

First record of *Spurilla neapolitana* (Mollusca: Nudibranchia: Aeolidiidae) on the central coast of Peru (Humboldt Current Upwelling Ecosystem)

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Members of the genus Spurilla are nudibranchs with circumtropical distribution. Spurilla neapolitana is reported for the first time inhabiting subtidal soft-bottom habitats of the central coast of Peru. Adult specimens were found in Bahía Ferrol (09°04'S 78°35'W) at 10 m depth in November of 2009. Spurilla neapolitana is characterized by the presence of a long body with numerous cerata along the dorsal side of the body and a distinctive orange colouring with white dots. This finding extends the geographical range of Spurilla spp. into the south-eastern Pacific and adds a new contribution to the macro-mollusc diversity thriving in the Humboldt Current Upwelling Ecosystem.

Keywords: nudibranchs, range extension, Bahía Ferrol, Ancash, sea slug

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INTRODUCTION

The northern area of the Humboldt Current Upwelling Ecosystem (HCUE) in front of the Peruvian coast (3°23'–10°21'S; Chavez *et al.*, 2008) holds a unique marine biodiversity due to the spatial heterogeneity of the coastline and the complex oceanographic characteristics, especially the oscillating conditions produced by the occurrence of the warm El Niño and cold La Niña events (Paredes *et al.*, 1998, 2004; Tarazona *et al.*, 2003). The diversity of marine molluscs in this region is composed of species of tropical, subtropical and Antarctic origin, resulting in a rich endemic fauna and a high number of species (Ramírez *et al.*, 2003; Tarazona *et al.*, 2003). Although many species have been compiled and reported (see reviews in Alamo & Valdivieso, 1997; Ramírez *et al.*, 2003), the information is often skewed towards reports of macro gastropods, bivalves and cephalopods with distinctive morphological characteristics (e.g. shell, valves or peaks) while some groups such as nudibranchs (Gastropoda, Nudibranchia) have received very little attention and the available information is scarce.

Even though their colourful and striking morphology may be appealing for taxonomic work, the current status of the number of species and distribution of nudibranchs on the coast of Peru is restricted to a few locations with the main research emphasis having been focused on the northern coast. Nakamura (2006, 2007) registered a total of 54 species on the Peruvian coast

with 17 species recorded exclusively in the northern area (~3°S). Recently a new species of the genus *Corambe* has been described in the northern region (Martynov *et al.*, 2011). Clearly, much more information from the central and southern coast (approximately 2500 km of coastline) is necessary for fully understanding the diversity and composition of nudibranchs in this highly productive upwelling ecosystem.

Spurilla neapolitana Delle Chiaje, 1823 is a nudibranch of the Aeolidiidae family with circumtropical distribution, thriving from the middle intertidal down to 80 m depth (Reed & Mikkelsen, 1987). This species can be found in rocky substratum among crevices and underneath boulders (Bertsch & Kerstitch, 1984), soft bottoms and kelp forest invertebrate communities (Rodríguez *et al.*, 2003). It preys on sea anemones, consuming the oral disc and tentacles (García & Cervera, 1985; Schlesinger *et al.*, 2009) and also serves as a prey item of crustaceans, star fish and a few predatory gastropods (Reed & Mikkelsen, 1987).

In this study we report the presence of *S. neapolitana* for the first time in Bahía Ferrol, a location within the HCUE of the central coast of Peru. A brief description of the external morphology is presented.

MATERIALS AND METHODS

Two specimens of *Spurilla neapolitana* were collected in November 2009 at Hueco de la Vela (09°04'S 78°35'W) within Bahía Ferrol on the central coast of Peru (Figure 1). The samples were taken during a stock assessment of the scallop *Argopecten purpuratus* (Lamarck, 1819) population, conducted by IMARPE (Instituto del Mar del Peru,

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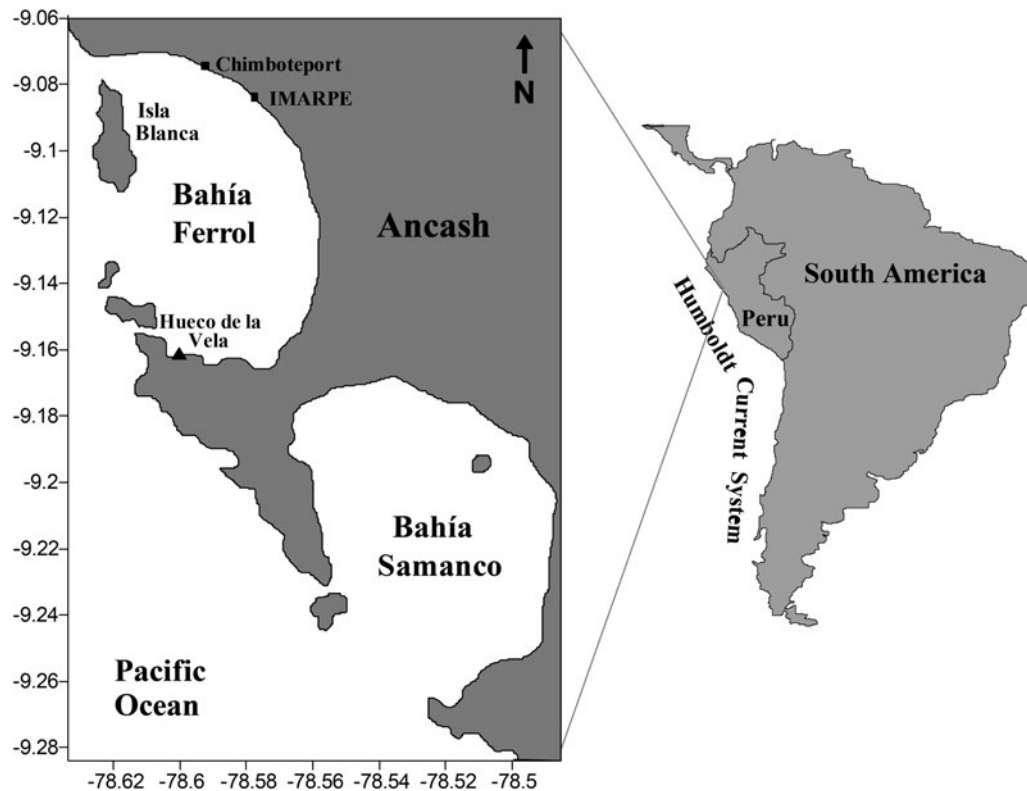


Fig. 1. Map of Bahía Ferrol, located at the coast of Ancash, Peru. The triangle indicates the location where *S. neapolitana* were collected.

Peruvian Sea Research Institute). During the assessment the scallop population size is surveyed using randomly distributed sampling points ($N = 15$) covering the entire seabed area ($\sim 280,000 \text{ m}^2$). At each sampling point a hooka diver placed a 1-m^2 quadrat on the bottom, observing the epibenthos inside the quadrat and the surrounding marked area, and then all the biota within the quadrat was collected and stored in plastic bags. In addition, depth was recorded and water samples for measurements of bottom temperature and dissolved oxygen were taken using a Niskin bottle. Individuals of *S. neapolitana* were observed in the surrounding area outside a sampling quadrat and collected separately. In the laboratory, live animals were maintained in a seawater aquarium in order to take photographs and make observations. Length measurements were taken with a caliper of 0.1-mm precision and wet weight (0.01 g). Thereafter, the samples were fixed in 10% formalin solution and preserved in 70% alcohol. The sample was deposited in the marine specimens collection of the Laboratorio Costero de Chimbote (IMARPE laboratory no. 4.11.2009.MN1-LCCH).

RESULTS

Habitat

Spurilla neapolitana was found at 10 m depth with a water temperature of 15.7°C and 1.50 ml/l dissolved oxygen. The sediment comprised a mix of sand-gravel and shell pieces. The epibenthic community was dominated by the tube building polychaete *Diopatra rizhoicola*, red algae *Rhodomyenia* sp., scallops *Argopecten purpuratus* and predatory crabs

Platyxanthus cokeri and *Cancer setosus*. In addition, small white anemones were observed and likely served as food for the sea slug (Bigger, 1980; García & Cervera, 1985).

Diagnosis

The total length of the adult *S. neapolitana* was 85.5 mm and weighed 3.58 g. The body is long with an intense orange colouring and white spots along the dorsal line (Figure 2A). Distinguishing this species (García & Cervera, 1985; Domínguez *et al.*, 2008) are the perfoliate rhinophores with 18 lamella horizontally alternating, one over the other. The general yellowish and light-brown coloration gives a dark appearance to the rhinophores (Figure 2B). Oral tentacles are thin, short and rounded, translucent with white tips deployed at both sides of the mouth (Figure 2B). The oral palps are rough. The cerata are long, gross and flat closer to the tip (Figure 2B). There are between eight and 12 ceratal arcs in each side of the body. The second ceratal arc shows 60 cerata at each side. Larger cerata are located in the middle of the arc while short cerata are present in the arc extreme. The apex of the cerata is curved towards the dorsal middle line. Cerata are translucent with white spots. The brownish digestive gland can be observed through the cerata (Figure 2B). The pericardium is located in the first and second ceratal group (García & Cervera, 1985). The genital opening is on the right side of the body located below the first arc and the anus is located below the second group. The tail is short and translucent. The foot is wide, of light-orange colour. The hepatic branches look like fine trusses of dark colour. The coloration of *S. neapolitana* varies depending on the habitat and feeding type and food composition,

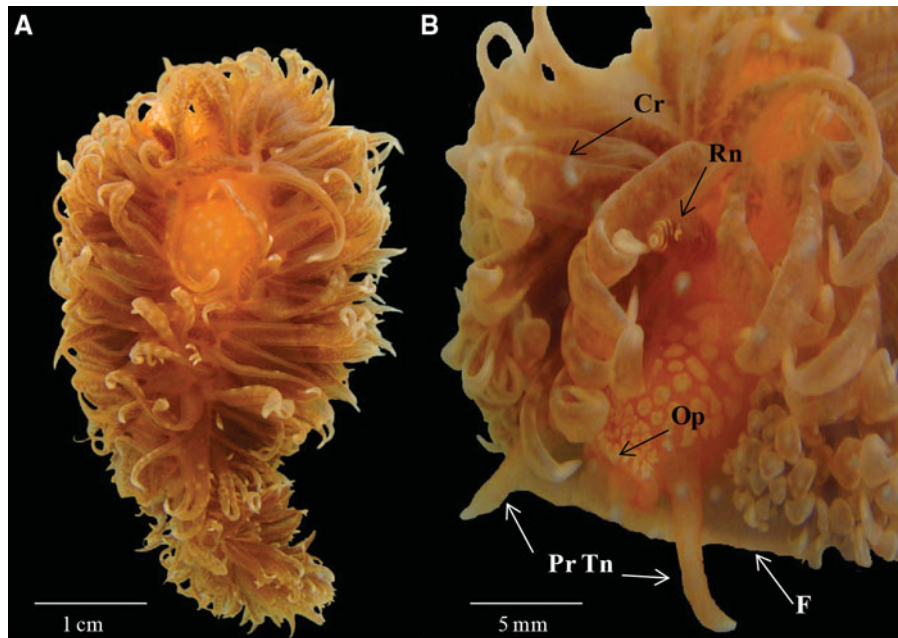


Fig. 2. *Spurilla neapolitana* (A) Dorsal view; (B) anterior view. Cr: cerata, Rn: rhinophore, Op: oral palps, Pr Tn: propodial tentacles, F: foot.

however, the yellow-orange and white dotted pattern is distinctive in most of the reported individuals (Haefelfinger, 1969; García & Cervera, 1985; Just & Edmunds, 1985).

DISCUSSION

Taxonomic remarks

The genera *Spurilla*, *Berghia* and *Aeolidiella* are distinctive for having more cerata compared with other nudibranchia species (Gosliner *et al.*, 2007). *Spurilla neapolitana* shows external similarities to *S. chromosoma* (Cockerell & Eliot, 1905; Rudman, 1999). Both species show the dorsal part with a white dotted pattern, curved and translucent cerata with dark colouring and a white dotted pattern (García & Cervera, 1985). However, *S. chromosoma* shows cerata lines in the anterior region of the body and rhinophores with few lamella diagonally arranged, while *S. neapolitana* shows ceratal arcs in a horseshoe shape and the perfoliated rhinophore are completed transversal (Domínguez *et al.*, 2008).

Distributional remarks

Spurilla neapolitana (Delle Chiaje, 1841) shows a circumtropical distribution (Bertsch, 2010) and it has been reported in several areas in the Mediterranean Sea, eastern/western Atlantic Ocean and a few places in the Pacific Ocean (Table 1). Despite its wide distribution, *S. neapolitana* is often reported thriving in warm waters or locations with strong seasonal changes in the oceanographic conditions. Here we report this species in the central coast of Peru, a region that even though it is at low latitude and closer to the equator, the presence of a cold, nutrient rich upwelling process resembles more a temperate region. Interestingly, the diversity of nudibranchs along the Peru–Chile coastline has been better described in ecotone areas such as the

transition from the cold upwelling to the warm Equatorial province in northern Peru (Nakamura, 2006, 2007) or in the transition from the upwelling to the Magellanic province in southern Chile (Schrödl, 2003). Whether transitional areas are more diverse in terms of nudibranch species is still a

Table 1. World distribution of *Spurilla neapolitana* Delle Chiaje, 1841, including sampling zone of the material study.

Region	Locality	Reference
Mediterranean Sea	Estrecho de Gibraltar	Ros (1975)
	Cataluña and Baleaas, Spain	Ros (1975)
	Barcelona, Spain	García & Cervera (1985)
	Tarento, Italy	García & Cervera (1985)
	Turkey	Marcus & Marcus (1966)
Eastern Atlantic	Adriatic Sea	Marcus & Marcus (1966)
	Israel coast	Schlesinger <i>et al.</i> (2009)
	Tarifa and Huelva, Spain	García & Cervera (1985)
	France	Just & Edmunds (1985)
	Morocco	Just & Edmunds (1985)
	Senegal	Marcus & Marcus (1962)
Western Atlantic	Cabo Verde and Canarias Island	Marcus & Marcus (1962)
	Guinea Gulf	Marcus & Marcus (1966)
	Laguna Indian River	Mikkelsen <i>et al.</i> (1995)
	Florida	Reed & Mikkelsen (1987)
	Golfo de México	Marcus & Marcus (1966)
Pacific	Jamaica	Marcus & Marcus (1966)
	Tayrona, Colombia	Ardila <i>et al.</i> (2007)
	Río de Janeiro and Bahía, Brazil	Domínguez <i>et al.</i> (2008)
	Argentina	Schrödl (2003)
	Oahu, Hawaii	Gosliner (1979)
	Baja California del Sur, Mexico	Bertsch & Kerstitch (1984)
	Golfo de California, Mexico	Bertsch (1979)
	Punta Arenas, Costa Rica	Rodríguez <i>et al.</i> (2003)
Ancash, Perú	This study	

matter of further study, our knowledge about nudibranchs diversity will improve when more information coming from the core area of the upwelling system is available. The record of *S. neapolitana* adds support to the predictions of Gosliner (1991) and Schrödl (2003) for findings of more nudibranch species in the region.

While this report extends the distribution range of *S. neapolitana* into the south-east Pacific, it is difficult to determine the source location of this species. Research effort on nudibranchs is poor in the area, so it is possible that this species and others may be overlooked during surveys of benthic organisms. However, there are other processes influencing the marine benthic biota composition in the region that must be taken into account. During strong El Niño events, many mollusc species extend their distributional range towards high latitudes due to the intrusion of equatorial transporting larvae and adults from the equator down to central and southern Chile (e.g. Paredes *et al.*, 1998, 2004). Some species may stay even longer at specific locations with suitable conditions for survival after El Niño events (e.g. Ashton *et al.*, 2008). During upwelling conditions, larvae transport from high latitudes towards the equator is due to the predominant northward direction of the Humboldt Current (Tarazona *et al.*, 2003). Also, a great amount of invertebrates including nudibranchs can be transported through rafting (Astudillo *et al.*, 2009) which may explain the local presence of several species with disjoint geographical distribution (e.g. Castilla & Guíñez, 2000; Pacheco & Laudien, 2008).

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