



SHORT COMMUNICATION OPEN ACCESS

Occurrence of *Phyllariopsis brevipes* (C. Agardh) E.C. Henry & G.R. South 1987 in the Gulf of Naples

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ABSTRACT

The first record of the kelp species *Phyllariopsis brevipes* in the Campania Region (Tyrrhenian Sea, South Italy) is here reported. The species has been observed in October 2021 in four sites along Sorrento Peninsula and Capri Island coast during scuba diving surveys. *P. brevipes* grew on living thalli of crustose coralline algae from 32 up to 55 m depth, occasionally forming dense aggregations with a maximum cover of about 0.2 m². The DNA barcoding analysis on the basis of the *cox1* gene supported the identification, with 98.36% of similarity between the sample collected in this study (NCBI accession number: [PP622796](#)) and a sequence obtained from a specimen from Provence, Mediterranean France (NCBI accession number: [GQ368264](#)). The study area can be considered a stepping stone for the species dispersion. The occurrence of *P. brevipes* can be related to upwelling and good water quality and the monitoring of its health status might be a sentinel of environmental changes.

1 | Introduction

Kelp forests inhabit subtidal shallow and deep rocky reefs in temperate and polar seas, supporting crucial ecosystem services for coastal areas (Araújo et al. 2016). In the Mediterranean Sea, kelps are represented by the families Laminariaceae Bory, 1827, Alariaceae Setchell & N. L. Gardner and Phyllariaceae Tilden, 1935, for a total of six species: *Laminaria ochroleuca* Bachelot-Pylaie, 1824, and *L. rodriguezii* Bornet, 1888, for the first family, *Undaria pinnatifida* (Harvey) Suringar, 1873, for the second, *Phyllariopsis brevipes* (C. Agardh) E. C. Henry & G. R. South, 1987, *Phyllariopsis purpurascens* (C. Agardh)

E. C. Henry & G. R. South, 1987, and *Saccorhiza polyschides* (Lightfoot) Batters, 1902, for the latter. *P. brevipes* is characterized by a rounded entire blade of about 50 cm length, a thin and short stipe (2–5 cm), basal, reniform sporangial sorus, and holdfasts with short unbranched haptera (Cormaci et al. 2012). The species grows in subtidal rocky reefs in the presence of cold water, strong currents, and upwelling conditions (Cormaci et al. 2012; Flores-Moya 2012; Tempera et al. 2021). Along the Italian coastline, this species is uncommon as it has been recorded only in Tuscany (Piazzi, Pardi, and Cinelli 1995), Sicily (Catra et al. 2006; Cormaci et al. 2012), and Sardinia Regions (Marino, Pizzuto, and Serio 1998; Cossu et al. 2009). We report

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the first records of *P. brevipes* in the Campania region (South Italy), where kelps have never been found.

2 | Material and Methods

2.1 | Study Area

In October 2021, during a survey carried out by SCUBA diving in the framework of a project on Marine Protected Areas effectiveness along the coast of Campania region, southern Tyrrhenian Sea, several macroalgal specimens were identified in the field and photographed. Among these species, *Phyllariopsis brevipes* has been recorded. The records of this species are located in four sites on the southern side of the Gulf of Naples: two sites along Sorrento Peninsula (A, B) and two along Capri Island (C, D) (Figure 1).

2.2 | Samples Collection and Analysis

On September 2023, we collected a single individual (size 7.4 cm from the holdfast) at site B at 35 m depth. A fragment of the blade without epiphytes has been cut and preserved in RNA later for genetic barcoding. DNA was extracted with the commercial Nucleospin Plant II kit (Macherey-Nagel Duren, Germany) and diluted 1:100 for PCR reactions. Two fragments of the mitochondrial barcode *cox1* (=COI) gene were amplified using the primer pairs GAZF2/GAZR2 (Lane, Lindstrom, and Saunders 2007) and *cox1*-789F/*cox1*-1378R (Silberfeld et al. 2010) according to the original publication and sequenced in a SeqStudio Genetic Analyzer automated sequencer at CCMAR, Portugal. Sequences were trimmed, proofread, concatenated in Geneious Prime 2020 (<http://www.geneious.com>) and blasted against the NCBI database (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>).

3 | Results

At each site, the species grows on living thalli of crustose coralline algae on vertical/sub-vertical substrate at depths ranging between 32 and 40 m (sites A, B, and C), or down to 55 m (site D). Individuals are mostly interspersed but they can form aggregates reaching about 0.2 m² of coverage (Figure 2).

The two fragments produced a concatenated sequence of 1156 bp that was deposited in Genbank under the accession number: PP622796. Its best match was the sequence with the accession number: GQ368264, accounting for 98.36% of similarity (99.13% when ignoring unknown N positions) and corresponding to *Phyllariopsis brevipes cox1* sequence (from Port-Cros, Provence, France) deposited so far in the database. An alignment revealed 10 single mutations between our sequence and GQ368264.

4 | Conclusions

The *cox1* sequence supports the taxonomic identification of these algae as *Phyllariopsis brevipes* carried in situ. Despite the small size compared with other kelps species, *P. brevipes* creates an important canopy in the rocky subtidal reefs (Tempera et al. 2021), increasing the three-dimensional complexity of the habitat and thus supporting local biodiversity and functioning (Bertocci et al. 2015; Teagle, Moore, and Smale 2017). Its presence in the study area is likely related to the occurrence of strong currents and upwelling (De Ruggiero et al. 2018). Considering its ecological constraints and its high sensitivity to stress and anthropogenic disturbances in coralligenous formations (Montefalcone et al. 2017), *P. brevipes* can be considered a sentinel species under climate change scenarios. Its scattered distribution in Italian seas suggests that Campania region might represent an

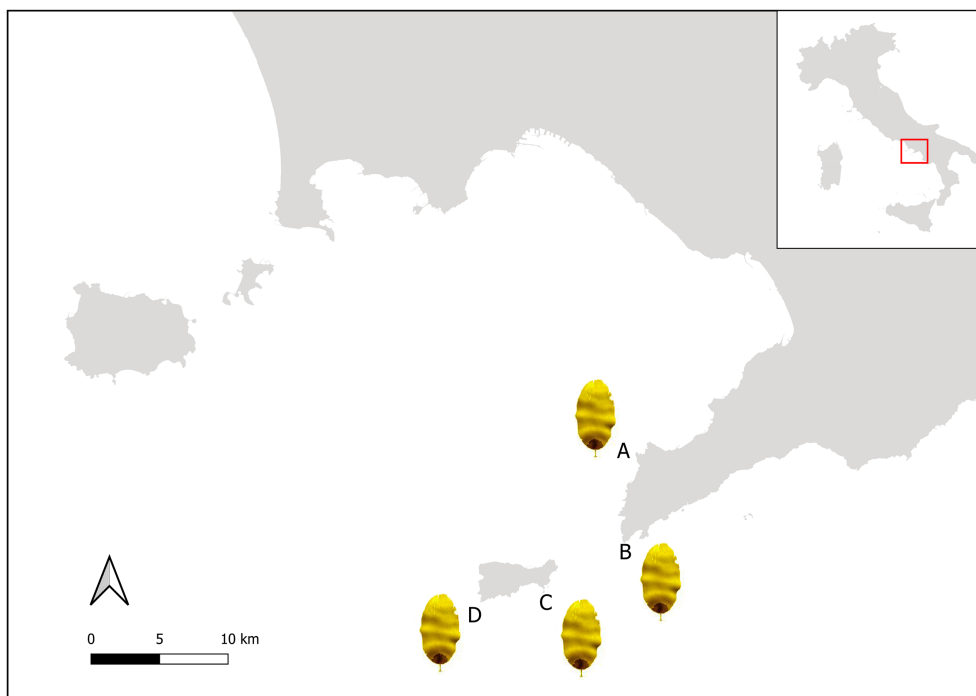


FIGURE 1 | Sites distribution of *Phyllariopsis brevipes* records.

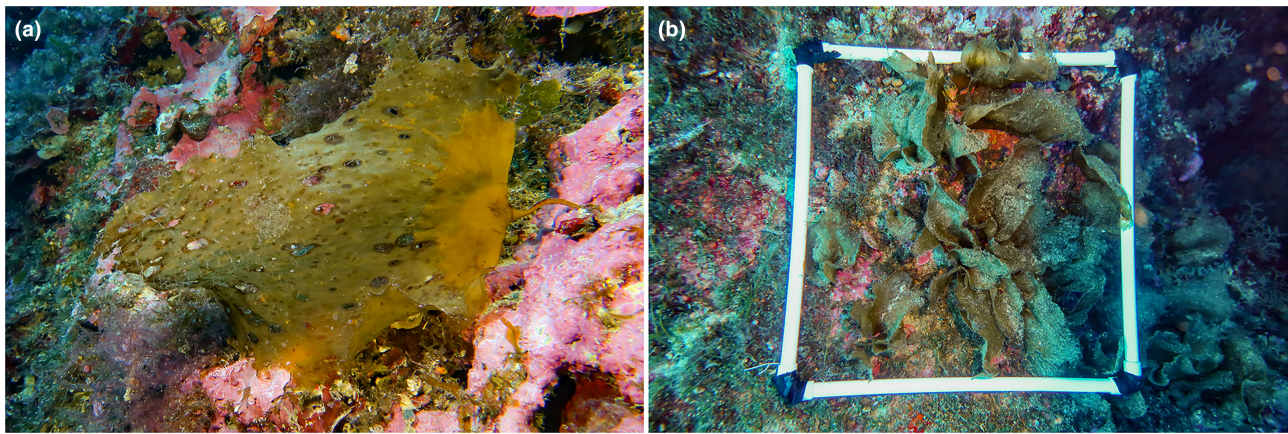


FIGURE 2 | *Phyllariopsis brevipes* specimens at site B (a) and high substrate coverage within a 50×50 cm plot at site D (b).

important “stepping stone” for species dispersion and long-term regional persistence. In Italy, local population extinctions have been documented in the Strait of Messina (Cormaci et al. 2012) highlighting the importance of baseline data and long-term monitoring for its conservation.

It should be noted that the sequence here obtained and the one deposited in Genbank from Port-Cros differ for 10 nucleotides. Intra-specific variability of *cox1* is basically unassessed in Phyllariacean kelps, but the level of differentiation is appreciable by *Laminaria* spp. and furoid algae (e.g., *Cystoseira sensu lato*.) standards (e.g., Bringloe and Saunders 2018; Neiva et al. 2023). Data are very limited, and in-depth genetic analysis is needed to assess how genetically distinct is the Campanian population compared with populations from other Mediterranean locations.

Author Contributions

Alberto Colletti and Simonetta Frascchetti contributed to the study conception. Alberto Colletti, Antonia Chiarore, Sara De Benedictis, Erika Fabbrizzi, Giulio Franzitta, Luca Licciardi, Simone Musumeci, and Chiara Silvestrini support the field activity and data collection. João Neiva carried out the genetic analysis. All authors wrote the first draft of the manuscript and read and approved the final manuscript.

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Ethical Statement

All applicable international, national and/or institutional guidelines for the survey of organisms for the study have been followed.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All relevant data are within the paper, but further data can be obtained from the authors of the study by contacting the corresponding author. The *cox1* sequence was deposited in Genbank.

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