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Peruvian nudibranchs (Mollusca, Gastropoda): an updated list of species

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Abstract

Nudibranchs are, in general terms, poorly studied organisms along the Peruvian coast. The most up-to-date list of nudibranch species from the Peruvian sea to date, based on bibliographic compilation, is presented here. We compiled 31 species distributed in 2 suborders, 10 superfamilies, 20 families and 28 genera. According to the coastal-marine biogeographic provinces present in Peru, 23 species inhabit within the Warm Temperate Southeastern Pacific, 18 within the Tropical Eastern Pacific and 10 inhabit both provinces crossing the transition zone in between. Regarding distribution patterns, two species exhibit a cosmopolitan distribution (*Glaucus atlanticus* and *Fiona pinnata*), two exhibit a circumtropical distribution (*Cephalopyge trematoides* and *Phylliroe bucephala*), one exhibits a bipolar distribution in the Eastern Pacific and amphi-South American coast (*Rostanga pulchra*), six exhibit a amphi-South American distribution (*Rostanga pulchra*, *Diaulula punctuolata*, *Doto uva*, *Tyrinna evelinae*, *Tyrinna delicata* and *Doris fontainii*) and two species are endemic of Peru (*Corambe mancorensis* and *Felimare sechurana*). Biogeographical aspects, geographical distributions, taxonomic classification updates are supplied and discussed. In addition, a brief discussion regarding those species listed and persisted in the literature, but unconfirmed by collections (referred to herein as predicted) is presented.

Keywords

Biogeography, country species richness, geographic distribution, sea slug, taxonomy

Introduction

Nudibranchia Cuvier, 1817 (Subclass Heterobranchia: Infraclass Euthyneura: Superorder Nudipleura) is an order of exclusively marine gastropod mollusks characterized by the absence of shells in the adult stage (Behrens et al. 2005; Wägele and Klussmann-Kolb 2005). Their striking aposematic body colorations become them frequent targets of underwater photography (Gosliner 1992). Approximately 3000 species of nudibranchs have been described worldwide in cold and tropical regions (Shields 2009; Almada et al. 2016), mainly in shallow waters (0 – 30 m) (Wägele and Klussmann-Kolb 2005), although new species have been reported in deeper areas (Valdés 2001a,b; Gosliner et al. 2008). The ecological importance of nudibranchs lies in the control of populations of jellyfish, anemones, and sponges, from which they incorporate toxins adapting them for their own defense (Todd 1981, 1983). Recently, symbiotic associations with bacteria that provide them essential nutrients have been described (Zhukova et al. 2022). Some species has been reported to synthesize secondary metabolites with high biotechnological potential (Pereira et al. 2012; Dean and Prinsep 2017). Others species could be used as environmental indicators since are sensitive to ocean stressors such as coastal pollution (Caballer et al. 2008).

The most recent list of aquatic mollusks in Peru (Ramírez et al. 2003) counted 1018 marine species composed mainly of gastropods and bivalves, with only few species of nudibranchs (Ramírez et al. 2003). In fact, the Peruvian sea is considered one of the poorest regions in the world in terms of nudibranch species (Schrödl 1997, 2002, 2003; Schrödl and Hooker 2014). Comparatively, other regions such as the Caribbean Sea, the Tropical Eastern Pacific, the Indian Ocean, the Mediterranean Sea (Sachidhanandam et al. 2000; Valdés 2006; Chavanich et al. 2013; Ah Shee Tee et al. 2019; Furfaro et al. 2020; Londoño-Cruz 2021) and other South American countries such as Brazil, Chile, and Venezuela (Fischer and Cervera 2005b; Ardila et al. 2007; Aldea et al. 2011; Padula et al. 2011; Alvim and Pimenta 2013; Gutiérrez et al. 2015; Araya and Valdés 2016; Londoño-Cruz 2021) exhibit a greater richness of nudibranchs.

The first nudibranchs in Peru were described by d'Orbigny (1835-1846) and later by Dall (1909). After a considerable lapse of time with no new species discovered, Millen et al. (1994) reported to *Okenia luna* occurring in Peruvian and Chilean waters. Shortly after, the first list of Peruvian aquatic mollusks was published, which considered nudibranch species (Álamo and Valdivieso 1997), and two years later another list was published (Paredes et al. 1999) where the authors thanked Sandra Millen for the preliminary list of species belonging to the infraclass Opisthobranchia (an abandoned and currently deprecated taxonomic category, see: Jörger et al. 2010; Schrödl et al. 2011; Wägele et al. 2014). In 2003, a more updated list of Peruvian aquatic mollusks was published (Ramírez et al. 2003) which included the nudibranch species reported to date. Years later, four new species were reported on the north coast: *Felimida baumanni*, *Doriopsilla janaina*, *Flabellina cynara* and *Cuthona* sp. (Nakamura 2006), the species *Corambe mancorensis* as endemic (Martynov et al. 2011) and the species *Spurilla neapolitana* (later corrected as *Spurilla braziliana*) (Uribe and Pacheco 2012). Four new nudibranch species were then added for the Peruvian coast (Uribe et al., 2013), and another study listed the species shared with Chile (Schrödl and Hooker 2014). *Felimare sechurana* was reported as an endemic species in the transition zone of the northern coast (Hoover et al. 2017) and finally two new species of planktonic nudibranchs were added (Quesquen 2017). We must emphasize that some species have been listed in previous publications as occurring in Peru without sufficient evidence, e.g., under the assumption of geographic continuity (e.g., *Cadlina sparsa;* Álamo and Valdivieso 1997), personal

communications (e.g. *Polycera cf. alabe*; Paredes et al. 1999; Uribe et al. 2013), misinterpretations (e.g. *Gargamella immaculata* and *Thecacera darwini*; Nakamura 2006), etc., becoming problematic because they have persisted in the literature. To distinguish them from the confirmed ones, these species are hereinafter referred to as 'predicted'. However, abandoning this status is feasible, e.g., the species *Rostanga pulchra* was predicted for Peruvian waters for many years (Uribe et al. 2013) until finally confirmed (Schrödl and Hooker 2014).

Inter-annual variability such as ENSO (El Niño-Southern oscillation) events tend to displace tropical species southward (Velez and Zeballos 1985; Paredes et al. 1998) while cold events tend to intensify the Humboldt current, dragging larvae northward. Precisely, the transport of larvae northwards by the Humboldt Current or southwards by warm ENSO events could be bringing Magellanic or tropical species to Peruvian waters, respectively, affecting distribution ranges. In addition, the vulnerability to temperature variations mainly during larval periods (Leatherman 2019), the aragonite internal network of several species (Ehrlich 2010), small body size, small populations (Nybakken 1978; Todd et al. 2016), and the possibility that the Humboldt ecosystem is particularly sensitive to ocean stressors (Echevin et al. 2012), such as warming and acidification (Barnosky et al. 2011; Ceballos et al. 2015; Pievani 2014), the diversity and distribution of nudibranchs could be affected (Nimbs and Smith 2018).

Information regarding Peruvian nudibranchs remains limited, mainly because of insufficient research effort (Uribe and Pacheco 2012). Explorations targeting nudibranchs have been extremely scarce, and most sightings and reports are occasional (Nakamura 2006; Schrödl and Hooker 2014; Uribe et al. 2013). Since the species richness of nudibranchs is undervalued in Peru (Hooker pers. comm.), this taxonomic order in particular needs further attention. Our aim was to update and rectify the list of nudibranchs from the Peruvian sea, emphasizing the current scientific nomenclature and geographical distributions of each species.

Materials and methods

All available literature related to the order Nudibranchia in Peru was compiled. Different sources of information were included in the search, such as articles indexed in peer-reviewed journals, books, book chapters, "grey literature" (e.g., scientific reports and theses) and sea slug forums (http://www.seaslugforum.net/). Key terms such as 'Opisthobranchia', 'Heterobranchia', 'Nudibranch', 'Nudibranchia', 'sea slug', 'phylogeny', 'checklist', 'Peru', 'Humboldt' and 'taxonomy' were included. Relevant data such as the reporting date, scientific name, geographic distribution, collection sites, bathymetric distribution, and biogeographical provinces were considered. Updated scientific names were confirmed through the WoRMS portal (World Register of Marine Species, https://www.marinespecies.org/) and sighting occurrences through the GBIF portal (Global Biodiversity Information Facility, https://www.gbif.org/). Modifications, revalidations, and refutations regarding the taxonomy were included as "remarks" accompanied by their respective justifications. Endemic species of Peru were also shown. The QGIS 3.22.8 software (QGIS Development Team 2022) was used to build distribution maps and the VENNY 2.1 online software (Oliveros 2016) was used to visualize the number of species shared with neighboring countries. The predicted species were separated from the confirmed ones.

The collections where the type of material available for some species was deposited were added, whose codes are:

CASIZ: California Academy of Sciences, San Francisco

CZA: Colección de Zoología Acuática, Universidad Peruana Cayetano Heredia, Lima

NHMUK: Natural History Museum UK, London

RMNH: Naturalis Biodiversity Center, Leiden

SMNH: Swedish Museum of Natural History, Stockholm

USNM: Smithsonian National Museum of Natural History, Washington

ZMB: The Berlin Zoological Museum, Berlin

ZSM: The Bavarian State Collection of Zoology, Munich

Results

Overview

A total of 31 species were confirmed for Peruvian waters, distributed in two suborders, 10 superfamilies, 20 families and 28 genera (Table 1). The suborder Cladobranchia consists of 16 species, distributed in five superfamilies and 13 families. Suborder Doridina is comprised of 15 species, which are distributed in five superfamilies and seven families (Table 1). The most specious families are Chromodorididae and Discodorididae with five and four species, respectively (Fig. 1), both belonging to the suborder Doridina. The predicted species (n = 8) are distributed in four superfamilies, seven families and seven genera (Table 2).

Table 3 shows a chronology of published lists considering nudibranch species for the Peruvian sea. The increasing number of reported species and the updating of several scientific names over time can be appreciated over time.

Considering the coastal marine biogeographical classification proposed by Spalding et al. (2007), 23 species inhabit within the Warm Temperate Southeastern Pacific province, 18 inhabit the Tropical Eastern Pacific province, and 10 inhabit both provinces (Table 4, Fig. 2).

Peru hosts fewer nudibranch species than other South American countries such as Chile, Colombia, and Brazil (Fig. 3A). Regarding the species shared with these countries, of the 31 species confirmed in Peruvian Waters, 19 species are also present in Chilean waters, four in Colombian waters and four in Brazilian waters (Fig. 3B). The distribution ranges of nudibranch species present in Peruvian Waters restricted to South America, in the context of the coastal-marine biogeographic division proposed by Spalding et al. (2007), are shown in the figure 4. The wide range of distribution of amphi-South American species (*Doto uva*, *Tyrinna delicata*, *Rostanga pulchra* and *Doris fontainii*), is remarkable in comparison with the restricted distribution of endemic species (*Corambe mancorensis* and *Felimare sechurana*). In the context of the entire American continent, the wide distribution range of *Rostanga pulchra* is notable, followed by *Dendronotus venustus* (Fig. 5).

Table 1. Nudibranch species confirmed for Peruvian waters according to the bibliographic compilation of this study.

Suborders (n = 2)	Superfamilies (n = 10)	Families (n = 20)	Species (n = 31)
Cladobranchia	Aeolidioidea	Aeolidiidae	*Spurilla braziliana* **MacFarland, 1909**
		Facelinidae	*Phidiana lottini* (**Lesson, 1831**)
			Bajaeolis bertschi **Gosliner and Behrens, 1986**
		Glaucidae	*Glaucus atlanticus* **Forster, 1777**
	Arminoidea	Arminidae	*Armina californica* **(J.G. Cooper, 1863)**

	Dendronotoidea	Dendronotidae	*Dendronotus venustus* **MacFarland, 1966**
		Dotidae	*Doto uva* **Er. Marcus, 1955**
		Hancockiidae	*Hancockia schoeferti* **Schrödl, 1999**
		Phylliroidae	*Cephalopyge trematoides* **(Chun, 1889)**
			Phylliroe bucephala **Lamarck, 1816**
		Cuthonidae	*Cuthona* sp **Alder and Hancock, 1855**
		Fionidae	*Fiona pinnata* **(Eschscholtz, 1831)**
		Flabellinidae	*Kynaria cynara* **(Ev. Marcus and Er. Marcus, 1967)**
			Coryphellina cerverai **(M. A. Fischer, van der Velde and Roubos, 2007)**
	Proctonotoidea	Janolidae	*Janolus rebeccae* **Schrödl, 1996**
	Tritonoidea	Tritoniidae	*Tritonia* sp **Cuvier, 1798**
Doridina	Chromodoridoidea	Chromodorididae	*Tyrinna delicata* **(Abraham, 1877)**
			Felimare agassizii **(Bergh, 1894)**
			Felimare sechurana **Hoover, Padula, Schrödl, Hooker and Valdés, 2017**
			Felimida baumanni **(Bertsch, 1970)**
			Tyrinna evelinae **(Er. Marcus, 1958)**
	Doridoidea	Discodorididae	*Baptodoris peruviana* **(d'Orbigny, 1837)**
			Diaulula variolata **(d'Orbigny, 1837)**
			Diaulula punctuolata **(d'Orbigny, 1837)**
			Rostanga pulchra **MacFarland, 1905**
		Doridiidae	*Doris fontainii* **d'Orbigny, 1837**
	Onchidoridoidea	Corambidae	*Corambe lucea* **Er. Marcus, 1959**
			Corambe mancorensis **Martynov et al. 2011**
		Goniodorididae	*Okenia luna* Millen, **Schrödl, Vargas and Indacochea, 1994**
	Phyllidioidea	Dendrodorididae	*Doriopsilla janaina* **Er. Marcus and Ev. Marcus, 1967**
	Polyceroidea	Polyceridae	*Polycera priva* **Er. Marcus, 1959**

Table 2. Nudibranch species predicted to inhabit Peruvian waters according to the bibliographic compilation of this study.

Suborder (n = 2)	Superfamilies (n = 4)	Families (n = 7)	Species (n = 8)
Cladobranchia	Aeolidioidea	Aeolidiidae	*Aeolidia campbellii* **(Cunningham, 1871)**
		Glaucidae	*Glaucus* sp **Forster, 1777**
		Phylliroidae	*Phylliroe lichtensteinii* **Eschscholtz, 1825**
	Fionoidea	Coryphellidae	*Itaxia falklandica* **(Eliot, 1907)**
Doridina	Chromodoridoidea	Cadlinidae	*Cadlina sparsa* **(Odhner, 1922)**
		Discodorididae	*Gargamella immaculata* **Bergh, 1894**
	Polyceroidea	Polyceridae	*Polycera* cf. *alabe* **Collier and Farmer, 1964**
			Thecacera darwini **Pruvot-Fol, 1950**

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Table 3. Nudibranch species confirmed and predicted for the Peruvian sea in different checklists published over time.

Legend: First reports for Peruvian waters: [a]d'Orbigny (1835-1846), [b]Dall (1909), [c]Millen et al. (1994), [d]Nakamura (2006), [e]Schrödl (2003), [f]Schrödl (1999), [g]Schrödl (2000), [h]Martynov et al. (2011), [i]Uribe et al. (2013), [j]Uribe and Pacheco (2012), [k]Schrödl and Hooker (2014), [l]Hoover et al. (2017), [m]Quesquen (2017), sp = number of nudibranch species mentioned in each checklist. Single asterisk (*) shows predicted species and double asterisk (**) shows recent confirmation of previously predicted species in Peruvian waters. § shows that the scientific name has undergone changes.

d'Orbigny (1835-1846) (sp = 5)	Dall (1909) (sp = 6)	Álamo and Valdivieso (1997) (sp = 7)	Paredes et al. (1999) / Ramírez et al. (2003) (sp = 18)	(Nakamura 2006) (sp = 23)	Uribe et al. (2013) (sp = 25)	Schrödl and Hooker (2014) (sp = 14)	This study (31 confirmed and 8 predicted = 39)
Doriopsis peruviana[a]	*Doris peruviana*	*Dendrodoris peruviana*	*Doris peruviana*	*Baptodoris peruviana*	*Baptodoris peruviana*	*Baptodoris? peruviana*	*Baptodoris peruviana*§
Diphyllidia cuvieri	*Pleurophyllidia cuvieri*			*Armina cuvieri*	*Armina californica*		*Armina californica*§
Phidiana natans[a]	*P. natans/Fiona pinnata*	*Phidiana natans*	*P. natans / Fiona pinnata*	*Fiona pinnata*	*Fiona pinnata*		*Fiona pinnata*§
Phidiana inca[a]	*Phidiana inca*	*Phidiana inca*	*Phidiana lottini*	*Phidiana lottini*	*Phidiana lottini*	*Phidiana lottini*	*Phidiana lottini*§
Glaucus distichoicus	*Glaucus distichoicus*		*Glaucus atlanticus*		*Glaucus atlanticus*		*Glaucus atlanticus*
	Doris punctuolata[b]	*Doris punctuolata*	*Anisodoris punctuolata*	*Diaulula punctuolata*			*Diaulula punctuolata*§
		Okenia luna[c]	*Okenia luna*	*Okenia luna*	*Okenia luna*	*Okenia luna*	*Okenia luna*
		*Cadlina? sparsa**	*Cadlina sparsa**	*Cadlina sparsa**			*Cadlina sparsa**
		*Rostanga pulchra**	*Rostanga pulchra***	*Rostanga pulchra***		*Rostanga pulchra***	*Rostanga pulchra*
			*Aeolidia serotina**	*Aeolidia serotina**			*Aeolidia campbellii**§
			Hypselodoris cf. *agassizzi*	*Hypselodoris agassizzi*	*Felimare agassizii*		*Felimare agassizii*§
			Flabellina cf. *falklandica**	*Flabellina falklandica*			*Itaxia falklandica**§
			Dendronotus frondosus	*Dendronotus frondosus*	*Dendronotus* cf. *venustus*		*Dendronotus venustus*§
			Doto cf. *uva*	*Doto uva*	*Doto uva*	*Doto uva*	*Doto uva*
			Polycera cf. *alabe*	*Polycera alabe*	*Polycera alabe*		*Polycera cf. alabe*
			Tyrinna evelinae	*Tyrinna evelinae*	*Tyrinna evelinae*		*Tyrinna delicata*
			Bajaeolus bertschi	*Bajaeolis bertschi*	*Bajaeolis bertschi*		*Bajaeolis bertschi*
			*Phylliroe lichtensteini**				*Phylliroe lichtensteinii**
				Flabellina cynara[d]	*Flabellina cynara*		*Kynaria cynara*§
				Glossodoris baumanni[d]	*Glossodoris baumanni*		*Felimida baumanni*§
				Cuthona sp[d]	*Cuthona* sp.		*Cuthona* sp.
				Doriopsilla janaina[d]	*Doriopsilla janaina*		*Doriopsilla janaina*
				Flabellina sp2[e]	*Flabellina cerverai*	*Flabellina* cf. *cerverai*	*Coryphellina cerverai*§
				*Gargamella immaculata**[f]			*Gargamella immaculata**
				Doris fontainei[g]	*Doris fontainei*	*Doris fontainei*	*Doris fontainii*§
					Corambe mancorensis[h]		*Corambe mancorensis*
					Diaulula variolata[i]	*Diaulula variolata*	*Diaulula variolata*
					Tyrinna nobilis[i]		*Tyrinna delicata*§
					Tritonia sp[i]		*Tritonia* sp.
					Spurilla cf. *neapolitana*[j]	*Spurilla braziliana*	*Spurilla braziliana*
				*Thecacera darwini**	*Thecacera darwini**	*Thecacera darwini**	*Thecacera darwini**
						Polycera priva[k]	*Polycera priva*
						Corambe lucea[k]	*Corambe lucea*
						Janolus rebeccae[k]	*Janolus rebeccae*
						Hancockia schoeferti[k]	*Hancockia schoeferti*
							Felimare sechurana[l]
							Cephalopyge trematoides[m]
							Glaucus sp.*[m]
							Phylliroe bucephala[m]

Table 4. Distribution of nudibranch species inhabiting Peruvian waters along several marine coastal biogeographic provinces

Legend: the asterisk (*) indicates that the species is predicted species for Peruvian waters

Families	Species	Magellanic	Pacific					Atlantic								
			Warm Temperate Southeastern Pacific	Tropical East Pacific	Warm Temperate Northeast Pacific	Cold Temperate Northeast Pacific	Galapagos	North Brazil Shelf	Tropical Northwestern Atlantic	Tropical Southwestern Atlantic	West African Transition	Warm Temperate Southwestern Atlantic	Lusitanian	Mediterranean Sea	Circumtropical	Cosmopolitan
Aeolidiidae	*Spurilla braziliana*		X	X	X				X	X						
	Aeolidia campbellii (*)	X	X													
Facelinidae	*Phidiana lottini*	X	X													
	Bajaeolis bertschi			X	X											
Glaucidae	*Glaucus atlanticus*		X	X	X		X		X	X				X	X	X
	Glaucus sp. (*)		X													
Arminidae	*Armina californica*			X	X	X										
Dendronotidae	*Dendronotus venustus*		X													
Dotidae	*Doto uva*	X	X									X				
Hancockiidae	*Hancockia schoeferti*	X	X													
Phylliroidae	*Cephalopyge trematoides*		X	X	X						X		X		X	
	Phylliroe bucephala		X	X					X				X	X	X	
	Phylliroe lichtensteinii (*)		X							X						X
Coryphellidae	*Itaxia falklandica* (*)	X	X									X				
Cuthonidae	*Cuthona* sp.	X		X												
Fionidae	*Fiona pinnata*		X													X
Flabellinidae	*Kynaria cynara*		X	X	X											
	Coryphellina cerverai		X	X												
Janolidae	*Janolus rebeccae*		X	X												
Tritoniidae	*Tritonia* sp.		X	X												
Cadlinidae	*Cadlina sparsa* (*)	X	X		X											
Chromodorididae	*Tyrinna delicata*	X	X													
	Felimare agassizii		X	X	X		X									
	Felimare sechurana			X												
	Felimida baumanni			X	X											
	Tyrinna evelinae			X	X											
Discodorididae	*Baptodoris peruviana*		X													
	Diaulula variolata	X	X													
	Diaulula punctuolata		X													
	Rostanga pulchra	X	X		X	X										
	Gargamella immaculata (*)	X	X													
Doridae	*Doris fontainii*	X	X													
Corambidae	*Corambe lucea*	X	X	X												
	Corambe mancorensis			X												
Goniodorididae	*Okenia luna*		X													
Dendrodorididae	*Doriopsilla janaina*			X	X		X									
Polyceridae	*Polycera priva*	X	X													
	Polycera cf. *alabe* (*)			X	X											
	Thecacera darwini (*)	X	X													

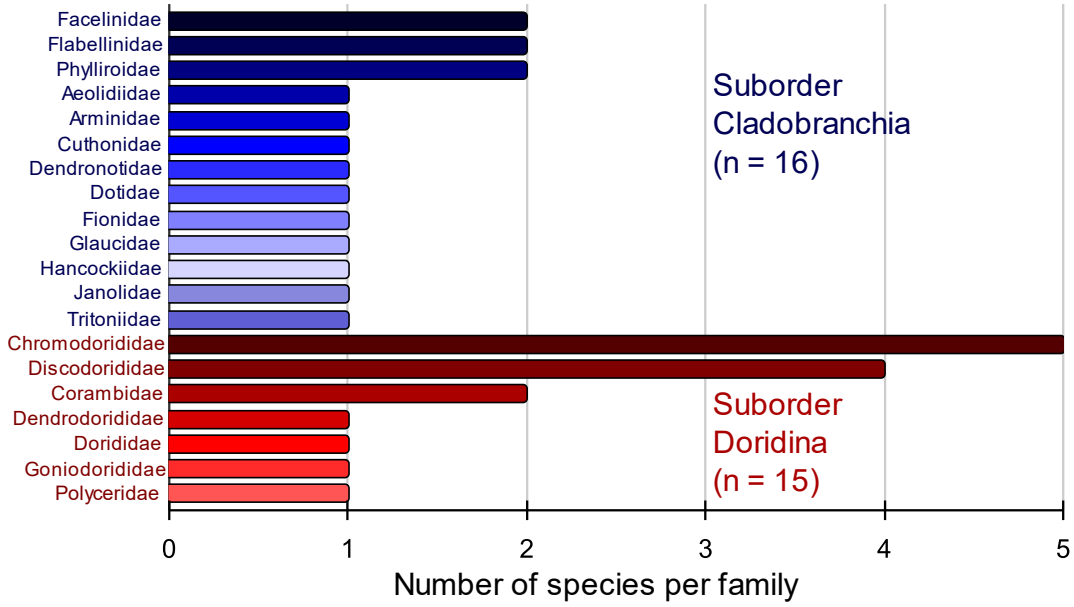

Figure 1. Number of species by family and suborder of Nudibranchia in Peruvian waters.

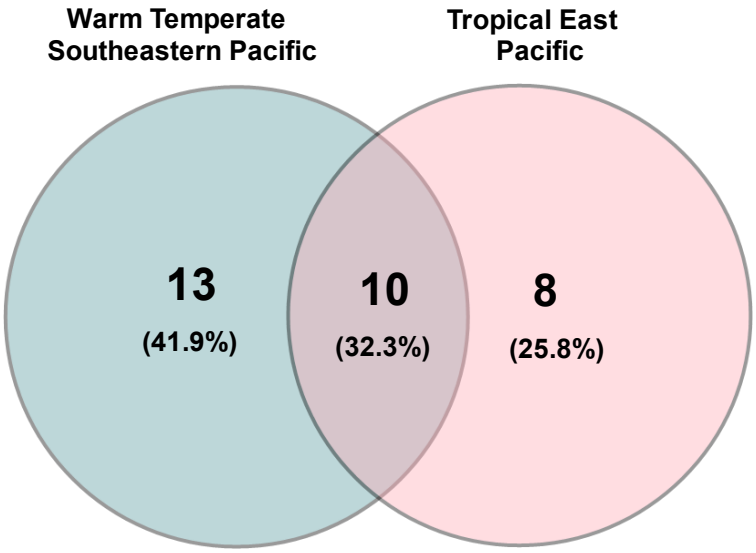

Figure 2. Venn diagram showing the number of species shared between the marine-coastal biogeographical provinces of Peru.

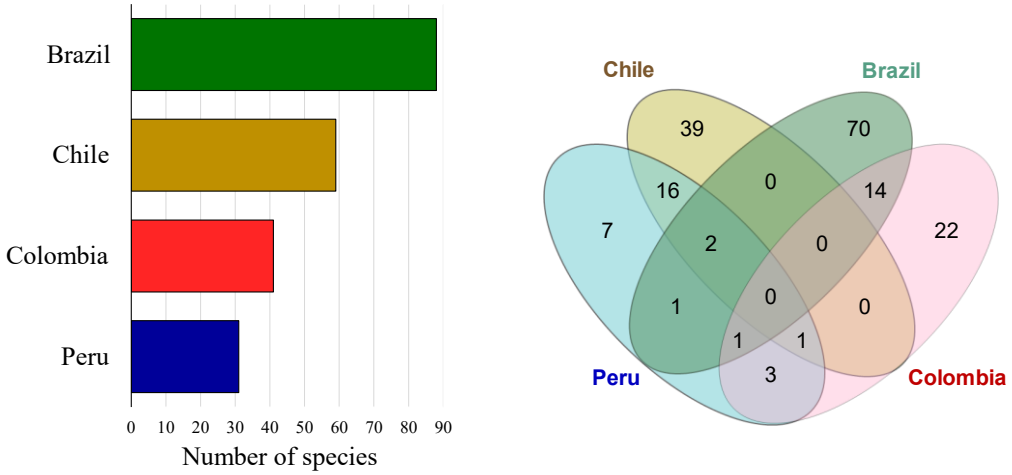

Figure 3. A Nudibranch species richness by country **B** Venn diagram showing the number of species in common between these countries. Only confirmed species are considered.

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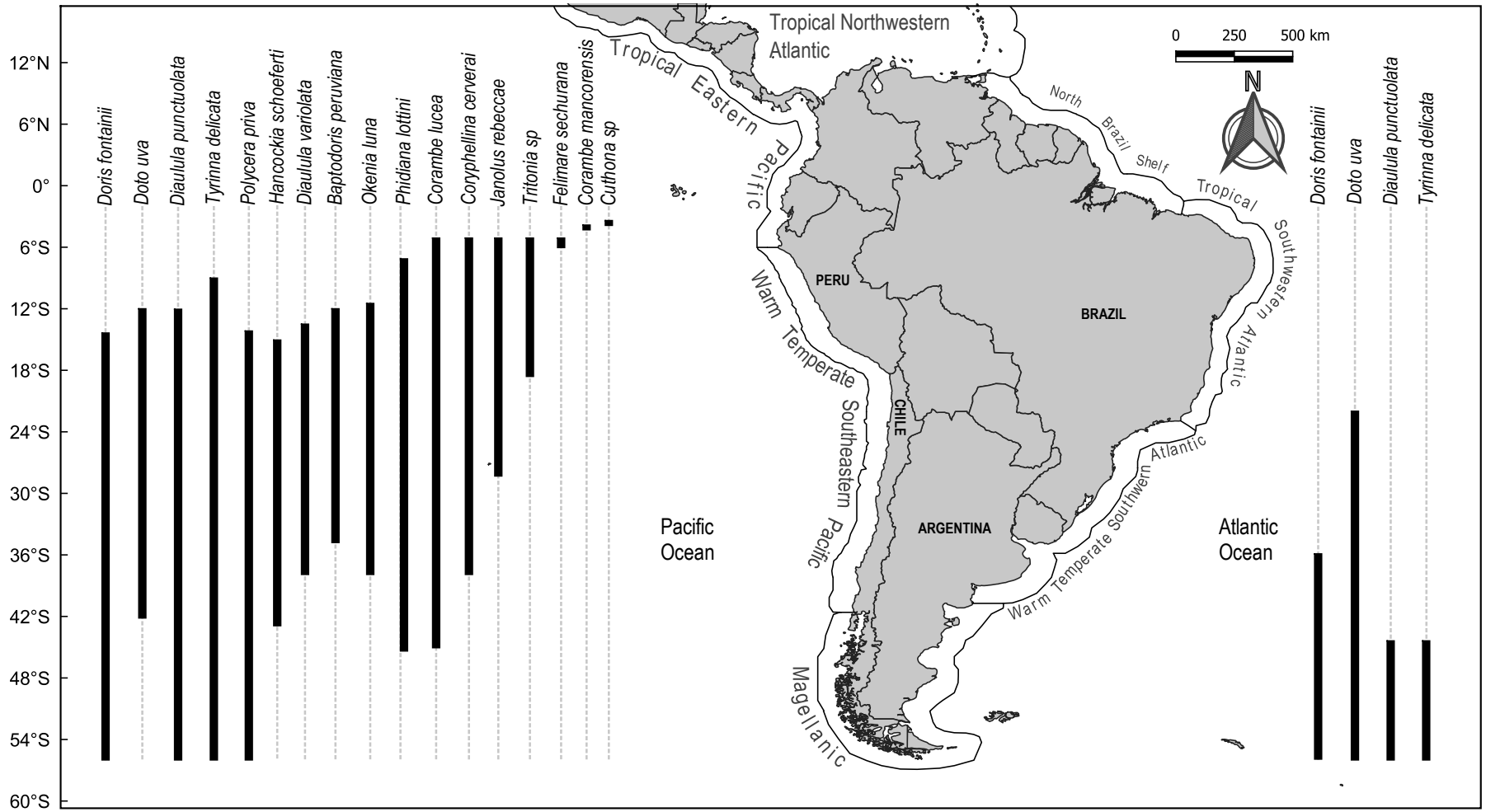

Figure 4. Distribution ranges of South American nudibranch species present in Peruvian waters in the context of the biogeographic classification according to Spalding et al. (2007).

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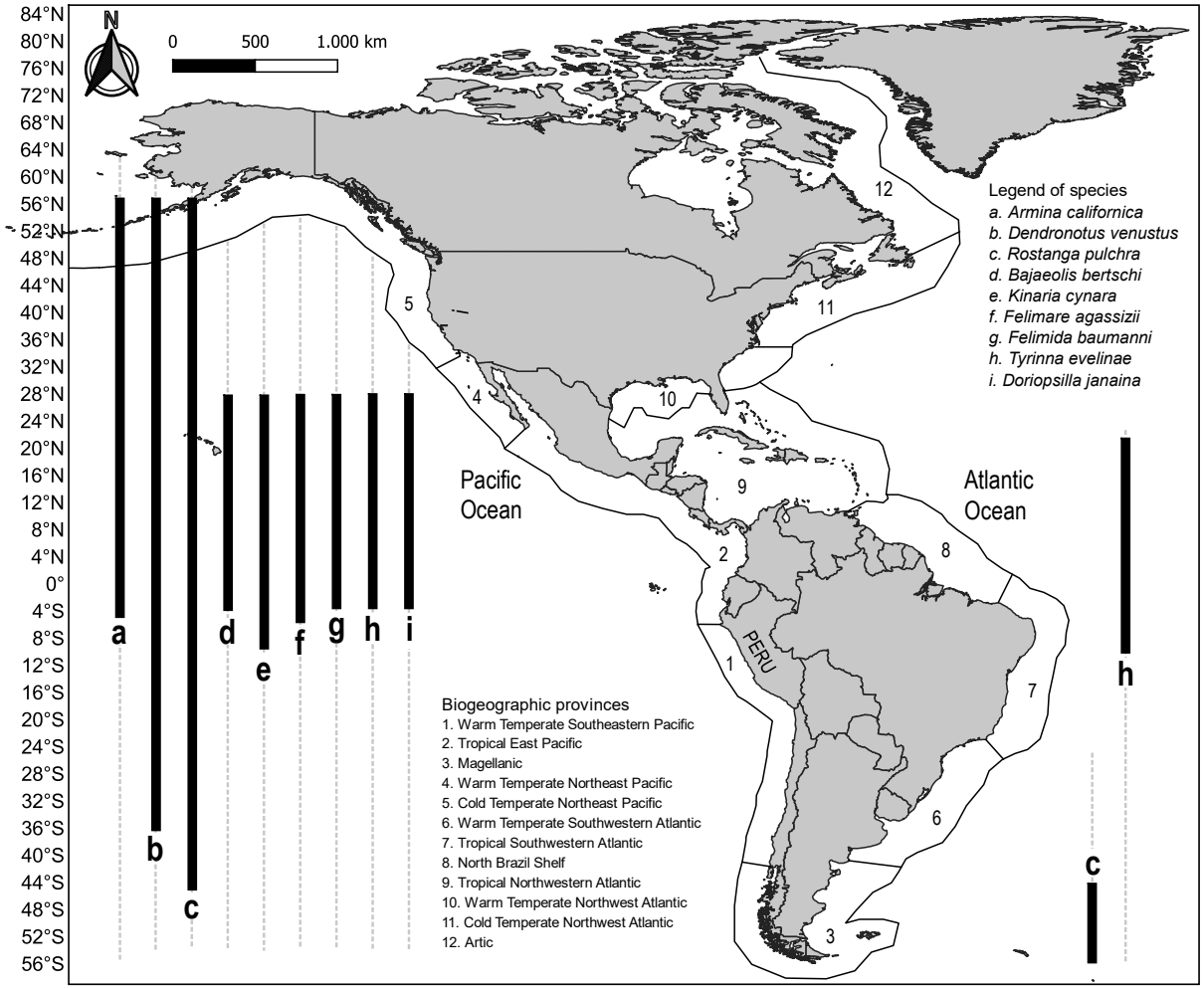


Figure 5. Distribution ranges of nudibranch species in the American continent present in Peruvian waters in the context of the biogeographic classification of Spalding et al. (2007).

Species confirmed in Peruvian waters

Spurilla braziliana

Habitat: Benthic

Depth: 0-10 m

Type material: Holotype CASIZ 019731 (Alagoas, Brazil) (Carmona et al. 2014).

Distribution: This species is distributed in the western Atlantic, from Florida to Brazil (Behrens and Hermosillo 2005; Marcus 1959) and in the Pacific.

Main collection points: On the western Pacific side, this species has been collected in Japan (Hamatani, 2000), China (Lin, 1992) and Australia (Willan, 2006) and in the Eastern Pacific in Baja California, Costa Rica, Colombia (Carmona et al. 2013) and Peru (Uribe et al. 2013; Uribe and Pacheco 2012). A specimen has also been collected from Hawaii (Gosliner 1979).

In Peru, this species was collected in Bahia Ferrol (Ancash) (Uribe and Pacheco 2012) and in Pucusana (Uribe et al. 2013) although initially reported as *Spurilla neapolitana.*

Remarks: Carmona et al. (2013), based on mitochondrial and nuclear sequences, showed that *Spurilla neapolitana* is actually a complex of five cryptic species, reserving the name *Spurilla braziliana* for western Atlantic and Pacific populations. Carmona et al. (2013) considered that its presence in the Pacific Ocean could be due to human introduction.

***Phidiana lottini* (Fig. 6)**

Habitat: Benthic

Depth: 0-15 m

Distribution: This species is distributed in the west coast of South America (Schrödl 1997) from northern Peru (7°42 'S) to Islas Guaitecas (43°52'S), south of Chile (Schrödl 2003; Schrödl and Hooker 2014).

Main collection points: In Peru, *P. lottini* was reported in Callao by d'Orbigny, (1835-1846) and Dall (1909). Recently, Uribe et al. (2013) reported specimens in Ancash (Isla Santa), Lima (Ancon, San Bartolo and Pucusana) and Ica (Marcona). Schrödl and Hooker (2014) also reported individuals in Pucusana and San Juan de Marcona, in addition to recording the species in La Punta (Callao). The record of Flores (2014) in Puerto Malabrigo (La Libertad) was the first occurrence of this species in that region. Valdivia-Chavez et al. (2020) presented the most recent report of this species in Arequipa.

Remarks: Initially identified as *Phidiana inca* (d'Orbigny 1835-1846) and cited by Alamo and Valdivieso (1997) until research by Schrödl (1997), who considered it conspecific with *Eolidia lottini*, proposing *P. lottini* as a valid name.

Bajaeolis bertschi

Habitat: Benthic

Depth: 3-8 m

Type material: Holotype CASIZ 059589, collected in Punta la Gringa, Baja California (Gosliner and Behrens 1986).

Distribution: From Bahía De Los Angeles, Baja California (28°N) to the north coast of Peru (4ºS) (Nakamura, 2006).

Main collection points: On the coast of Panama(8°N) (Camacho-García et al. 2005; Gosliner and Behrens 1986). In Peru, Nakamura (2006) reported the species in Playa Las

Pocitas and Mancora, Piura. Uribe et al. (2013) included an observation in El Rubio (Tumbes) based on a personal communication with Millen.

***Glaucus atlanticus* (Fig. 7)**

Habitat: Pelagic

Distribution: A cosmopolitan and circumtropical species (Churchill et al. 2014b; Thompson and McFarlane 1967).

Main collection points: Off the north coast of Chile (Schrödl 2003). On the coast of El Salvador(13°N) (Segovia and López 2015). In Peru, it was mentioned by Paredes et al. (1999) and Ramírez et al. (2003) based on the records of d'Orbigny (1854) in Callao (10º 15'S). Recently reported on Isla Santa, Ancash (9°01'S) by Uribe et al. (2013).

Remarks: Included in Paredes et al. (1999), probably based on a personal communication with Millen. The records of *Glaucus distichoicus* in Peru (d'Orbigny 1854; Dall 1909; Paredes et al. 1999; Ramírez et al. 2003) do not have enough evidence to formalize the species within the genus *Glaucus* and could refer to *G. atlanticus*.

Armina californica

Habitat: Benthic

Distribution: From the Gulf of Alaska (57ºN) (Baez et al. 2011) to Piura, Peru (Dall 1909).

Main collection points: Paita, Peru (Dall 1909)

Remarks: Reported in Paita, Piura (Dall 1909) under the name *Pleurophyllidia* (*Diphyllidia*) *cuvieri* and later considered as *Armina cuvieri*. However, *D. cuvieri* currently corresponds to *Armina tigrina*, a species from the Mediterranean Sea (Thompson et al. 1990). Nakamura (2006), based on Dall (1909), erroneously listed *A. californica* as *A. cuvieri*. Baez et al. (2011) examined samples of *Armina cuvieri* finding that there was an error in its identification, being actually *A. californica*. This correction is adopted in Uribe et al. (2013).

Dendronotus venustus

Habitat: Benthic

Distribution: From Alaska (57ºN) (Stout et al. 2010) to Bahía de Coliumo, Chile (36°32'S) (Schrödl 2003).

Main collection points: In Peru, Uribe et al. (2013) reported this species in Pucusana, Lima.

Remarks: Paredes et al. (1999) listed this species as *Dendronotus frondosus*, an Atlantic species (Ekimova et al. 2015), based on personal communication with Millen. It was confirmed that *D. frondosus* from Europe presents morphological and molecular differences with *D. venustus* (Stout et al. 2010; Ekimova et al. 2015) exclusively to the Pacific.

Doto uva

Habitat: Benthic

Depth: 0-15 m

Distribution: Amphi-South American. On the Pacific side of South America, it extends from Callao(12ºS) to Comau Fjord, Chile (42ºS) and on the Atlantic side from Patagonia to Sao Paulo, Brazil (21ºS) (Marcus, 1959).

Main collection points: In Peru, this species was collected in Callao, San Juan de Marcona, Islas Ballestas (Schrödl and Hooker 2014) and Bahía Independencia (Uribe et al. 2013). In Chile, it was collected in Tocopilla, La Herradura, Tongoy (Fischer and Cervera 2005b), Canal de Calbuco (Marcus 1959), Bahía de Coliumo (Schrödl 2003) and in Comau Fjord (Schrödl et al. 2005). In Brazil, it was collected in Sao Paulo (Marcus, 1959).

Remarks: Molecular studies are needed to clarify the genetic identity of populations on both sides of South America (Schrödl 2003; Uribe et al. 2013).

Hancockia schoeferti

Habitat: Benthic
Holotype: ZSM Moll 268555

Depth: 0-8 m

Distribution: From San Juan de Marcona, Peru (15°S) (Schrödl and Hooker 2014) to the south of Chile (43°S) (Schrödl 2009).

Main collection points: In Peru, eight specimens were collected in San Juan de Marcona, Ica (Schrödl and Hooker 2014). It was the first record of this species in Peruvian waters.

Cephalopyge trematoides

Habitat: Pelagic

Depth: 0-40 m

Distribution: Circumtropical pattern species (van der Spoel et al. 1997).

Main collection points: Reported in the Canary Islands and Cape Verde (Hernández et al. 2001, 2017), New South Wales (Steinberg 1956), Gulf of California (Fernández-Alamo 1997), and central and northern Chilean coast (Tokioka 1963). In Peru, Quesquen (2017) reported the species in Piura.

Remarks: Originally described as *Phylliroe trematoides*. The samples described in Quesquen (2017) were registered in gray literature (Quesquen 2008) and had previously registered in Quesquen and Guzmán (1999).

Phylliroe bucephala

Habitat: Pelagic

Depth: 0-60 m

Depth: Circumtropical species (van der Spoel et al. 1997).

Main collection points: Present in the Canary Islands (Hernández and Jiménez 1996), off the coast of Florida and Bermuda (Abott 1974), in northeastern Atlantic waters near the African coast (van der Spoel 1970) and the western Atlantic Ocean (Spencer et al. 2009). In the Mediterranean Sea there are reports in France and Syria (Durgham et al. 2016; Durgham and Ikhtiyar 2020; Pruvot-Fol 1954). South of the Pacific Ocean in Australia and New Zealand (Powell 1979; Spencer and Willan 1995). In the Indo-Pacific reported from Vietnam (Sachidhanandam et al. 2000). In Peru, Quesquen (2017) reported the species in Tumbes and Piura.

***Cuthona* sp.**

Habitat: Benthic

Depth: 5-7 m

Distribution: Specimen collected in Cancas (Tumbes, Peru) (03°56'S) by Nakamura (2006).

Remarks: Nakamura (2006) found a specimen of *Cuthona* sp. at 5 – 7 m depth. The author's description shows a length of 5 mm, body completely white, including rhinophores and oral tentacles with a translucent base. In addition, the specimen had dark reddish-brown cerata without the white tip, which would differentiate it from other species of the genus.

Fiona pinnata

Habitat: Benthic

Distribution: Cosmopolitan species (Gosliner 1987; Schmekel and Portmann 1982).

Main collection points: Reported in Chile in Mehuín, Valdivia (Fischer and Cervera 2005b), and in Islas Juan Fernández and caleta Tumbes, Talcahuano, central south zone (Bergh 1898). First reported in Peru by d'Orbigny (1835-1846) in Lima (Álamo and Valdivieso 1997; Dall 1909).

Remarks: Originally named *Eolidia pinnata* (type specimen from Alaska samples) (Eschscholtz 1831), until its final designation as *F. pinnata*, a species with a wide latitudinal range (Trickey 2013).

***Kynaria cynara* (Fig. 8)**

Habitat: Benthic

Depth: 5-8 m

Type material: USNM 678417, Bahía La Choya (31°20′30″N 113°38′06″W), Puerto Peñasco, Sonora, Mexico

Distribution: From Gulf of California, Mexico (28°N) (Millen and Hermosillo 2007) to Isla Tortuga, Peru (9ºS) (Uribe et al. 2013).

Main collection points: In Peru, the species was reported in Punta Sal (3°56'S), Cancas (3°56'S), Máncora (4°6'S), Chimbote (9°4'S) and Ancash (9°S) (Nakamura 2006; Uribe et al. 2013). It has recently been reported on Isla La Viuda (9°20′57″S) and Isla Tortuga (9°21′48″S) in Ancash (Uribe et al. 2019).

Remarks: The species was originally described as *Coryphella cynara* and reported along the Peruvian Han coast as *Flabellina cynara*, these designations are currently invalid and replaced by *K. cynara* (Korshunova et al. 2017).

Coryphellina cerverai

Habitat: Benthic

Depth: 0-10 m

Type material: RMNH Moll. 98130 (Chile)

Distribution: From Sechura, Perú (5ºS) to Bahía de Coliumo (36ºS), center of Chile.

Main collection points: Collected in Bahía de Coliumo, center of Chile (Schrödl 1996a) and in La Herradura, Coquimbo, north of Chile (Fischer et al. 2007). In Peru, the specimens reported in Ancon and Pucusana (Lima) as *Flabellina* sp.2 by Schrödl (1996a) coincide in morphological aspects with *C. cerverai*. The northernmost location for this

species is based on specimens collected at 6-10 m depth in Bahía de Sechura, Piura, by Schrödl and Hooker (2014).

Remarks: The species was first reported in Chile as *Flabellina cerverai* by Fischer et al. (2007), who also cite the finding by Schrödl (1996[a]) of *Flabellina* sp.2 specimens in Ancon and Pucusana (Lima, Peru) and discuss the coincidences in terms of external macroscopic morphology, radular anatomy, ceratal distribution and pattern of body coloration, which suggests its conspecificity.

***Janolus rebeccae* (Fig. 9)**

Habitat: Benthic

Depth: 2-10 m

Type material: ZSM 19960557 (Chile) in Bavarian State Collection of Zoology, Munich.

Distribution: From Bahía de Sechura, north of Peru (Schrödl and Hooker 2014), to Bahía Inglesa, north of Chile (27°07′51″S) (Schrödl 1996b, 2003).

Main collection points: In Peru, this species has been reported by Schrödl and Hooker (2014) in Paracas (Ica) and in Bahía de Sechura (Piura).

***Tritonia* sp.**

Habitat: Benthic

Depth: 5-15 m

Distribution: From Isla Foca, north of Peru, to Punta Picata (Tacna).

Main collection points: Isla Foca (Piura), Isla Santa, Bahía Ferrol, Punta Huaro, La Gramita, Casma, Colorado, Huarmey (Ancash), Pucusana and Asia, south of Lima; Bahía Independencia (Ica) and Punta Picata in Tacna (Uribe et al. 2013).

Remarks: Internally it is similar to *Tritonia odhneri* (Magallanes and northern central Chile) and in its external morphology it resembles *Tritonia festiva* (North Pacific: Alaska, Baja California, and Japan) (Uribe et al. 2013).

Tyrinna delicata

Habitat: Benthic

Depth: 22 m

Type material: NHMUK 1995038, Chile

Distribution: From Isla Blanca, Ancash, Peru (9°S) to Peninsula Valdés, Strait of Magellan, Chile (42°S) (Schrödl and Millen 2001; Uribe et al. 2013; Araya and Valdés 2016).

Main collection points: In Peru, this species has been reported in San Juan de Marcona (Ica) and Isla Blanca (Arequipa) (Uribe et al. 2013). There are reports of this species in Argentine waters, so its distribution is amphi-South American (GBIF, 2022).

Remarks: This species was initially cataloged as *Tyrinna nobilis*, until the rediscovery of its non-dissected holotype by Schrödl and Millen (2001), giving priority to *T. delicata*.

Felimare agassizii

Habitat: Benthic

Distribution: From the Gulf of California to the northern Peru.

Main collection points: Gulf of California (28°N), Panama (8°N), Galápagos Islands (0°S) in Ecuador and Malpelo Island (4°00'N) in Colombia (Behrens and Hermosillo 2005). In Peru, this species was reported in Cancas, Tumbes (3°56'S) and Isla Lobos de Tierra, Lambayeque (Uribe et al. 2013).

Remarks: Originally described as *Chromodoris agassizii* by Bergh (1894).

***Felimare sechurana* (Fig. 10)**

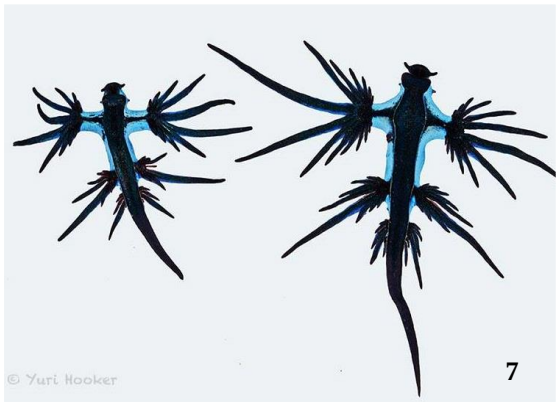
Habitat: Benthic

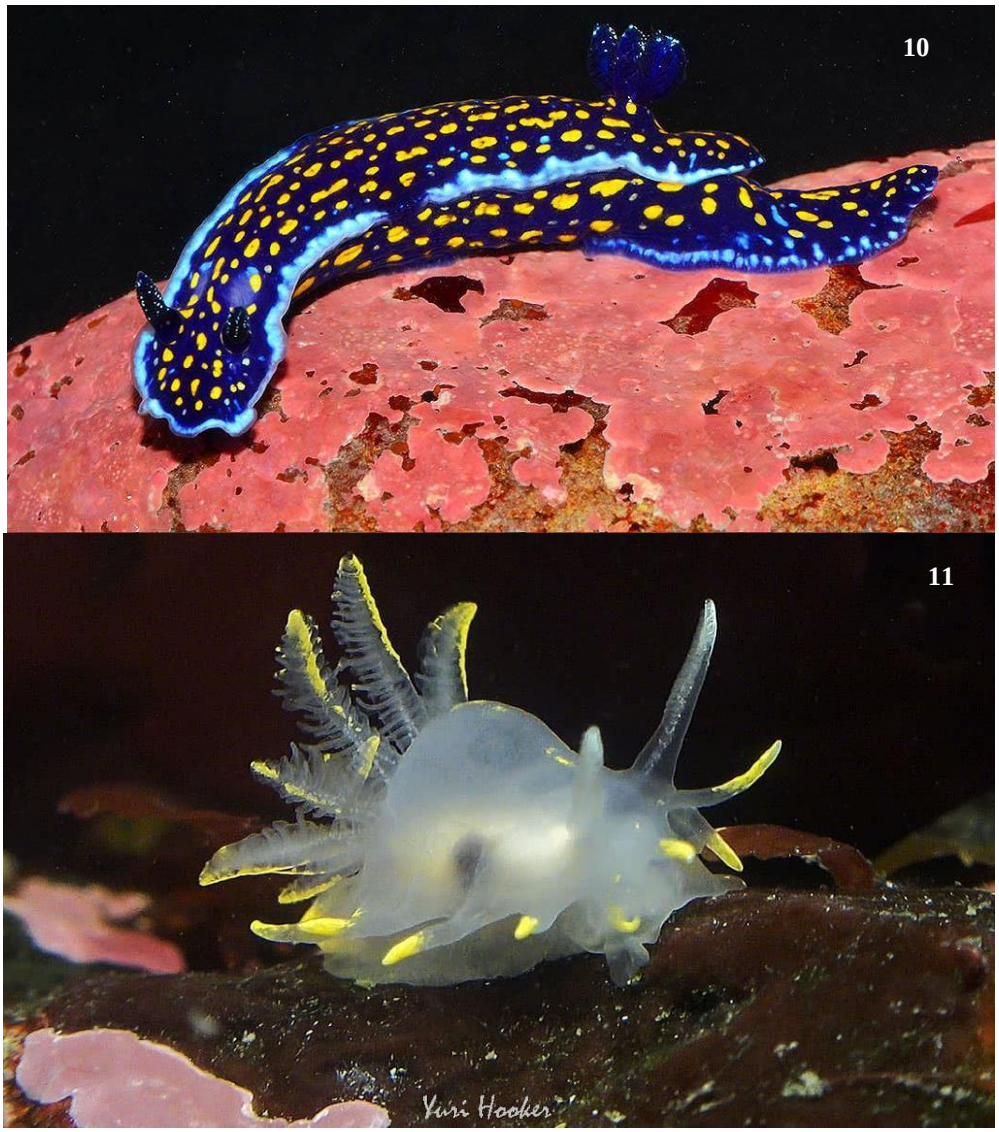
Type material: CZA 402 – Isla Foca (5°12'13.8" S, 81°12'38.0"W), Piura, Peru.

Distribution: Northern Peru.

Main collection points: Isla Foca, Piura (Hoover et al. 2017, 2018) and Islas Lobos de Afuera (6°S), Lambayeque (Bravo et al. 2020).

Remarks: This species is endemic to Peru. It was initially reported as *Felimare ghiselini* (Thompson, 2006), but later corrected by Hoover et al. (2017, 2018) and described as a new species.





Figures 6-11. 6. *Phidiana lottini*. **7.** *Glaucus atlanticus*. **8.** *Kynaria cynara*. **9.** *Janolus rebeccae*. **10.** *Felimare sechurana*. **11**. *Okenia luna* (Photos courtesy of Yuri Hooker)

Felimida baumanni

Habitat: Benthic

Depth: 5-8 m

Distribution: From Gulf of California (28°N) to Cancas (Tumbes, Peru).

Main collection points: Gulf of California (28°N), Panama (8°N), Galápagos Islands (0°S) Malpelo Islands, Colombia (4°00'N) (Behrens and Hermosillo 2005). The only report for Peru is by Nakamura (2006) in Cancas, Tumbes.

Remarks: The species has been reported in the past as *Glossodoris baumanni* (Nakamura 2006; Uribe et al. 2013) and *Chromodoris baummani*.

Tyrinna evelinae

Habitat: Benthic

Distribution: Amphi-american and West Africa.

Main collection points: Gulf of California (28°N) and Jamaica (Schrödl and Millen 2001). In the Atlantic it has been sampled in the Gulf of Mexico (de la Cruz-Francisco et

al. 2017), Panama (Goodheart et al. 2016), Brazil (Marcus 1958), Ghana and Cape Verde (Camacho-García et al. 2005). In Peru, this species has been reported at El Rubio (Tumbes, Peru) (Schrödl and Millen 2001)

Remarks: It was listed in Paredes et al. (1999), possibly through personal communication with Millen. According to Uribe et al. (2013) molecular studies are necessary to confirm the conspecificity of reports of *T. evelinae* in the Atlantic and Pacific populations that are morphologically hard to distinguish (Valdés et al. 2006).

Baptodoris peruviana

Habitat: Benthic

Depth: 4-15 m

Type material: ZMB 50748 (Isla Pajaros, northern Chile) deposited in Natural History Museum, Berlin.

Distribution: From San Lorenzo (12°S) in Peru (d'Orbigny 1835-1846) to Valparaíso (33°02'S), Chile (Dall 1909). In Peru it was reported for the first time on San Lorenzo Island by d'Orbigny (1835-1846). The most recent report for this species was from Pucusana, south of Lima (Schrödl 1996a).

Remarks: Initially reported as *Doris peruviana* (d'Orbigny 1835-1846), transferred to *Platydoris* by Schrödl (2003), who also includes Bergh (1898) description of *P. punctatella* as a junior synonym. Dorgan et al. (2002) ruled out that these reports were about a species belonging to *Platydoris*, based on a photograph of a live specimen (Schrödl 1996a). Finally, they compared doridoidea specimens from the Chilean coast with the type of material of *P. punctatella* and concluded the conspecificity of the reports and, based on the description of radular teeth, transferred them to the genus *Baptodoris*. Regarding its northernmost distribution, Fischer and Cervera (2005a) consider the records in the Galápagos Islands, Ecuador by Pilsbry and Vanatta (1902) as doubtful.

Diaulula variolata

Habitat: Benthic

Depth: 2-15 m

Distribution: From Ica (14°S), Peru to San Vicente (36°S), Chile (Fischer and Cervera 2005b, 2005a; Uribe et al. 2013). Multiple reports in Chile, in Bahía de Coquimbo by Bergh (1898); Marcus (1959) in Bahía de San Vicente and Punta Gualpén, in northern Chile; Schrödl (1996a) in Bahía Inglesa, Guanaqueros, Los Hornos and Bahía de Coliumo; Schrödl (1997) in Bahía Inglesa; Schrödl (2003) in Arica; Valdés and Muniaín (2003) in Coquimbo and Lota; in Valparaíso, Iquique (Fischer and Cervera 2005b). In Perú, this species is distributed in El Chaco, Caleta Atenas and San Juan de Marcona, in Ica (Schrödl and Hooker 2014). The study by Tejada-Pérez et al. (2018) presents the first record of this benthic species on the Arequipa coast, in Dos Playas and Calera, Islay province. Recently, in Valdivia-Chavez et al. (2020) is reported from samplings conducted between 2014 and 2019.

Diaulula punctuolata

Habitat: Benthic

Depth: 0-7 m

Type material: ZSM Moll 20040984, Isla Ipún (44° 33.1'S, 74°48.0'W), Aysén, Chile.

Distribution: Amphi-South American

Main collection points: Callao, Peru (Dall 1909), to the Strait of Magellan, Chile and Comodoro Rivadavia, Argentina (46°02'S, 67°35'W) (Schrödl 1996a).

Remarks: This species has been listed in the past as *Anisodoris punctuolata* and *Doris vestita* (Schrödl 1996a) both names being currently invalid.

Rostanga pulchra

Habitat: Benthic

Depth: 6-12 m

Type material: ZSM Moll 20040981, Isla Ipún (44° 33.1'S, 74° 48.0'W), Aysén, Chile

Distribution: This species presents a bipolar pattern in the Eastern Pacific and an amphi-South American pattern (Schrödl 2003; Schrödl and Grau 2006).

Main collection points: Specimens have been found in the North Pacific from Point Craven (57ºN, Alaska) (Lee and Foster 1985) to Bahía Los Ángeles (Mexico) (Lance 1966). In South America, specimens have been found in Bahía de Coliumo (Schrödl 2003; Schrödl and Grau 2006), Playa Brava (Marcus, 1959) and Isla Ipún (Chonos archipelago) (Schrödl 2003; Schrödl and Grau 2006) in the center of Chile. In Argentina, it was collected in Bahía Camarones, in central Argentina (Marcus and Marcus 1969).

Its distribution in Peruvian Waters was not certain, but it was listed by Álamo and Valdivieso (1997) and Paredes et al. (1999). It was considered a predicted species in Peru (Uribe et al. 2013) until the first specimen was finally reported in Punta San Juan (Marcona, Ica) (Schrödl and Hooker 2014). *R. pulchra* is the only species of the genus *Rostanga* in Peruvian and Chilean waters.

Remarks: Schrödl and Hooker (2014) mention that populations in the northern and southern hemispheres are likely to be different species based on preliminary unpublished molecular data.

Doris fontainii

Habitat: Benthic

Depth: 8-15 m

Type material: ZSM 19983417. Bahía de Coliumo (36°32'S, 72°57'W), Chile.

Distribución: Anfi-South American

Main collection points: In Chile it has been collected in Arica (Valdés and Muniaín, 2002; Schrödl 2003) and the Chonos Archipelago (Schrödl & Grau 2006). It has been sampled as far north to Argentina (Valdés and Muniaín, 2002)

In Peru it has been collected in Bahía Independencia, Ica (14º14'S) (Schrödl 1996, 2000b; Schrödl and Grau, 2006; Luque 2002; Uribe et al. 2013). Recently reported in Arequipa (Valdivia-Chavez et al. 2020).

Remarks: One specimen was collected in the San Fernando National Reserve, Ica, Peru (Ampuero, personal communication).

Corambe lucea

Habitat: Benthic

Type material: ZSM 1912 Caleta Buena (22°25' S, 70°15' O), Chile.

Depth: 0-27 m

Distribution: From Bahía de Sechura (5°S), northern Peru (Schrödl and Hooker 2014), to Golfo Corcovado, southern Chile (42°46'50''S, 73°12'10''W) (Schrödl 2009).

Main collection points: In Peru, this species has been reported in Bahía de Sechura, Piura; Callao; San Juan de Marcona and Paracas in Ica (Schrödl and Hooker 2014).

Remarks: In the past it was described as *Neocorambe lucea* (Schrödl 1996a).

Corambe mancorensis

Habitat: Benthic

Type material: ZSM 20080543. Máncora (4°6'36''S, 81°4'2''W), Piura, Peru.

Distribution: Species only reported off the coast of Máncora, in the department of Piura, northwestern Peru by Martynov et al. (2011).

Remarks: Endemic species of Peru.

Okenia luna (Fig. 11)

Habitat: Benthic

Depth: 0-12 m

Type material: California Academy of Sciences CASlZ 089293 Bahía Coliumo (36°32'S, 73°57'W), north of Concepción, Chile.

Distribution: From Bahía de Ancón (Lima, Peru) to Coliumo (Chile).

Main collection points: Bahía de Ancón (11º5'S) (Millen et al. 1994), Iquique (20°13'S) (Fischer 2006), Coliumo (36ºS), central Chile (Schrödl 2003).

Remarks: Species discovered in Peru, present in Chilean Waters. First *Okenia* species reported in the Southeast Pacific (Millen et al., 1994)

Doriopsilla janaina

Habitat: Benthic

Depth: 3 m

Type material: USNM 576269 Panama Canal (9°05′N 79°41′W), Panama

Distribution: From Gulf of California (28°N) to Cancas (3°56'S), northern Perú

Main collection points: Punta Lobos (23°16'N), Sonora (29°50'N), Mexico and Panama Canal (Pacific coast) (8°N) (Marcus and Marcus 1967); Galápagos Islands (0°S) (Gosliner 1991) and Cancas, Peru (3°56'S) (Nakamura 2006).

Polycera priva

Habitat: Benthic

Type material: ZSM Moll. 20041005 Punta Llonco, Comau Fjord (42°22′10″S 72°27′18″W), Chile

Depth: 15 m

Distribution: From Paracas Ica, Peru (14°06') (Schrödl and Hooker 2014) to Chilean Patagonia (54°S) (Schrödl 2009; Schrödl et al. 2005).

Remarks: Its report in Peru was surprising for the discoverers, since it was considered a predominantly Magellanic species, being very abundant in the fjords of southern Chile (41 - 44ºS) (Schrödl 1996a, 1999, 2003, 2009).

Predicted species in Peruvian waters

Thecacera darwini

Habitat: Benthic

Distribution: From Juan López, northern Chile, to Strait of Magellan (Schrödl 2003).

Remarks: This species was listed by Nakamura (2006) based on Schrödl (1999) who actually listed this species as present in the Peruvian province, referring to Chilean waters. Fischer and Cervera (2005b) support that this species has not been recorded off the Chilean coast, however, they emphasize the high probability that it is in Peruvian waters. Uribe et al. (2013) and Fischer (2006) cited to Zagal and Hermosilla (2001) who found this species in Peru. Schrödl (2003) mentioned that it was possible due to the oceanographic resemblance. Schrödl and Hooker (2014) pointed that this species is not found in Peru.

***Glaucus* sp.**

Habitat: Pelagic

Distribution: Peru

Main collection points: In Peru, Quesquen (2017) reported specimens twice off the coast of Ica in 1995 and 1998. Currently, the only valid species of the genus *Glaucus* is *G. atlanticus*, reported in Peru by Uribe et al. (2013) in Isla Santa, Ancash.

Remarks: Quesquen (2017) offered a description of the specimens collected in Ica, describing a navy blue and green back, with a white ventral area. In addition to this, they had three to four branches on both sides of the body, with a body length of up to 43 mm. A confirmation of the taxonomic status of these specimens is necessary, using morphological and molecular analyses.

Aeolidia campbellii

Habitat: Benthic

Type material: ZSM 20020700 (Chile), appointed as neotype due to absence of holotype (Kienberger et al. 2016).

Distribution: In South America, in the Falkland Islands (50°S) and from Argentine and Chilean Patagonia (41°S) to Valparaíso (32°S) (Schrödl 2003).

In Peru, this species was listed by Paredes et al. (1999) as *Aeolidia serotina* Bergh, 1873 and replicated by Ramírez et al. (2003)

Remarks: It was reported off the coast of Chile by Schrödl (2003) as *A. papillosa, later reassigned to the species A. campbelli*, according to molecular studies by Kienberger et al. (2016).

Gargamella immaculata

Habitat: Benthic

Type material: SMNH 1015 (Tierra del Fuego, Chile)

Distribution: It is a common species on the southern coast of Chile and Argentina.

Main collection points: Cabo Metalqui, Chiloé (Fischer and Cervera 2005b; Odhner 1926), in Última Esperanza, Tierra del Fuego (Marcus, 1959), in Cabo San Antonio; Cabo Delgado; Golfo de Ancud, between Isla Quenu and Calbuco; Schrödl Seno Otway, Queule and Bahía de Coliumo (Schrödl 1996a).

In Argentina: In the north (Bergh 1894; Odhner 1926), also in Argentine Patagonia and on the Burdwood Bank (Odhner 1926; Schrödl 2003).

Remarks: According to Schrödl (2003) the records in Peru by Zagal and Hermosilla (2001) are doubtful. However, in this compilation and in the most up-to-date (Zagal and Hermosilla 2007) *Gargamela immaculata* is not mentioned in Peruvian waters, but as an

inhabitant of the Peruvian zoogeographic province from Juan López (Atacama) to the south. The species was mistakenly included in Kentrodorididae by Schrödl (1996a), to Valdés (2002) who transferred it to the Discodorididae family, again.

Cadlina sparsa

Habitat: Benthic

Distribution*:* It presents disjunctive populations showing a bipolar distribution in the eastern Pacific and an amphi-South American pattern.

Main collection points: In the Pacific, the northernmost location is Baja California (Behrens 1991; Jaeckle 1983) and the southernmost location is the Comau Fjord in southern Chile. On the Atlantic side, it was recorded in Bahía Camarones in the central region of Argentina (Schrödl 2000, 2003). In Chile, it has also been sampled in the Juan Fernández Islands (Odhner 1922), Chiloé Islands (Marcus 1959) and Bahía de Coliumo (Schrödl 1996a, 2003).

Remarks: *Cadlina sparsa* was listed by Álamo and Valdivieso (1997) to be probably in Peruvian waters. The presence of this species persisted in Paredes et al. (1999), Ramírez et al. (2003) and Nakamura (2006). However, it has not yet been sampled in intermediate Pacific locations such as Peru. Assuming a hypothetical continuous geographic range, a Peruvian distribution has been predicted based on extrapolation (Uribe et al. 2013).

It was shown that *C. sparsa* does not belong to the family Chromodorididae (Johnson 2011) but to the family Cadlinidae. There are no updates on its scientific name. Taxonomy of the genera has been exhaustively described (Schrödl 2000).

Polycera* cf. *alabe

Habitat: Benthic

Type material: CASIZ 18190 Isla de Cedros, Baja California (28°12’13”N, 115°15’28”W), Mexico

Distribution: From Baja California (Behrens 2004; Behrens and Hermosillo, 2005; Camacho-García et al. 2005), Puerto Vallarta (20°40’N) in Mexico to Costa Rica (Behrens 2004); and northern Chile with a single isolated record (Schrödl 2003).

Remarks: In Peru, this species was listed as *Polycera* cf. *alabe* by Paredes et al. (1999) possibly by personal communication with Millen. It was listed later by Uribe et al. (2013) based on personal communication with Millen, who observed this species at El Rubio (Tumbes).

Phylliroe lichtensteinii

Habitat: Pelagic

Distribution: Cosmopolitan species (Padula, 2015).

Main collection points: Espiritu Santo, Southeast of Brazil (Ralph, 1959).

Remarks: For Peru, the species is listed in the publication Ramírez et al. (2003). There are no reports of collection of this species in Peruvian waters.

Itaxia falklandica

Habitat: Benthic

Depth: 2 m

Distribution: Abundant in the Magellanic Province, in the Southeast Pacific (Aldea et al. 2011; Velasco-Charpentier et al. 2021) and with records in the South (Eliot 1907; Odhner 1926, 1944), Pacific (Marcus 1959; Meyers-Muñoz et al. 2009; Schrödl 1996a, 2003) and Indian Ocean (Odhner, 1944).

Remarks: It was included in the list of molluscs of Peru by Paredes et al. (1999) as *Flabellina falklandica*, information replicated in Ramírez et al. (2003).

According to Uribe et al. (2013) its presence in Peru requires confirmation since the inclusion by Paredes et al. (1999) relied on unfounded approximations.

Discussion

Comprehensive knowledge of biodiversity requires effective taxonomy at the species level. Precisely, cataloging through lists becomes essential for biodiversity because simplifies taxonomic review, allows the design of conservation plans, and provides relevant scientific publications (Silveira et al. 2010).

This work summarizes the nudibranchs of Peru. The updated scientific names of various species are pointed out. In addition, we want to highlight and warn the presence of no confirmed species but erroneously enlisted in the literature, referred here as predicted, which would inflate the actual species richness of nudibranchs in Peru.

Even though the Peruvian sea comprises two well differentiated coastal-marine biogeographic provinces and an in-between transition zone (Schrödl and Hooker 2014; Ibanez-Erquiaga et al. 2018, Barahona et al. 2019) the species diversity of nudibranchs species is low (Table 1) in comparison with other latitudes such as the Gulf of Mexico, the Caribbean, the South Atlantic, the Indian Ocean and the Mediterranean Sea (Behrens 2004; Chavanich et al. 2013). In South American, neighboring countries such as Colombia (n > 40) (Ardila et al. 2007; Londoño-Cruz, 2021), Chile (n > 50) (Schrödl 1996a, 1999, 2003; Fischer and Cervera 2005b; Schrödl et al. 2005; Schrödl and Grau 2006; Aldea et al. 2011) and Brazil (n > 80) (Marcus and Marcus 1969; Padula et al. 2011; Pereira et al. 2012; Padula 2015) host a greater number of nudibranch species (Figs 3A, 3B).

The fact that there are "unexplored areas" along the Peruvian coast must be considered. Within the Tropical Eastern Pacific, only a limited points have been sampled. Within the Tropical Eastern Pacific, the points samples were Pocitas, Punta Sal, Mancora and Cancas. Within the transition zone, Sechura and Isla Foca have been sampled, and within the Warm Temperate Southeastern Pacific, only certain coastal points such as Santa, Casma, Huarmey (Ancash), Ancon, Callao, Isla San Lorenzo, Pucusana (Lima), Pisco, Bahía Independencia, Marcona (Ica), Matarani and Isla Blanca (Arequipa). Collection gaps between sampling sites or poor exploration may be caused by a combination of factors such as low sampling effort and challenging areas to dive. The absence of nudibranch taxonomist and a general lack of interest in this group in Peru are also noteworthy factors. Furthermore, a plethora of species are also likely to remain unreported and undescribed, mainly at deeper waters. Therefore, the number of nudibranchs confirmed in Peruvian waters (n = 31) stands for only a fraction of the real diversity.

Biogeography and influence of the Humboldt Current and El Niño

Various confirmed species have a biogeographical affinity for the Warm Temperate Southeastern Pacific (n = 23). Humboldt current is an important oceanographic factor since various species from the Chilean sea, nineteen of them with Magellanic influence, reach Peruvian waters (species in common). *Phidiana lottini*, collected in Callao and Puerto Malabrigo, may reach tropical waters due to the influence of the Humboldt Current (Uribe et al. 2013). *Polycera priva* report in Peru was surprising for the authors, considering that this species is Magellanic and endemic to the Patagonian fjords (Schrödl 1996a, 1999, 2003, 2009). Therefore, its Peruvian presence is attributed to the influence of the Humboldt Current (Schrödl 1996a, 1999, 2003, 2009) (Schrödl and Hooker 2014). The species *Corambe lucea*, *Coryphellina cerverai*, *Janolus rebeccae* and *Tritonia* sp.,

collected in the Warm Temperate Southeastern Pacific province, have been collected in Bahía de Sechura and Isla Foca, in the middle of the biogeographical transition zone, suggesting an adaptation to slightly warmer waters (Fig. 4).

El Niño may lead to shifts in sea slugs' distribution ranges (Goddard et al. 2018) and even cause a species turnover (Valqui et al. 2021). In fact, species of mollusks endemic of tropical areas have reached Peruvian waters during strong El Niño events due to the displacement of warm water masses (Velez and Zeballos 1985; Paredes et al. 1998; Ramírez et al. 2003). The nudibranch species *Cuthona* sp., *Armina californica*, *Felimida baumanni*, *Felimare agassizii*, *Tyrinna evelinae* and *Bajaeolis bertschi*, typical of the Tropical Eastern Pacific province, have been sampled only in Tumbes (Figs. 4 and 5), meaning that their presence may be only temporary due to the displacement of water masses, or may have become permanent through adaptation to similar conditions after several El Niño events (Ashton et al. 2008). Further sampling effort is needed in this area to assess this hypothesis.

The distribution of cosmopolitan and circumglobal species can be explained by biological factors such as their high dispersal potential. For example, *Glaucus atlanticus* exhibits interesting dispersal adaptations, such as the larval gas bubble or its specialized anatomy to exploit the water surface tension (Thompson and McFarlane 1967; Valdés and Angulo 2004, Churchill et al. 2014a). Furthermore, abiotic factors such as ocean currents (Miller, 1993) and indirect human intervention, e.g., buoy rafting (Astudillo et al. 2009), ballast water or ships, can increase the dispersal of these species, extending their geographic distributions.

Predicted species

Predicted species are those unconfirmed by collections to date but have been included in earlier lists (Table 3). They are, therefore, problematic because they have persisted and may persist in upcoming nudibranch lists. The most representative case is *Cadlina sparsa*. This species was listed by Alamo and Valdivieso (1997), but the authors specified it as probable. However, it persisted and was listed by Paredes et al. (1999), Ramírez et al. (2003) and Nakamura (2006) without mentioning that its presence was only probable. Uribe et al. (2013) commented about its predicted distribution for Peruvian Waters based on extrapolation assuming a continuous distribution, since it inhabits Baja California and Chile.

Paredes et al. (1999) included, through personal communication with Millen, the species *Aeolidia campbellii* (as *Aeolidia serotina*) and *Itaxia falklandica* (as *Flabellina falklandica*), which persisted in the lists of Nakamura (2006) and Ramírez et al. (2003) respectively. However, no further reports have been published to support them. Ramírez et al. (2003) also included the species *Phylliroe lichtensteinii* without mentioning any justification. On the other hand, the species *Gargamella immaculata* and *Thecacera darwini* were erroneously listed as present in Peruvian waters by Nakamura (2006) citing Schrödl (1999). However, this author placed both species in a table as present in the 'zoogeographic Peruvian province' referring to the fact that they were present in Chilean waters corresponding to this biogeographical province, but not in Peruvian waters. Despite the abovementioned, the possibility of future collections cannot be discarded. For example, *R. pulchra* has been a predicted species for Peru for many years until its first report in San Juan de Marcona (Ica) (Schrödl and Hooker 2014). *Phylliroe lichtensteinii* is a cosmopolitan species, so its Peruvian presence is likely to be confirmed in future

collections. Fischer and Cervera (2005b) consider *Thecacera darwini* to be highly likely to be present in Peruvian waters.

Identification uncertainties

The genus *Polycera* exhibits a remarkable variability in coloration which seems to be correlated to the geographic range (Behrens and Hermosillo 2005). A genetic study found clades with overlapping ranges in the Northeastern Pacific, strongly suggesting a species complex (Santander and Valdés 2013). One year later, a morphology-based study conducted by Pola et al. (2014) found that specimens previously collected by Camacho-García et al. (2005) in Costa Rica, Panama and Mexico are actually a new species, *Polycera anae*. Since *P. alabe* is only a species "observed" by Millen in Tumbes, it is possible that it was actually another species of Polycera, e.g., *P. anae*, since it is a species complex (Santander and Valdés 2013).

Glaucus sp., reported by Quesquen (2017), needs to be verified by molecular methods. Currently, in the genus *Glaucus*, only the species *G. atlanticus* has been confirmed since many of the records turned out to be synonyms (*G. distichoicus*) or were incorporated into the genus *Glaucilla*. In the same way with the reports of *Tritonia* sp. and *Cuthona* sp., which have yet to be recognized at the species level.

This work contributes to the dissemination and diffusion of this groups of organisms, poorly studied in Peru. Monitoring needs to be intensified to appreciate changes over time and assess man-driven impacts as well as displacements caused by El Niño. In addition, because of the challenging external morphological identification of their members given their frequent plasticity in coloration and cryptic species, a plethora species may still remain undiscovered. For this reason, detailed internal anatomy and molecular tools-based studies such as DNA barcodes and phylogenetic analyses are urgently needed.

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