
Revision of the Nassariidae (Gastropoda, Neogastropoda) of the malacological collection of the Museu de Ciències Naturals de Barcelona

C. Gili

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Abstract

Revision of the Nassariidae (Gastropoda, Neogastropoda) of the malacological collection of the Museu de Ciències Naturals de Barcelona.— The entire set of samples of the Nassariidae integrated in the malacological collection of the Museu de Ciències Naturals de Barcelona has been reviewed. For all the samples, the number of individuals has been counted, each shell has been revised individually, and the taxonomic determination has been corrected in those cases in which it seemed justified, updating the nomenclature. For those samples containing a mixture of different species, new samples have been created so that each sample contained a single species. Regardless of the annotated in the original labels, one biogeographical region has been assigned to each sample. Finally, the Nassariidae collection has been valued as a whole regarding the number of samples, the number of species and its geographical distribution.

Key words: Nassariidae, Taxonomic revision, Biogeography

Resumen

Revisión de los Nassariidae (Gastropoda, Neogastropoda) de la colección malacológica del Museu de Ciències Naturals de Barcelona.— Se ha revisado el conjunto de muestras de Nassariidae integradas en la colección malacológica del Museu de Ciències Naturals de Barcelona. Se han analizado individualmente los ejemplares de cada muestra, se han contado y se ha corregido la determinación taxonómica en aquellos casos en los que ha parecido justificado, actualizándose la nomenclatura. En aquellas muestras que contenían una mezcla de especies distintas, se han creado nuevas muestras, de manera que cada una de ellas contenga un único taxón. Con independencia de la anotación existente en las etiquetas originales, a cada muestra se le ha asignado una región biogeográfica. Finalmente, se ha valorado el conjunto de la colección de Nassariidae con relación al número de muestras, al número de especies y a la distribución geográfica de las mismas.

Palabras clave: Nassariidae, Revisión taxonómica, Biogeografía

Resum

Revisió dels Nassariidae (Gastropoda, Neogastropoda) de la col·lecció malacològica del Museu de Ciències Naturals de Barcelona.— S'ha revisat el conjunt de mostres de Nassariidae integrades a la col·lecció malacològica del Museu de Ciències Naturals de Barcelona. S'han analitzat individualment els exemplars de cada mostra, s'han comptat i se n'ha corregit la determinació taxonòmica i actualitzat la nomenclatura en aquells casos en què ha semblat justificat. En aquelles mostres que contien una barreja d'espècies diferents, s'han creat noves mostres, de manera que cadascuna contingui un sol taxó. Amb independència de l'anotació existent a les etiquetes originals, s'ha assignat una regió biogeogràfica a cada mostra. Finalment, s'ha valorat el conjunt de la col·lecció de Nassariidae amb relació al nombre de mostres, al nombre d'espècies i a la distribució geogràfica d'aquestes.

Paraules clau: Nassariidae, Revisió taxonòmica, Biogeografia

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Carles Gili, Dept. d'Estratigrafia, Paleontologia i Geociències Marines, Fac. de Geologia, Univ. de Barcelona, c/ Martí i Franqués s/n., 08028 Barcelona, Espanya (Spain).

E-mail: nassariusgili@gmail.com

Introduction

The malacological collection of the *Museu de Ciències Naturals de Barcelona* was created at the same time as the museum. The promoters were molluscan shell collectors, thus establishing the initial malacological fund of the institution. Other legacies from collectors or other entities were added during the early periods of the Museum functioning and successively. As for the marine molluscs, they are highlighted those of Francesc Martorell, who donated the foundational funds for creating the museum, Joan Rosals, Baltasar Serradell, Artur Bofill, Manuel Chia and Joan-Baptista d'Aguilar-Amat as numerous collections.

During this period, exchanges and probably acquisitions were performed through contacts with certain European malacologists and from other places. Moreover, it was observed certain collection campaign that was promoted by the Museum; usually near the coastal areas. However, it was not observed any material from scientific expeditions of naturalist prospecting in far seas unlike in other museums as those in Madrid, Paris or London. Nevertheless, numerous samples have been gathered until forming the whole malacological collection found currently. Since the beginning, this approach has determined the composition and structure of the collection.

The Museum activity was significantly diminished during the long post-war period (from 1939 to the 1970s), and although considerable performances on the malacological collection were attained, such as rearrangements, taxonomic reviews, changes in the procedure of the specimens display, etc., the contributions were scarcer. It was not until the last decades of the 20th century when significant legacies were added to the collection, especially those of Lluís Gasull and Joan Rosal, encouraging somehow the beginning of cataloguing of the entire malacological collection and the computerization of its contents. This work was continued for years according to the staff's availability at every stage.

Currently, this work is achieved, the consulting and access to the collection contents is precise and rapid, and the new contributions are perfectly integrated. It was at this point when the author was especially interested to initiate the review on the Nassariidae family presented below.

This review has allowed, as a first impact, publishing descriptions of two new species of the genus *Nassarius* (Gili, 2015).

Material and methods

The preliminary point was the selection of samples containing the Nassariidae through the database screening of the entire malacological collection of the Museum. Each sample has been studied by reviewing its contents. The number of specimens was counted and each one was individually observed with the aid of stereomicroscope when required.

In each sample, the specific determination of its label was assessed and modified if needed. In this aspect, the Cernohorsky works (1975, 1981 and particularly 1984) were taken as initially guide, but also using subsequent works and reviews listed in annex 1.

For those cases containing specimens of two or more species, new registered lots were created so that each sample contained a single species. Some forms which are currently considered as different species, but at the time were deemed as a single species, or simple varieties of a species, were segregated. In other cases, the specimens that have been segregated in new samples were different species that moreover were from different geographical regions. The same procedure was performed on those specimens that did not belong to the Nassariidae family but were mixed together. For each sample, it was recorded the specimen's morphologic features or colour pattern as well as its state of preservation.

In order to assess the contents of the collection regarding the different geographical sources, each sample was assigned to one of the biogeographical regions commonly used in marine malacology (annex 2). This was performed if the source was specified or not. When the source was deemed to be erroneous, it was assigned to the biogeographical region where the species is really located. In certain cases, owing to its uncertain source, there was certain ambiguity for designating the sample to a single region, therefore sorting those localities where it probably exists.

The scientific nomenclature of the species has been updated, and indicating the full name of the genus, as well as the complete name of the author and the year of publication, following the standards, recommendations and current trends within this field. Generally, in this review, the names of the varieties were not preserved or considered. Special caution has been devoted to the taxonomic identification from labels printed with the name *Museo de Biología de Barcelona*. In this context, it is quite common to read apparent subspecific names that in fact are only varietal forms that did not meet the biological concept of subspecies. The current practice in taxonomy eliminates such subspecific levels. However, certain subspecies that are properly described and assigned to their corresponding geographic regions were considered.

No subgeneric division was used, since in the Nassariidae family it has not been reached any satisfactory subgeneric subdivision scheme with a minimum of ambiguity and a maximum of consensus.

In the taxonomic determination, it was always intended to reach to the species. In spite of the state of preservation of the specimens in certain samples did not permit it without any significant risk of error. In these cases, the open nomenclature (Bengtson, 1988) was applied but avoiding misuse of the particle 'sp.', which did not provide any information on which species the author had focused on, which forms he questioned or with which morphologies he carried out the comparison. Whereas, the use of the particle 'cf.', to indicate the resemblance of a doubtful form to a certain species, provides further information. Regarding the species names and years of publication, an aspect entailing certain discrepancies among the authors, the criterion of Cernohorsky (1984) was mainly followed.

All the collected information was entered into a datasheet and processed in order to describe thoroughly the collection. The resulting report and associated inventory have been put in hands of technical staff of the Department of Non-Arthropod Invertebrates of the *Museu de Ciències Naturals de Barcelona*.

Many specimens of several samples were measured for a better knowledge and characterization of the species; moreover, pictures of several specimens were taken.

Results and discussion

As a first result of the review performed, the number of studied samples is detailed in table 1 and the taxonomic distribution of the species in table 2.

The overall number of living Nassariidae species is not definitively established. The assessment of the validity of certain forms differs according to the authors; some identified them as 'valid species', whereas others considered them synonyms. On the other hand,

Table 1. Summary of the number of studied samples.
Tabla 1. Resumen del número de muestras estudiadas.

Samples	No
Number of studied samples	1,298
Excluded samples for not containing Nassariidae	15
Samples containing Nassariidae	1,283
Samples of Nassariidae added or split, because the original sample had miscellaneous species	179
Final samples of Nassariidae	1,462
Number of identified Nassariidae species	126–128
Overall Nassariidae specimens reviewed:	
Shells	15,625
Operculums	36

Table 2. Taxonomic distribution of the species.
Tabla 2. Distribución taxonómica de las especies.

Family		
Subfamily	Species	No species
Nassariidae Iredale, 1916		
Dorsaninae Cossmann, 1901	<i>Buccinanops</i> d'Orbigny, 1841	6
	<i>Buccinanops</i> sp.	1
	<i>Bullia</i> Gray in Griffith & Pidgeon, 1834	11
	<i>Bullia</i> sp.	1
Nassariinae Iredale, 1916	<i>Cyclope</i> Risso, 1826	2
	<i>Demoulia</i> Gray, 1838	1
	<i>Hebra</i> H. & A. Adams, 1853	3
	<i>Nassarius</i> Duméril, 1806	103
	<i>Nassarius</i> sp.	1
Cylleninae Bellardi, 1882		0

new species are regularly described while exploring poorly sampled places, or studying thoroughly certain groups. Cernohorsky (1984) considered there would be about 319 valid species. However, since that period, certain names that Cernohorsky (1984) considered as synonyms have been established as valid species, and they have been described more than twenty new species. Therefore, it does not seem very bold to consider that the number of species of such family is about 360 currently.

From this viewpoint, the overall number of Nassariidae species identified in the collection of the Museu is not considered very significant; about 1/3 of the whole existing, approximately. However, from the qualitative perspective, there are taxonomically interesting forms regarding their size, colouring, ornamentation, or their variability; or because they enabled us a direct assessment of the entity of certain synonyms and the identification of new species.

Characteristics of the collection

The Nassariidae collection is mainly formed by empty shells deriving from living animals or dead collected shells, although a certain proportion had remnants of the soft tissue and occasionally preserving the operculum. Just a pair of samples included operculums without shells exclusively.

An outstanding fact is the presence of the types of two species, *Nassarius absconditus* Gili, 2015 (holotype and two paratypes) and *Nassarius rainbowae* Gili, 2015 (holotype), based on the material of the collection.

The materials state of preservation is rather varied; from complete shells, preserving their original colour, to very discoloured and damaged shells. The specimens were not preserved for their conchological aesthetic 'perfection', but with the criterion of establishing their source locality for enabling the scientific study. Thus, in many samples it is preserved a large number of material without prioritizing its condition, or a single or few specimens although their shells are rather impaired. It is not always relied on the presence of the protoconch, therefore in certain cases, it may hinder the specific determination of the material. Discolouration is due to sun exposure in those cases where the shells were collected on the beach, or have been kept under aggressive conditions for the pigments or shell material, in other cases.

Another important fact to note is that most of the original labels of the sample were preserved including those with nomenclature modifications or other type that might have been added overtime. On the other hand, the information of such labels is rather limited regarding the precise geographical locality that sometimes is not recorded, as the dates of the collection, data concerning the habitat, or methods of obtaining. Certain collectors specified the dates although the majority omitted them; concerning the habitat (depth, type of community, nature of bottom, accompanying species, etc.) just few samples included certain indication; and the method of collection was not specified in any sample.

As for the geographical locality, it is quite generic, indicating the name of a country or a province, a sea or an ocean. However, in some samples there is a significant ambiguity regarding such aspect. In some cases, the label indicates a locality but the specimens belong to a species never cited in such area. In other samples that contain a single specimen, there are two or more labels with different geographical localities. On the other hand, there are samples with two specimens of different species deriving from different regions with just one geographic locality on the label (see annex 3 for more details on uncertain geographic origins).

As specified above, the limitations indicated are the result of how the collection was formed and the vicissitudes endured overtime; the former collecting was not cultivated in such aspects and perhaps the staff who handled the collection lacked training and, as for the malacological trading, it is unusual to consider such significant facts for the scientific study.

Considering the above stated, the Nassariidae of the Museum's collection has mainly a taxonomic utility. As in some Mediterranean species there are a significant number of specimens, therefore in such cases, they could be used for studies of population and of

variability. Perhaps they may have certain significant historical viewpoint thus allowing us to study the changes endured by the populations of certain species, mainly those concerning our geographical area, or to verify their longevity or disappearance. It should be considered that many of the samples were collected about 100 years ago and during such period, the changes and transformations occurred in many places have been significant or drastic.

Previous reviews of the collection

During the study period, it was detected that several actions were performed on the original samples, such as modifications in the determinations of the species, grouping and subdivision of samples, etc.

Modifications in the species nomenclature were detected from the several labels that were added to the original ones. In many of the cases, it was not an exact transcription of the original, but a taxonomic interpretation of the sample's contents or an adjustment of the nomenclature according to the trends of that time, and frequently adding the name of variety. Owing to that many samples had an identification number of the initial collection, and these numbers were preserved in the new labels, it was able to detect the division of some original samples into two or more samples (see annex 4).

At some point, several samples had been grouped into a single one, occasionally, from different geographical sources. This has been detected because some of the samples had several original labels of one collection, or from different collections, with different specific names but were considered as synonyms (see annex 4).

In some cases, it has been detected the simultaneous exclusions and groupings of several samples. This was observed in those cases where it was intended to distribute the specimens of a species of various collections in new homogeneous samples regarding the varieties of species under consideration (see annex 5).

In some samples, there is indication that it was the author of a specific review, since there was an added label with his name.

Distribution of the samples by biogeographic regions

The following table (table 3) shows the number of samples assigned to each of the malacological regions considered. In annex 2 the concrete geographic space included in these regions is given.

As perceived in table 3, the samples distribution according to the region is rather uneven and is not related with the number of species identified in each of them. The Lusitanian region (region 3) accumulates more than 71% (71.08) of overall samples and, within this region, samples of the Mediterranean province (3a) represent 61.20% of the whole. On the other hand, the Indo–Pacific region (region 6), the second with largest number of samples, accumulates almost only 19% (18.84). In contrast, the number of Nassariidae species living in the Indo–Pacific region is larger than the number of Lusitanian species. Regarding the material of the collection studied, it was observed that 71% of the Lusitanian samples contained only 16% of the species, whereas the number of species identified in the Indo–Pacific region represents 55.2% of the whole, just with 19% of the samples. It is observed, with more poor proportion, the Caribbean (region 10), with 3.22%, and the Californian (region 13), with 1.58% of the samples. The remaining biogeographical regions represent individually lower percentages of the whole, and ranged about 5.2% globally.

Taxonomic outcomes

In table 4 the complete list of species identified is given with specification of the number of samples where each one is located, the total number of specimens, and the corresponding geographical regions according to the numbers assigned in table 3.

Table 3. Number of samples assigned to each of the malacological regions considered (see annex 2 for more details for each region).

Tabla 3. Número de muestras asignadas a cada una de las regiones malacológicas consideradas (ver el anexo 2 para una descripción más detallada de cada región).

Region	Subregion	Samples	Region	Subregion	Samples
1 – Artic		0	6c or 8		5
2 – Celtic		4	7 – Japanese		4
3 – Lusitanian		1.037	8 – New Zealand		6
	Province 3a	893	9 – Carolinian		6
	Province 3b	32	10 – Caribbean		47
	Province 3c	23	10 or 11		1
	Undetermined	87	11 – Patagonian		0
	Uncertain	2	12 – Oregonian		1
4 – West African		7	13 – Californian		22
4 or 5		1	14 – Panamanian		12
5 – South African		11	15 – Peruvian		16
6 – Indo-Pacific		278	15 or 16		1
	Province 6a	60	16 – Magallanian		1
	Province 6b	29	17 – Antarctic		0
	Province 6c	170			
	Undetermined	19			

Table 4. List of species identified is given with specification of the number of samples (Sm) where each one is located, the total number of specimens (Sp), and the corresponding geographical regions (R) according to the numbers assigned in table 3. *Table 4. Lista de las especies identificadas con el número de muestras localizadas (Sm), el número total de especímenes (Sp) y las regiones geográficas correspondientes (R) de acuerdo con los números asignados en la tabla 3.*

Species	Sm	Sp	R
Dorsaninae			
<i>Buccinanops cochlidium</i> (Kiener, 1834)	6	7	10–11–16
<i>Buccinanops deforme</i> (King & Broderip, 1832)	3	4	10
<i>Buccinanops duartei</i> Klappenbach, 1961	3	5	10
<i>Buccinanops cf. globulosum</i> (Kiener, 1834)	2	4	10
<i>Buccinanops moniliferus</i> (Kiener, 1834)	9	18	10
<i>Buccinanops uruguayensis</i> Pilsbry, 1897	1	2	10
<i>Buccinanops</i> sp.	1	1	10
<i>Bullia baccatta</i> Basterot, 1825 (fòssil)	1	2	3b
<i>Bullia callosa</i> (Wood, 1828)	2	2	4–5
<i>Bullia cf. digitalis</i> (Dillwyn, 1817)	4	13	5
<i>Bullia laevis</i> (Gmelin, 1791)	1	1	5
<i>Bullia mauritiana</i> Gray, 1839	1	1	6a
<i>Bullia melanooides</i> (Deshayes in Belanger, 1832)	3	7	6
<i>Bullia miran</i> (Bruguière, 1789)	2	3	4
<i>Bullia pura</i> Melvill, 1885	2	4	5
<i>Bullia rhodostoma</i> Reeve, 1847	2	2	5–6a
<i>Bullia tranquebarica</i> (Roeding, 1798)	3	7	6b
<i>Bullia vittata</i> (Linnaeus, 1767)	4	6	6–6a–b
<i>Bullia</i> sp.	1	2	4
Nassariinae			
<i>Cyclope neritea</i> (Linnaeus, 1758)	30	415	3–3a
<i>Cyclope pellucidus</i> Risso, 1826	55	2,018	3–3a
<i>Demoulia nataliae</i> Kilburn, 1972	1	2	4
<i>Hebra corticata</i> (A. Adams, 1852)	5	9	6a–b–c
<i>Hebra horrida</i> (Dunker, 1847)	3	6	6a–c
<i>Hebra subspinosa</i> (Llamarck, 1822)	6	14	6a–b–c
<i>Nassarius absconditus</i> Gili, 2015	3	3	6c
<i>Nassarius albescens</i> (Dunker, 1846)	10	14	6b–c
<i>Nassarius</i> aff. <i>albus</i> auct., non Say, 1822	1	1	10

Table 4. (Cont.)

Species	Sm	Sp	R
<i>Nassarius cf. albus</i> (Say, 1822)	3	5	10
<i>Nassarius arcularia arcularia</i> (Linnaeus, 1758)	30	56	6–6b–c
<i>Nassarius arcularia plicatus</i> (Roeding, 1798)	7	12	6–6a
<i>Nassarius cf. bellulus</i> (A. Adams, 1852)	1	1	6a
<i>Nassarius bicallosus</i> (E. A. Smith, 1876)	1	4	6c
<i>Nassarius bimaculosus</i> (A. Adams, 1852)	5	7	6b–c
<i>Nassarius brunneostomus</i> (Stearn, 1893)	1	4	13
<i>Nassarius burchardi</i> (Dunker in Philippi, 1849)	5	11	6c–8
<i>Nassarius callospira</i> (A. Adams, 1852)	2	3	6c
<i>Nassarius camelus</i> (Von Martens, 1897)	2	3	6c
<i>Nassarius canaliculatus</i> (Lamarck, 1822)	3	5	6c
<i>Nassarius capensis</i> (Dunker, 1846)	2	8	5
<i>Nassarius cinctellus</i> (Gould, 1850)	1	2	6c
<i>Nassarius circumcinctus</i> (A. Adams, 1852)	2	2	3a
<i>Nassarius complanatus</i> (Powys, 1835)	4	15	14
<i>Nassarius concinnus</i> (Powys, 1835)	1	1	6a
<i>Nassarius conoidalis</i> (Desahayes in Bélanger, 1832)	6	10	6–6a–c–7
<i>Nassarius conspersus</i> (Philippi, 1849)	10	217	3c–4
<i>Nassarius coppingeri</i> (E. A. Smith, 1881)	4	28	15
<i>Nassarius coralligenus</i> (Pallary, 1938)	1	1	3a
<i>Nassarius corniculus</i> (Olivi, 1792)	136	2,375	3–3a
<i>Nassarius coronatus</i> (Bruguière, 1789)	16	45	6a–b–c–7
<i>Nassarius corpulentus</i> (C. B. Adams, 1852)	1	2	14
<i>Nassarius crenoliratus</i> (A. Adams, 1852)	1	1	6c
<i>Nassarius cuvierii</i> (Payraudeau, 1826)	153	2,125	3–3a–c
<i>Nassarius denticulatus</i> (A. Adams, 1852)	3	6	3–3a
<i>Nassarius dentifer</i> (Powys, 1835)	2	4	15
<i>Nassarius cf. dermestinus</i> (Gould, 1860)	1	1	6c
<i>Nassarius deshayesii</i> (Hombron & Jacquinot, 1848)	3	5	6b–c
<i>Nassarius distortus</i> (A. Adams, 1852)	7	10	6a–c
<i>Nassarius ecstilbus</i> (Melvill & Standen, 1896)	1	2	6c
<i>Nassarius elatus</i> (Gould, 1850)	1	1	3a
<i>Nassarius elegantissimus</i> Shuto, 1969 non Risso, 1826	2	3	6c
<i>Nassarius fenistratus</i> (Marrat, 1877)	6	16	6a
<i>Nassarius festivus</i> (Powys, 1835)	3	12	6c–7
<i>Nassarius fissilabris</i> (A. Adams, 1852)	1	2	6c

Table 4. (Cont.)

Species	Sm	Sp	R
<i>Nassarius fossatus</i> (Gould, 1850)	7	11	12–13
<i>Nassarius gaudiosus</i> (Hinds, 1844)	11	34	6a–c
<i>Nassarius gayii</i> (Kiener, 1834)	10	72	15–16
<i>Nassarius gemmulosus</i> (C. B. Adams, 1852)	1	2	15
<i>Nassarius gibbosulus</i> (Linnaeus, 1758)	1	1	3a
<i>Nassarius glans glans</i> (Linnaeus, 1758)	12	23	6a–c–8
<i>Nassarius glans particeps</i> (Hedley, 1915)	1	3	8
<i>Nassarius globosus</i> (Quoy & Gaimard, 1833)	9	35	6c
<i>Nassarius grana</i> (Lamarck, 1822)	48	578	3–3a
<i>Nassarius granifer</i> (Kiener, 1834)	3	5	6c
<i>Nassarius gruneri</i> (Dunker, 184)	5	11	6a–c
<i>Nassarius hirtus</i> (Kiener, 1834)	2	4	6a–c
<i>Nassarius incrassatus</i> (Stroem, 1768)	202	4,082	2–3a–b–c
<i>Nassarius jacksonianus</i> (Quoy & Gaimard, 1833)	2	2	6b–6c
<i>Nassarius johni</i> (Monteosato, 1899)	1	3	3c
<i>Nassarius kiiensis</i> Kira, 1959	1	1	6c
<i>Nassarius leptospirus</i> (A. Adams, 1852)	3	8	6–6a–b
<i>Nassarius lima</i> (Dyllwin, 1817)	4	8	3a
<i>Nassarius limnaeiformis</i> (Dunker, 1847)	3	13	6–6c
<i>Nassarius luridus</i> (Gould, 1850)	13	41	6c
<i>Nassarius luteostomus</i> (Broderip & Sowerby, 1929)	5	8	14
<i>Nassarius margaritifera</i> (Dunker, 1847)	4	7	6–6a
<i>Nassarius mendicus</i> (Gould, 1850)	6	25	13
<i>Nassarius mitralis</i> (A. Adams, 1852)	1	1	6c
<i>Nassarius multiplicatus</i> (Schepman, 1911)	1	2	6a
<i>Nassarius mutabilis</i> (Linnaeus, 1758)	107	689	3–3a–b
<i>Nassarius nigellus</i> (Reeve, 1854)	1	3	6c–8
<i>Nassarius nitidus</i> (Jeffreys, 1867)	48	199	2–3a–b
<i>Nassarius nodicinctus</i> (A. Adams, 1852)	1	1	14
<i>Nassarius obsoletus</i> (Say, 1822)	5	15	9
<i>Nassarius olivaceus</i> (Bruguière, 1789)	14	24	6a–b–c
<i>Nassarius papillosus</i> (Linnaeus, 1798)	7	7	6a–b–c
<i>Nassarius pauperatus</i> (Lamarck, 1822)	2	3	8
<i>Nassarius pauperus</i> (Gould, 1850)	1	5	6c
<i>Nassarius perpinguis</i> (Hinds, 1844)	3	9	13
<i>Nassarius pfeifferi</i> (Philippi, 1844)	4	11	3b–c

Table 4. (Cont.)

Species	Sm	Sp	R
<i>Nassarius politus</i> (Marrat, 1880)	1	1	6c
<i>Nassarius polygonatus</i> (Lamarck, 1822)	13	28	10
<i>Nassarius pullus</i> (Linnaeus, 1758)	12	31	6–6b–c
<i>Nassarius pygmaeus</i> (Lamarck, 1822)	63	756	2–3–3a
<i>Nassarius pyrrhus</i> (Menke, 1843)	2	7	6c–8
<i>Nassarius quadrasii</i> (Hidalgo, 1904)	2	3	6c
<i>Nassarius rainbowae</i> Gili, 2015	1	1	6c
<i>Nassarius reeveanus</i> (Dunker, 1847)	5	5	6–6a–c
<i>Nassarius reticulatus</i> (Linnaeus, 1758)	105	407	2–3a–b–c
<i>Nassarius rufus</i> (Dunker, 1847)	2	3	6a
<i>Nassarius scalaris</i> (A. Adams, 1852) non Borson, 1835	1	1	6a
<i>Nassarius semisulcatus</i> (Rousseau, 1854)	7	15	6–6c
<i>Nassarius sinusigerus</i> (A. Adams, 1852)	1	3	6c
<i>Nassarius siquijorensis</i> (A. Adams, 1852)	3	3	6c–7
<i>Nassarius sordidus</i> (A. Adams, 1852)	1	1	6c
<i>Nassarius splendidulus</i> (Dunker, 1846)	3	5	6a
<i>Nassarius stolatus</i> (Gemil, 1791)	1	7	6a
<i>Nassarius succinctus</i> (A. Adams, 1852)	1	1	6c
<i>Nassarius sufflatus</i> (Gould, 1850)	6	14	6c
<i>Nassarius tiarula</i> (Kiener, 1841)	7	38	13–14
<i>Nassarius tringa</i> (Montrouzier in Sowerby & Montrouzier, 1864)	1	3	6c
<i>Nassarius tritoniformis</i> (Kiener, 1834)	1	2	4
<i>Nassarius trivittatus</i> (Say, 1822)	1	4	9
<i>Nassarius unifasciatus</i> (Kiener, 1834)	66	695	3–3a
<i>Nassarius variciferus</i> (A. Adams, 1852)	1	2	6c
<i>Nassarius vibex</i> (Say, 1822)	7	44	10
<i>Nassarius vitiensis</i> (Hombron & Jacquinot in Rousseau, 1854)	3	5	6a–c
<i>Nassarius</i> sp.	1	14	6c

Since many species are found in more than one region, in annex 6 species are grouped by biogeographical regions to facilitate consultation.

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Annex 2. Biogeographic regions considered in the review collected and modified from Abbott & Zim (1963), D'Angello & Gargiullo (1981), and Briggs & Bowen (2012). *Anexo. Regiones biogeográficas consideradas en la revisión, tomadas y modificadas de Abbott & Zim (1963), D'Angello & Gargiullo (1981) y Briggs & Bowen (2012).*

Region 1. Arctic: North Atlantic and Pacific above the parallel 70 N approximately

Region 2. Celtic: North Atlantic below the 71 N parallel to the latitude of Normandy

Region 3. Lusitanian: the Mediterranean and part of the West Atlantic

Province 3a: Mediterranean Sea and the Black Sea, Atlantic next to the Strait of Gibraltar

Province 3b: Northwest Atlantic from Cape San Vincent (Portugal) to Normandy (English Channel) (including Azores and Madeira)

Province 3c: West Atlantic from Rabat (Morocco) to Cape Blanc, including the Canary Islands

Region 4. West African: African coast to the border with South Africa, including the archipelago of Cape Verde and Sao Tomé and Príncipe Islands

Region 5. South African: coasts of South Africa, both the Atlantic and the Indian Ocean

Region 6. Indo–Pacific: Pacific Ocean and Indian Ocean

Province 6a: African Coast and Islands of the Indic Ocean to the Red Sea included

Province 6b: Arabian Peninsula, Persian Gulf and continental coast of Asia to Thailand

Province 6c: Chinese coast to the China Sea, Indonesia, Philippines, northern half of Australia and all the Pacific Islands until Hawaii

Region 7. Japanese: Japanese Islands and eastern coast of Asia (North coast of China and both South and North Korea)

Region 8. New Zealand: New Zealand, Tasmania and southern half of Australia

Region 9. Carolinian: North–East Atlantic from New Scotland to the northern coasts of Florida (northern half) and North coast of the Gulf of Mexico

Region 10. Caribbean: East Atlantic (Bermuda, southern half of Florida, Caribbean and South American coast to the mouth of Rio de la Plata)

Region 11. Patagonian: South East Atlantic (South American coast to the Valdes Peninsula)

Region 12. Oregonian: Pacific Northwest (from British Columbia to Northern California)

Region 13. Californian: West Central Pacific (entire coast of the California peninsula).

Region 14. Panamic: Equatorial Pacific (coast of Mexico and Central America to borders with Peru)

Region 15. Peruvian: Coasts of Peru and Chile to Concepción

Region 16. Magallanian: The Southern Cone of South America, from Concepcion, in the Pacific, up to the Valdes peninsula, in the Atlantic, including the Falkland Islands

Region 17. Antarctic: Atlantic and Pacific above parallel 60 S

Annex 3. Some cases with uncertain geographic origin.
Anexo 3. Algunos casos con origen geográfico incierto.

In several cases, it was difficult or impossible to determine the source of the sample's specimens. Next, concrete situations with examples of samples where they were found are detailed.

Inconsistent locality

Sample with one or more specimens of a species belonging to one geographical region, indicating on its label a locality of a region where the species is known that does not live there. The MZB 86–0162 sample contains a specimen of *Nassarius semisulcatus* (Rousseau, 1854), an Indo–pacific species, while its label indicated Mahon, that is to say, a Mediterranean locality. In such cases, in the review, the reference to the locality remained undetermined although assigning the typical geographic region of the species.

Varied localities of the same region

Sample with a single specimen, indicating two different localities on the labels, but both belonging to the same geographical region that is consistent with the common distribution of the species. In such case, the doubt is focused on the specific locality and not on the original geographical region. For example, the MZB 88–6304 sample comprises a single specimen of *Buccinanops moniliferus* (Kiener, 1834); on the label of the Serradell Collection it is indicated Rio La Plata and inside the specimen's aperture there is an additional piece of paper indicating Rio Janeiro. In this review, both localities were included with an interrogative point, however not involving the geographical region.

Mixed localities

Sample with several specimens pertaining to the same species and with two labels indicating different type localities; species that were found in both localities. This may be due to the grouping of specimens in a single sample that were identified initially in different samples. As in the previous case, in the review, the different typical localities are preserved and separated by a sign (+) and assigning them to a single geographic region. For example, the original sample MZB 88–6305 includes 12 specimens of *Cyclope neritea* (Linnaeus, 1758) and two labels; one specifies Barcelona and the other Cadiz.

Uncertain locality by segregation

When a single specimen of an original sample, indicating two or more localities belonging to the same geographical region, was segregated to a new sample for belonging to a different species, its location remains unclear. It was decided to indicate the two or more localities of the original sample with interrogation points. For example, from the original sample MZB 88–6158 with determination *Nassa ambigua*, with two localities Pineda and Vilassar, a specimen was separated into a new sample MZB 88–6158–B, as *Nassarius pygmaeus* (Lamrck, 1822) and the localities were indicated with interrogation points (Pineda? Vilassar?).

Annex 4. Certain cases of segregation and grouping of samples.
Anexo 4. Algunos casos de segregación y agrupación de muestras.

The casuistry in this aspect is varied and frequently adding some change in the taxonomic determination of the samples specimens. The following examples are described below.

Sample MZB 88–6057

Containing two shells, there are four labels with different determinations. The earliest were from the Rosals Collection (No 2084 and 2085), the first with the specific determination of *Nassa bourguignati* Loc. And, the second, *Nassa poirieri* Loc, both from Barcelona. A third latest label, of the *Museo de Biología de Barcelona*, modifies the determination by assigning the specimens to *Nassa reticulata nitida* Jfr., and attributing them to No 2085 of the Rosals Collection. A latest typewritten label preserves the last determination of the species, but attributes it to No 2084 of the Rosals Collection. Obviously, the reviewer had gathered the two specimens that Rosals separated, in a single sample considering they belonged to the same species and the same locality. Yet it remained unclear when this grouping occurred. The fact that the two latest labels are attributed to different numbers of the Rosals Collection suggests that, a label was set for each sample initially, modifying only the name of the species and, in a subsequent review were grouped in a single sample, since they had the same specific determination and both derived from Barcelona, preserving all the labels.

Sample MZB 88–6063

Which included 10 specimens determined as *Nassa reticulata* (L), the label indicates that they belonged to the collections of Aguilar–Amat (unnumbered) and Rosals (No. 462), without any original label, and from the Mediterranean. Considering the ambiguity of the geographical source, the reviewer may have grouped them in sight they pertained to the same species. The same happened with sample MZB 88–6074 containing 21 specimens, where the latest label indicates species *Nassa gayi* Kien of Southern America, from the Martorell and Aguilar–Amat collections. There are label fragments of the Bofill collection where it is not possible to identify the locality, and a label of the *Museo de Biología de Barcelona* which indicated 'Chile'. Most likely, the specimens of the species of the Martorell, Bofill and Aguilar–Amat Collections were grouped into this single sample, since they derived from the same geographic region.

Sample MZB 88–6052

Is the result of grouping the *Nassarius corniculus* (Olivi, 1792) deriving from two localities, Barcelona and Cadaqués into a single lot, without any indication about which are the specimens of each locality. Both labels of the Rosals Collection corresponded to numbers 470 and 473.

Sample MZB 88–6708

There are three specimens determined as *Nassa canaliculata* Lam, but containing three labels, one of the Serradell Collection (No. 1510), another of the Martorell Collection, and a latest of the *Museo de Biología de Barcelona*. As the two previous labels of the original samples indicated the same locality, they were grouped into a single sample.

Annex 4. (Cont.)

Samples MZB 88–6609 and MZB 88–6611

These two current accession numbers came from the same sample, encoded as 765 for the Chia collection. Original labels were not preserved, but on the labels of the *Museo de Biología de Barcelona*, shared provenance is clearly identified. The original lot probably included two varieties of the same species that were sorted into two samples once the Chia collection reached the museum. Thus, the MZB 88–6609 sample contains specimens of *Nassa costulata* Ren. var. *ferussaci* whereas specimens of *Nassa costulata* Ren. var. *cuvieri* are found in the MZB 88–6611 lot.

Samples MZB 88–6856, MZB 88–6858 and MZB 88–6865

Presented exclusions, groupings and taxonomic evaluations. In sample MZB 88–6856, there are 20 specimens and three labels: one of Serradell Collection No. 1499 (*Nassa valliculata* Locard), another from the Serradell Collection as well, No. 1500 (*Nassa ascanias* Brug.) and a third latest label of the *Museo de Biología de Barcelona* (*Nassa incrassata elongata* B.D.D.) indicating as original samples those of Serradell Nos. 1498 and 1499. Therefore, the MZB 88–6856 sample was formed from three different samples of the Serradell Collection (numbers 1498, 1499 and 1500). However, in sample MZB 88–6858 with a specimen (*Nassa incrassata varicosa* B.D.D.) and a label of the *Museo de Biología de Barcelona*, it is indicated that it derived from the Serradell Collection No. 1498. Thus, this specimen was separated from the others of the same sample of Serradell. On the other hand, the MZB 88–6865 sample included seven specimens (*Nassa incrassata* Müll.) with label of the *Museo de Biología de Barcelona* indicating that they derived from sample 1498 of the Serradell Collection. It is obvious that somebody had grouped, subdivided and rearranged samples 1498, 1499 and 1500 of the Serradell collection on evaluating that all the specimens belonged to the same species (considering *valliculata* and *ascanias* as synonyms of *incrassatus*), and they had to be grouped according to the 'variety' of the species; ignoring the fact that the original localities were not the same (Barcelona for 1949 and 1500, and Vilanova i la Geltrú for 1948).

Furthermore, the original samples of the Serradell Collection 1498 and 1499 were subdivided and rearranged in many others, following the 'variety' criterion, as can be seen in the corresponding label of the *Museo de Biología de Barcelona*: sample MZB 88–6727 contains three specimens of (*Nassa incrassata elongata* B.D.D.), deriving from 1498 and 1499; the Serradell sample 1498 was subdivided into five more, the current samples MZB 88–6732 (19 specimens of *Nassa incrassata* Müll.), MZB 88–6744 (four specimens of *Nassa incrassata minor* B.D.D.), MZB 88–6761 (three specimens of *Nassa incrassata fusca* Mts.), MZB 88–6767 (five specimens of *Nassa incrassata fasciata* Mts.) and MZB 88–6735 (one specimen of *Nassa incrassata varicosa* B.D.D.); and of the original sample of Serradell 1499, five specimens were assigned to the current MZB 88–6734 as *Nassa incrassata varicose* B.D.D.

Annex 5. Taxonomic modifications with or without grouping or segregations.
 Anexo 5. Modificaciones taxonómicas con o sin agrupaciones o segregaciones.

There are current samples that retain a history of taxonomic changes that may be followed through the original labels, i.e., there was a taxonomic reinterpretation of the sample material, since the text was not literally transcribed, or something was added. The determination of the species was modified according to the trends of the moment.

- In some cases, certain errors were produced in the transcription of the original labels, which were usually almost damaged, as in sample MZB 88–6231 where the label indicates *Nassa articulata* (L.). However, Linnaeus did not describe any *Buccinum articulatum*; the specimens of the sample corresponded to the species *Nassarius reticulatus*.
- The original sample label MZB88–6071 of the Serradell Collection (No. 1498), indicates only *Nassa incrassata* Müll. from San Sebastian, and in the latest label of the *Museo de Biología de Barcelona*, it is indicated *Nassa incrassata fasciata* Sc. Obviously the reviewer assigned a name of subspecies to the seven specimens of the sample; subspecies that was not considered initially.
- In the initial label of sample MZB 88–6592 of the Gros collection, it is indicated *Nassa costulata* Ren. var. *encaustica* whereas the label of the *Museo de Biología de Barcelona* indicates *Nassa costulata madeirensis* Rve. In such case, the specific name was preserved but the one of the variety was modified, giving it the category of subspecies. Likewise, in sample MZB 88–6632 the label of Serradell indicates *Nassa ferussaci* Payr., whereas, the one of *Museo de Biología de Barcelona* specifies *Nassa costulata ferussaci* Payr. This means that the species name was modified considering the previous name as a subspecies of the new specific name.
- In Sample MZB 88–6634, it was observed labels of two different samples of the Serradell collection, *Nassa unifasciata* Kiener, with No. 1495, and *Nassa Guernei* Locard, with No. 1496. The label of the *Museo de Biología de Barcelona* indicates *Nassa costulata encaustica* Brus. But the typewritten display label specified the name of *Nassa costulata castanea* Brs. The author of the label of the *Museo de Biología de Barcelona* gathered the two samples of the Serradell Collection considering they corresponded to a single species of the same locality, thus assigning them the specific and subspecific names that he deemed to be correct. Subsequently, the author of the typewritten label considered that the sample did not correspond to the subspecies or variety indicated on the previous label and modified it.
- In samples MZB 88–6064 belonging to the Samá Collection and MZB 88–6069 belonging to the Bofill Collection, the original labels indicated, respectively, *Nassa reticulata* (Lin) var. and *Nassa nitida* Jfr., and the subsequent labels of the *Museo de Biología de Barcelona* in all the samples indicated *Nassa reticulata nitida* Jfr. The reviewer modified the original determinations considering that those specimens should be attributed to the subspecies *nitida* of the *N. reticulatus* species.

Annex 5. (Cont.)

- There are samples with an additional label indicating the name of the person who conducted the taxonomic review. Thus, in sample MZB 88–6680 with original label of the Martorell Collection, and with the material determination as *Nassa* sp., it was observed another label assigning the specimen to *Nassarius siquijorensis* A. Ad. with 'Det. Giner' added. A third label, from the *Museo de Biología de Barcelona*, preserved the specific determination set by Giner.
 - In sample MZB 88–6368 with original label *Nassa* sp., but containing a specimen which does not belong to the Nassariidae family, there is an additional handwritten piece of paper, indicating 'not *Nassa*'. Moreover, another paper was found with the same script and text in sample MZB 88–6364, although in this case the contents belonged to the Nassariidae family. This suggested taxonomic assessment of the sample's contents after arriving to the Museum.
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Annex 6. Identified species grouped by biogeographic regions.
Anexo 6. Especies identificadas agrupadas por regiones biogeográficas

Celtic region (region 2): 4 species

Nassarius incrassatus (Stroem, 1768)
Nassarius nitidus (Jeffreys, 1867)
Nassarius pygmaeus (Lamarck, 1822)
Nassarius reticulatus (Linnaeus, 1758)

Lusitanian región (region 3): 20 species

Cyclope neritea (Linnaeus, 1758)
Cyclope pellucidus Risso, 1826
Nassarius circumcinctus (A. Adams, 1852)
Nassarius conspersus (Philippi, 1849)
Nassarius coralligenus (Pallary, 1938)
Nassarius corniculus (Olivi, 1792)
Nassarius cuvierii (Payraudeau, 1826)
Nassarius denticulatus (A. Adams, 1852)
Nassarius elatus (Gould, 1850)
Nassarius gibbosulus (Linnaeus, 1758)
Nassarius grana (Lamarck, 1822)
Nassarius incrassatus (Stroem, 1768)
Nassarius johni (Monteosato, 1899)
Nassarius lima (Dyllwin, 1817)
Nassarius mutabilis (Linnaeus, 1758)
Nassarius nitidus (Jeffreys, 1867)
Nassarius pfeifferi (Philippi, 1844)
Nassarius pygmaeus (Lamarck, 1822)
Nassarius reticulatus (Linnaeus, 1758)
Nassarius unifasciatus (Kiener, 1834)

West African region (region 4): 5 species

Bullia callosa (Wood, 1828)
Bullia miran (Bruguère, 1789)
Demoulia nataliae Kilburn, 1972
Nassarius conspersus (Philippi, 1849)
Nassarius tritoniformis (Kiener, 1834)

South–African region (region 5): 6 species

Bullia callosa (Wood, 1828)
Bullia cf. *digitalis* (Dillwyn, 1817)
Bullia laevissima (Gmelin, 1791)
Bullia pura Melvill, 1885
Bullia rhodostoma Reeve, 1847
Nassarius capensis (Dunker, 1846)

Indo–Pacific region (region 6): 70 species

Bullia mauritiana Gray, 1839
Bullia melanoides (Deshayes in Belanger, 1832)
Bullia rhodostoma Reeve, 1847

Annex 6. (Cont.)

Bullia tranquebarica (Roeding, 1798)
Bullia vittata (Linnaeus, 1767)
Hebra corticata (A. Adams, 1852)
Hebra horrida (Dunker, 1847)
Hebra subspinosa (Lamarck, 1822)
Nassarius absconditus Gili, 2015
Nassarius albescens (Dunker, 1846)
Nassarius arcularia arcularia (Linnaeus, 1758)
Nassarius arcularia plicatus (Roeding, 1798)
Nassarius cf. bellulus (A. Adams, 1852)
Nassarius bicallosus (E. A. Smith, 1876)
Nassarius bimaculosus (A. Adams, 1852)
Nassarius burchardi (Dunker in Philippi, 1849)
Nassarius callospira (A. Adams, 1852)
Nassarius camelus (von Martens, 1897)
Nassarius canaliculatus (Lamarck, 1822)
Nassarius cinctellus (Gould, 1850)
Nassarius concinnus (Powys, 1835)
Nassarius conoidalis (Deshayes in Bélanger, 1832)
Nassarius coronatus (Bruguière, 1789)
Nassarius crenoliratus (A. Adams, 1852)
Nassarius deshayesii (Hombron & Jacquinot, 1848)
Nassarius cf. dermestinus (Gould, 1860)
Nassarius distortus (A. Adams, 1852)
Nassarius ecstilbus (Melvill & Standen, 1896)
Nassarius elegantissimus Shuto, 1969 non Risso, 1826
Nassarius fenistratus (Marrat, 1877)
Nassarius festivus (Powys, 1835)
Nassarius fissilabris (A. Adams, 1852)
Nassarius gaudiosus (Hinds, 1844)
Nassarius glans glans (Linnaeus, 1758)
Nassarius globosus (Quoy & Gaimard, 1833)
Nassarius granifer (Kiener, 1834)
Nassarius gruneri (Dunker, 184)
Nassarius hirtus (Kiener, 1834)
Nassarius jacksonianus (Quoy & Gaimard, 1833)
Nassarius kiiensis Kira, 1959
Nassarius leptospirus (A. Adams, 1852)
Nassarius limnaeiformis (Dunker, 1847)
Nassarius luridus (Gould, 1850)
Nassarius margaritifer (Dunker, 1847)
Nassarius mitralis (A. Adams, 1852)
Nassarius multiplicatus (Schepman, 1911)
Nassarius nigellus (Reeve, 1854)
Nassarius olivaceus (Bruguière, 1789)
Nassarius papillosus (Linnaeus, 1798)
Nassarius pauperus (Gould, 1850)
Nassarius politus (Marrat, 1880)

Annex 6. (Cont.)

Nassarius pullus (Linnaeus, 1758)
Nassarius pyrrhus (Menke, 1843)
Nassarius quadrasii (Hidalgo, 1904)
Nassarius rainbowae Gili, 2015
Nassarius reeveanus (Dunker, 1847)
Nassarius rufus (Dunker, 1847)
Nassarius scalaris (A. Adams, 1852) non Borson, 1835
Nassarius semisulcatus (Rousseau, 1854)
Nassarius sinusigerus (A. Adams, 1852)
Nassarius siquijorensis (A. Adams, 1852)
Nassarius sordidus (A. Adams, 1852)
Nassarius splendidulus (Dunker, 1846)
Nassarius stolatus (Gemil, 1791)
Nassarius succinctus (A. Adams, 1852)
Nassarius sufflatus (Gould, 1850)
Nassarius tringa (Montrouzier in Sowerby & Montrouzier, 1864)
Nassarius variciferus (A. Adams, 1852)
Nassarius vitiensis (Hombron & Jacquinet in Rousseau, 1854)

Japanese region (region 7): 4 species

Nassarius conoidalis (Deshayes in Belanger, 1832)
Nassarius coronatus (Bruguière, 1789)
Nassarius festivus (Powys, 1835)
Nassarius siquijorensis (A. Adams, 1852)

New–Zealand region (region 8): 5 species

Nassarius glans glans (Linnaeus, 1758)
Nassarius glans particeps (Hedley, 1915)
Nassarius nigellus (Reeve, 1854)
Nassarius pauperatus (Lamarck, 1822)
Nassarius pyrrhus (Menke, 1843)

Carolinian region (region 9): 2 species

Nassarius obsoletus (Say, 1822)
Nassarius trivittatus (Say, 1822)

Caribbean region (region 10): 10 species

Buccinanops cochlidium (Kiener, 1834)
Buccinanops deforme (King & Broderip, 1832)
Buccinanops duartei Klappenbach, 1961
Buccinanops cf. *globulosus* (Kiener, 1834)
Buccinanops moniliferus (Kiener, 1834)
Buccinanops uruguayensis Pilsbry, 1897
Nassarius aff. *albus* auct., non Say, 1822
Nassarius cf. *albus* (Say, 1822)
Nassarius polygonatus (Lamarck, 1822)
Nassarius vibex (Say, 1822)

Annex 6. (Cont.)

Patagonian region (region 11): 1 species

Buccinanops cochlidium (Kiener, 1834)

Oregonian region (region 12): 1 species

Nassarius fossatus (Gould, 1850)

Californian region (region 13): 5 species

Nassarius brunneostomus (Stearn, 1893)

Nassarius fossatus (Gould, 1850)

Nassarius mendicus (Gould, 1850)

Nassarius perpinguis (Hinds, 1844)

Nassarius tiarula (Kiener, 1841)

Panamanian region (region 14): 5 species

Nassarius complanatus (Powys, 1835)

Nassarius corpulentus (C. B. Adams, 1852)

Nassarius luteostomus (Broderip & Sowerby, 1929)

Nassarius nodicinctus (A. Adams, 1852)

Nassarius tiarula (Kiener, 1841)

Peruvian region (region 15): 4 species

Nassarius coppingeri (E. A. Smith, 1881)

Nassarius dentifer (Powys, 1835)

Nassarius gayii (Kiener, 1834)

Nassarius gemmulosus (C. B. Adams, 1852)

Magallanian region (region 16): 2 species

Buccinanops cochlidium (Kiener, 1834)

Nassarius gayii (Kiener, 1834)
