanidae	<i>Excirrolana braziliensis</i> Richardson, 1912	Brusca & Iverson 1985
Arthropoda: Crustacea: Malacostraca: Stomatopoda: Gonodactylidae	<i>Neogonodactylus bahiahondensis</i> (Schmitt, 1940) in lit <i>Gonodactylus bahiahondensis</i>	Schmitt 1940, Manning 1971
	<i>Neogonodactylus lalibertadensis</i> (Schmitt, 1940) as <i>Gonodactylus lalibertadensis</i>	Manning 1971, 1974
Arthropoda: Crustacea: Malacostraca: Stomatopoda: Squillidae	<i>Meiosquilla dawsoni</i> Manning, 1970	Manning 1971, 1974
	<i>Squilla parva</i> Bigelow, 1891	Manning 1971
Arthropoda: Crustacea: Maxillopoda: Calanoida: Acartiidae	<i>Acartia lilljeborgii</i> Giesbrecht, 1889	Bednarski & Morales-Ramírez 2004
	<i>Acartia tonsa</i> Dana, 1849	Bednarski & Morales-Ramírez 2004

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Calanidae	<i>Canthocalanus pauper</i> (Giesbrecht, 1888)	Bednarski & Morales-Ramírez 2004
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Caligidae	<i>Caligus chorinemi</i> Kroyer, 1863 <i>Neocalanus gracilis</i> (Dana, 1852) <i>Undinula vulgaris</i> (Dana, 1849)	Wilson 1937 Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Calocalanidae	<i>Calocalanus</i> spp.	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Candaciidae	<i>Candacia catula</i> (Giesbrecht, 1888) <i>Candacia pachydactyla</i> (Dana, 1849)	Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Centropagidae	<i>Centropages furcatus</i> Dana, 1849 <i>Centropages longicornis</i> Mori, 1932	Bednarski & Morales-Ramírez 2004 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Clausocalanidae	<i>Clausocalanus arcuicornis</i> (Dana, 1849)	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Eucalanidae	<i>Eucalanus elongatus</i> (Dana, 1848) <i>Pareucalanus attenuatus</i> (Dana, 1849) as <i>Eucalanus attenuates</i>	Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Euchaetidae	<i>Euchaeta indica</i> Wolfenden, 1905 as <i>Euchaeta wolfendeni</i> <i>Paraeuchaeta longicornis</i> (Giesbrecht, 1888) as <i>Euchaeta longicornis</i>	Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Lucicutiidae	<i>Lucicutia flavicornis</i> (Claus, 1863)	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Paracalanidae	<i>Acrocalanus longicornis</i> Giesbrecht, 1888 <i>Paracalanus parvus</i> (Claus, 1863)	Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Pontellidae	<i>Labidocera acuta</i> (Dana, 1849) <i>Pontellina plumata</i> (Dana, 1849)	Bednarski 2001 Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Pseudodiaptomidae	<i>Pseudodiaptomus wrighti</i> Johnson, 1964	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Scolecitrichidae	<i>Scolecitrichella bradyi</i> (Giesbrecht, 1888)	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Temoridae	<i>Temora discaudata</i> Giesbrecht, 1889	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Rhincalanidae	<i>Rhincalanus</i> spp.	Bednarski 2001

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Arthropoda: Crustacea: Maxillopoda: Calanoidea: Subeucalanidae	<i>Subeucalanus subcrassus</i> (Giesbrecht, 1888)	Bednarski 2001
	<i>Subeucalanus subtenuis</i> (Giesbrecht, 1888) as <i>Eucalanus subtenuis</i>	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Cyclopoida: Oithonidae	<i>Oithona plumifera</i> Baird, 1843	Bednarski & Morales-Ramírez 2004
	<i>Oithona setigera</i> Dana, 1852	Bednarski 2001
	<i>Oithona similis</i> Claus, 1866	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Mostrilloidea: Monstrillidae	<i>Cymbasoma concepcionae</i> Suárez-Morales & Morales-Ramírez, 2003	Suárez-Morales & Morales-Ramírez 2003
Arthropoda: Crustacea: Maxillopoda: Poecilostomatoidea: Clausidiidae	<i>Saphirella tropica</i> Wolfenden, 1906	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Poecilostomatoidea: Corycaidae	<i>Corycaeus ovalis</i> Claus, 1863	Bednarski 2001
	<i>Ditrichocorycaeus brehmi</i> (Steuer, 1910) as <i>Corycaeus brehmi</i>	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Poecilostomatoidea: Oncaeidae	<i>Oncaea mediterranea</i> (Claus, 1863)	Bednarski 2001
	<i>Oncaea venusta</i> Philippi, 1843	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Poecilostomatoidea: Sapphirinidae	<i>Copilia mirabilis</i> Dana, 1852	Bednarski 2001
	<i>Sapphirina opalina</i> Dana, 1849	Bednarski 2001
	<i>Sapphirina ovatolanceolata</i> Dana, 1849	Bednarski 2001
	<i>Sapphirina scarlata</i> Giesbrecht, 1891	Bednarski 2001
Arthropoda: Crustacea: Maxillopoda: Sessilia: Balanidae	<i>Balanus masignotus</i> Henry & McLaughlin, 1967	Henry & McLaughlin 1967
	<i>Balanus mexicanus</i> Henry, 1941 as <i>Balanus</i> <i>concaus mexicanus</i>	Henry & McLaughlin 1975
	<i>Balanus trigonus</i> Darwin, 1864	Henry & McLaughlin 1975
Arthropoda: Crustacea: Maxillopoda: Siphonostomatoidea: Lernanthropidae	<i>Lernanthropus micropterygis</i> Richiardi, 1884	Wilson 1937
Arthropoda: Crustacea: Branchiopoda: Diplostraca: Cladocera	Unidentified species	Bednarski & Morales-Ramírez 2004
Arthropoda: Crustacea: Ostracoda	Unidentified species	Bednarski & Morales-Ramírez 2004
Arthropoda: Chelicerata: Pycnogonida: Pantopoda: Phoxichilidiidae	<i>Anoplodactylus</i> especies indeterminada	Childs 1979
Bryozoa: Gymnolaemata: Cheilostomatida: Beaniidae	<i>Beania hirtissima</i> (Heller, 1867)	Osburn 1950
Bryozoa: Gymnolaemata: Cheilostomatida: Buffonellodidae	<i>Aimulosia uvulifera</i> (Osburn, 1914)	Osburn 1952

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List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Bryozoa: Gymnolaemata: Cheilostomatida: Bryocryptellidae	<i>Porella porifera</i> (Hincks, 1884)	Osburn 1952
Bryozoa: Gymnolaemata: Cheilostomatida: Mamilloporidae	<i>Mamillopora cupula</i> Smitt, 1873	Osburn 1952
Bryozoa: Gymnolaemata: Cheilostomatida: Membraniporidae	<i>Biflustra savartii</i> (Audouin, 1826) as <i>Membranipora savarti</i>	Osburn 1950
Bryozoa: Gymnolaemata: Cheilostomatida: Microporellidae	<i>Microporella gibbosa</i> Canu & Bassler, 1930	Osburn 1952
Bryozoa: Gymnolaemata: Cheilostomatida: Petraliidae	<i>Petralia japonica</i> (Busk, 1884)	Osburn 1952
Bryozoa: Gymnolaemata: Cheilostomatida: Schizoporellidae	<i>Hippodiplosia americana</i> (Verrill, 1875)	Osburn 1952
Bryozoa: Gymnolaemata: Ctenostomatida: Vesiculariidae	<i>Amathia convoluta</i> (Lamarck, 1816)	Osburn & Soule 1953
Echinodermata: Ophiuroidea: Ophiurida: Ophiolepididae	<i>Ophiolepis plateia</i> Ziesenhenné, 1940	Ziesenhenné 1940
Echinodermata: Asteroidea: Paxillosida: Astropectinidae	<i>Astropecten armatus</i> Gray, 1840	Clark 1940
Echinodermata: Echinoidea: Cidaroida: Cidaridae	<i>Eucidaris thourasii</i> (Valenciennes, 1846)	Jiménez 1998
Echinodermata: Echinoidea: Clypeasteroida: Mellitidae	? <i>Encope irregularis</i> Clark, 1948	Clark 1948
Echinodermata: Echinoidea: Diadematoidea: Diadematidae	<i>Astropyga pulvinata</i> (Lamarck, 1816) <i>Diadema mexicaum</i> A. Agassiz, 1863	Alvarado 2008 Jiménez 1998
Echinodermata: Echinoidea: Temnopleuroidea: Toxopneustidae	<i>Toxopneustes roseus</i> (A. Agassiz, 1863)	Clark 1948
Echinodermata: Holothuroidea: Aspidochirota: Holothuriidae	<i>Holothuria (Platyperona) difficilis</i> Semper, 1868 as <i>Microthele difficilis</i> <i>Holothuria (Selenkothuria)</i> Deichmann, 1958 as <i>Selenkothuria lubrica</i> <i>Holothuria (Thymiosyca) impatiens</i> (Forskål, 1775) as <i>Brandtothuria impatiens</i> <i>Labidodemas maccullochi</i> (Deichmann, 1958) as <i>Irenothuria macculloch</i>	Deichmann 1958 Deichmann 1958 Deichmann 1958 Deichmann 1958
Chaetognatha: Sagittoidea: Sagittoidea: Sagittidae	Unidentified species	Bednarski & Morales-Ramírez 2004
Chordata: Appendicularia: Copelata: Oikopleuridae	<i>Oikopleura fusiformis</i> Fol, 1872 <i>Oikopleura longicauda</i> (Vogt, 1854) <i>Oikopleura rufescens</i> Fol, 1872	Castellanos <i>et al.</i> 2009 Castellanos <i>et al.</i> 2009 Castellanos <i>et al.</i> 2009

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Chordata: Appendicularia: Copelata: Fritillariidae	<i>Fritillaria haplostoma</i> Fol, 1872	Castellanos <i>et al.</i> 2009
Chordata: Thaliacea: Salpida: Salpidae	Unidentified species	Bednarski & Morales-Ramírez 2004
Chordata: Chondrichthyes: Orectolobiformes: Ginglymostomatidae	<i>Ginglymostoma cirratum</i> (Bonnaterre, 1788)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Chondrichthyes: Rajiformes: Dasyatidae	<i>Himantura pacifica</i> (Beebe & Tee-Van, 1941)	Marques <i>et al.</i> 1996
Chordata: Chondrichthyes: Rajiformes: Myliobatidae	<i>Aetobatus narinari</i> (Euphrasen, 1790)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Albuliformes: Albulidae	<i>Albula pacifica</i> (Beebe, 1942) as <i>Dixonina pacifica</i>	Beebe 1942, Pfeiler 2008
Chordata: Actinopterygii: Anguilliformes: Muraenidae	<i>Gymnomuraena zebra</i> (Shaw, 1797) <i>Gymnothorax castaneus</i> (Jordan & Gilbert, 1883) <i>Muraena lentiginosa</i> Jenyns, 1842	Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Beryciformes: Holocentridae	<i>Myripristis</i> sp. <i>Sargocentron suborbitalis</i> (Gill, 1863)	Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Syngnathiformes: Fistulariidae	<i>Fistularia commersonii</i> Rüppell, 1838	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Syngnathiformes: Syngnathidae	<i>Hippocampus ingens</i> Girard, 1858	Bussing & López 2009
Chordata: Actinopterygii: Perciformes: Acanthuridae	<i>Prionurus laticlavus</i> (Valenciennes, 1846)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Apogonidae	<i>Apogon dovii</i> Günther, 1862 <i>Apogon pacificus</i> (Herre, 1935) as <i>Apogon pacifici</i>	Alvarado 2008 Alvarado 2008
Chordata: Actinopterygii: Perciformes: Blenniidae	<i>Ophioblennius steindachneri</i> Jordan & Evermann, 1898 <i>Plagiotremus azaleus</i> (Jordan & Bollman, 1890)	Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Carangidae	<i>Caranx caballus</i> Günther, 1868 <i>Caranx sexfasciatus</i> Quoy & Gaimard, 1825 as <i>Caranx marginatus</i> <i>Seriola lalandi</i> Valenciennes, 1833 as <i>Seriola dorsalis</i> <i>Seriola rivoliana</i> Valenciennes, 1833	Manter 1940 Manter 1940 Wilson 1937 Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Chaetodontidae	<i>Chaetodon humeralis</i> Günther, 1860 <i>Johnrandallia nigrirostri</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Cirrhitidae	<i>Cirrhitichthys oxycephalus</i> (Bleeker, 1855) <i>Cirrhitus rivulatus</i> Valenciennes, 1846	Dominici-Arosemena <i>et al.</i> 2005 Dominici-Arosemena <i>et al.</i> 2005

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Chordata: Actinopterygii: Perciformes: Ehippidae	<i>Chaetodipterus zonatus</i> (Girard, 1858)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Haemulidae	<i>Anisotremus taeniatus</i> Gill, 1861	Dominici-Arosemena <i>et al.</i> 2005
	<i>Haemulon flaviguttatum</i> Gill, 1862	Dominici-Arosemena <i>et al.</i> 2005
	<i>Haemulon maculicauda</i> (Gill, 1862)	Pérez-Ponce de León <i>et al.</i> 1998
	<i>Haemulon scudderii</i> Gill, 1862	Dominici-Arosemena <i>et al.</i> 2005
	<i>Haemulon sexfasciatum</i> Gill, 1862	Dominici-Arosemena <i>et al.</i> 2005
	<i>Haemulon steindachneri</i> (Jordan & Gilbert, 1882)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Kyphosidae	<i>Kyphosus analogus</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Kyphosus elegans</i> (Peters, 1869)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Sectator ocyurus</i> (Jordan & Gilbert, 1882)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Labridae	<i>Bodianus diplotaenia</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Halichoeres chierchiai</i> Di Caporiacco, 1948	Dominici-Arosemena <i>et al.</i> 2005
	<i>Halichoeres dispilus</i> (Günther, 1864)	Dominici-Arosemena <i>et al.</i> 2005, Alvarado 2008
	<i>Halichoeres melanotis</i> (Gilbert, 1890)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Halichoeres nicholsi</i> (Jordan & Gilbert, 1882)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Halichoeres notospilus</i> (Günther, 1864)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Novaculichthys taeniourus</i> (Lacepède, 1801)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Thalassoma lucasanum</i> (Gill, 1862)	Alpermann 2001
	<i>Xyrichtys victori</i> Wellington, 1992	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Lutjanidae	<i>Lutjanus argentiventris</i> (Peters, 1869)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Lutjanus guttatus</i> (Steindachner, 1869)	Alvarado 2008
Chordata: Actinopterygii: Perciformes: Malacanthidae	<i>Malacanthus brevirostris</i> Guichenot, 1848	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Pomacanthidae	<i>Holacanthus passer</i> Valenciennes, 1846	Dominici-Arosemena <i>et al.</i> 2005
	<i>Pomacanthus zonipectus</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005, Alvarado 2008
Chordata: Actinopterygii: Perciformes: Pomacentridae	<i>Abudefduf troschelii</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Chromis atrilobata</i> Gill, 1862	Dominici-Arosemena <i>et al.</i> 2005
	<i>Microspathodon bairdii</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Microspathodon dorsalis</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Stegastes acapulcoensis</i> (Fowler, 1944)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Stegastes flavilatus</i> (Gill, 1862)	Dominici-Arosemena <i>et al.</i> 2005

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Chordata: Actinopterygii: Perciformes: Scaridae	<i>Nicholsina denticulata</i> (Evermann & Radcliffe, 1917)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Scarus compressus</i> (Osburn & Nichols, 1916)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Scarus ghobban</i> Forsskål, 1775	Dominici-Arosemena <i>et al.</i> 2005
	<i>Scarus perrico</i> Jordan & Gilbert, 1882	Dominici-Arosemena <i>et al.</i> 2005
	<i>Scarus rubroviolaceus</i> Bleeker, 1847	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Sciaenidae	<i>Odontoscion xanthops</i> Gilbert, 1898	Dominici-Arosemena <i>et al.</i> 2005
	<i>Pareques viola</i> (Gilbert, 1898)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Scombridae	<i>Scomberomorus sierra</i> Jordan & Starks, 1895	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Perciformes: Serranidae	<i>Alphestes immaculatus</i> Breder, 1936	Dominici-Arosemena <i>et al.</i> 2005
	<i>Alphestes multiguttatus</i> (Günther, 1867)	Alvarado 2008
	<i>Cephalopholis panamensis</i> (Steindachner, 1877)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Dermatolepis dermatolepis</i> (Boulenger, 1895)	Alvarado, 2008
	<i>Epinephelus labriformis</i> (Jenyns, 1840)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Hyporthodus acanthistius</i> (Gilbert, 1892) as <i>Epinephelus acanthistius</i>	Dominici-Arosemena <i>et al.</i> 2005
	<i>Paranthias colonus</i> (Valenciennes, 1846)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Rypticus bicolor</i> Valenciennes, 1846	Dominici-Arosemena <i>et al.</i> 2005
	<i>Serranus psittacinus</i> Valenciennes, 1846	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Syngnathiformes: Syngnathidae	<i>Cosmocampus arctus coccineus</i> (Herald, 1940) as <i>Bryx (Simocampus) coccineus</i>	Fritzsche 1980
Chordata: Actinopterygii: Tetraodontiformes: Balistidae	<i>Balistes polylepis</i> Steindachner, 1876	Dominici-Arosemena <i>et al.</i> 2005
	<i>Melichthys niger</i> (Bloch, 1786)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Pseudobalistes naufragium</i> (Jordan & Starks, 1895)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Sufflamen verres</i> (Gilbert & Starks, 1904)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Tetraodontiformes: Diodontidae	<i>Diodon holocanthus</i> Linnaeus, 1758	Dominici-Arosemena <i>et al.</i> 2005
	<i>Diodon hystrix</i> Linnaeus, 1758	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Tetraodontiformes: Monacanthidae	<i>Aluterus scriptus</i> (Osbeck, 1765)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Tetraodontiformes: Ostraciidae	<i>Ostracion meleagris</i> Shaw, 1796	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Actinopterygii: Tetraodontiformes: Tetraodontidae	<i>Arothron hispidus</i> (Linnaeus, 1758)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Arothron meleagris</i> (Anonymous, 1798)	Dominici-Arosemena <i>et al.</i> 2005
	<i>Canthigaster punctatissima</i> (Günther, 1870)	Dominici-Arosemena <i>et al.</i> 2005
Chordata: Reptilia: Squamata: Elapidae	<i>Pelamis platurus</i> (Linnaeus, 1766)	Taylor 1953, Tu 1976
Chordata: Mammalia: Cetacea: Balaenopteridae	<i>Megaptera novaeangliae</i> Borowski, 1781	May-Collado 2009

TABLE 1 (Continued)
List of marine species reported in the literature for Bahía Culebra, Guanacaste, Costa Rica

Classification: Phylum (Subphylum): Class: Order (Infraorder): Family	Species	References
Chordata: Mammalia: Cetacea: Delphinidae	<i>Stenella attenuata</i> Gray, 1846	Rodríguez-Sáenz & Rodríguez-Fonseca 2004
	<i>Stenella attenuata graffmani</i> Lönnberg, 1934	May-Collado & Morales-Ramírez 2005
	<i>Steno bredanensis</i> Lesson, 1828	May-Collado <i>et al.</i> 2005

as = As reported in the original publication.

? = Doubtful record.

a = species reported by Crouch & Poag (1987) but not found in any database.

TABLE 2
Number species per taxonomic group

Taxa	Number of species	Taxa	Number of species
Cyanobacteria	5	Annelida	4
Bacillariophyta	3	Sipunculida	2
Dinoflagellata	14	Mollusca	93
Chlorophyta	10	Bivalvia	55
Rhodophyta	28	Gastropoda	38
Ochrophyta	6	Crustacea	147
Magnoliophyta	5	Malacostraca	101
Protozoa: Foraminifera	33	Decapoda	94
Cnidaria	100	Maxillopoda	44
Anthozoa	23	Other Crustacea	2
Scyphozoa	2	Pycnogonida	1
Hydrozoa	75	Bryozoa	9
Ctenophora	1	Echinodermata	11
Plathyhelminthes	9	Chaetognatha	1
Acanthocephala	2	Chordata	92
Nematoda	1	Fishes	82
TOTAL 577			

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