Research paper

Diversity of nudibranchs in shallow water habitats in the region of Tromsø, northern Norway

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Baseline data on the distribution of marine species is crucial to be able to address biogeographical patterns and to monitor changes in species occurrences in marine systems. Nudibranch mollusks have proved to be useful bioindicators for monitoring shifts in distribution and have received much attention by the scientific community in recent years. Being positioned in a zoogeographic transition zone between boreal and Arctic regions, northern Norway is an important area for detecting and tracking early distributional shifts. Despite this, no comprehensive knowledge on current biodiversity and distribution of nudibranchs exists from the region. This work presents, for the first time, an annotated and illustrated inventory of nudibranchs in shallow water habitats of the Tromsø region in northern Norway. In total, 49 different nudibranch species or taxa belonging to 19 different families were recorded during the time period May 2020 – December 2023. Compared to occurrence data from literature records and online data sources, 31 species are here reported from the region for the first time. In addition, northern range extensions are presented for a significant part of the Norwegian nudibranch fauna. By documenting current biodiversity and distribution the present study hopes to serve as a baseline for studies focused on monitoring biodiversity in the Arctic region in the future.

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INTRODUCTION

Nudibranchs constitute an important and diverse group of soft-bodied marine gastropod mollusks. Most nudibranchs have planktotrophic larvae (Thompson 1967; Todd 1991), short life cycles (Todd 1981; Davies 1993) and high thermal sensitivity (Clarke 1975) and can therefore respond quickly to changes in environmental conditions. These life history traits make nudibranchs valuable bioindicators of ocean climate (Goddard *et al.* 2016; Garner & Oosthuizen 2023). Consequently, several studies have reported on distributional shifts of nudibranchs in response to ocean warming (Padula *et al.* 2011; Goddard *et al.* 2018; Nimbs & Smith 2018). Before it is possible to address biogeographical patterns, and to monitor changes in the distribution of species, it is of crucial importance to have a comprehensive documentation of present distributions. Such baseline knowledge is an essential prerequisite for identifying future range extensions and to make predictions about future changes to marine ecosystems. Although efforts to document local and regional nudibranch faunas around the world has increased greatly in recent years (e.g. Evertsen & Bakken 2002, 2005, 2013; Cervera *et al.* 2004; Martynov *et al.* 2006; Garcia & Bertsch 2009; Shields 2009; Chavanich *et al.* 2013; Bertsch 2014; Crocetta *et al.* 2015; Chichvarkhin 2016; Furfaro & Mariottini 2016; Nimbs & Smith 2016; Tibiriçá *et al.* 2017; Ah-Shee-Tee *et al.* 2019; Undap *et al.* 2019; Furfaro *et al.* 2020; Vadher *et al.* 2020; Dharmawan *et al.* 2021; Lombardo & Marletta 2021; Mehrota *et al.* 2021; Nithyanandan *et al.* 2021; Sabdono *et al.* 2021; Chow *et al.* 2022; Riccardi *et al.* 2022; Salvador *et al.* 2022; Toma *et al.* 2022; Cunha *et al.* 2023; Garner & Oosthuizen 2023; Grández *et al.* 2023), information from northern Norway is largely lacking. While the first published records of nudibranchs from northern Norway came already in the 18th century (Gunnerus 1770), more comprehensive knowledge from the region is sparse. The first overview from the area noted only four different species (Lovén 1846). Later, Norwegian marine zoologist Michael Sars was able to bring the total up to 14 species, but nevertheless concluded that nudibranchs seemed to be

very species-poor group in the region (Sars 1850). During the mid- to late 19th century, additional records from marine expeditions (e.g. Sars 1850, 1859; Danielssen 1861; Sparre-Schneider 1885; Krause 1895) increased the knowledge. More detailed information emerged during the first half of the 20th century, where the works by zoologists Nils Hjalmar Odhner (Odhner 1907, 1922, 1926, 1929, 1939) and Carl Dons (Dons 1942a, 1942b, 1942c) were instrumental. It was, however, not until the 1980`s when observations from the literature were compiled and published for the northern North Atlantic region (Platts 1985) and Norway (Høisæter 1986, Høisæter *et al.* 1997). The first dedicated field effort to examine the nudibranch fauna of northern Norway came as late as the early 21st century (Evertsen & Bakken 2002). The nudibranch fauna was then investigated, using SCUBA diving, and a total of 24 different nudibranch taxa were recorded from northern Norway (Evertsen & Bakken 2002). Following this field investigation, an extensive review of the diversity and distribution of nudibranchs in Norway was published by the same authors (Evertsen & Bakken 2005). Their work presented a revised review based on all available literature and listed 81 different species in Norwegian waters. The most recent Norwegian Red List for Species listed 89 different species (Artsdatabanken 2021). While no updated overview has been published since 2005, new discoveries and taxonomic advances have uncovered numerous new taxa during the last two decades. For example, hidden diversity in cryptic species have become increasingly revealed by DNA barcoding (Bickford *et al.* 2006), and new features for diagnosing and distinguishing closely related species have become available. This has dramatically increased the knowledge on nudibranch diversity in Norwegian waters (Korshunova *et al.* 2017a, 2017b, 2017c, 2020a, 2020b, 2020c, 2023a, 2023b; Sørensen *et al.* 2020; Descôteaux *et al.* 2021; Martinsson *et al.* 2021; Neuhaus *et al.* 2021; Broms *et al.* 2023). Thus, in the most recently updated source "Species online" (Bakken *et al.* 2024a), 125 different nudibranch species are currently listed as occurring in Norway. However, despite increased attention by the scientific community no comprehensive information on the nudibranch fauna of northern Norway exist. The present contribution aims to fill this gap in the knowledge, and presents for the first time, an annotated and illustrated inventory of the shallow water nudibranch fauna of the Tromsø region. By providing a synthesis of the current knowledge on the nudibranch fauna in the Tromsø region, the aim of this work is to serve as a baseline for studies focused on tracking changes in diversity and distribution of nudibranchs in the future.

MATERIAL AND METHODS

Study area and sampling localities

The study area is situated in the vicinity of the city of Tromsø in northern Norway between ca 69°N 17°E and 70°N 19°E (Figure 1). The area consists of a coastal archipelago with complex topography influenced by the Norwegian coastal current (NCC) (Sætre & Mork 1981). Close to the coasts and in the fjords local climatic processes are increasingly important (Eilertsen & Skarðhamar 2006). Sea surface water temperatures in the area vary from ca 2-4°C in winter to ca 12-15 °C in late summer (Hegseth *et al.* 1995). Thus, ice free conditions are maintained throughout the year except for sheltered localities and the inner parts of fjords which may be ice-covered during winter. Material for the study was collected around the islands of Tromsøya and Kvaløya from May 2020 to December 2023 (Figure 1). Four different intertidal localities and eight different fouling community localities were visited at all seasons of the year over the length of the study period. Intertidal localities included both soft-, mixed- and rocky bottom shorelines with varying degree of large or small boulders covered with macro algae (Table 1). Fouling community localities included artificial hard substrates such as floating docks and permanent structures in small harbours and marinas. Localities included both sheltered and current-exposed localities (Table 1). In addition, single or multiple visits to other localities, henceforth referred to as spot localities, also contributed to the records.

Sampling Methodology

All sampling was conducted from land and was restricted to very shallow waters. Intertidal zone localities were visited during low tide. Localities were systematically investigated by visually searching transects parallel to the shore. Transects were approximately 200 m long both on mudflat and/or rocky shore stretches. Substrates along this zone was visually investigated by walking along the *Ascophyllum nodosum* belt and searching for animals and spawn on the algae, rocks and bottom substrate in a 2 – 5 m wide belt. No other sampling tools than the hands were used. All nudibranchs, spawn as well as relevant ecological information was noted. Macro algae from the *Fucus vesiculosus* Linnaeus, 1753 belt down to the *Fucus serratus* Linnaeus, 1753 belt were examined with the main effort being concentrated on the mid- intertidal zone. Smaller stones and crevices in the rock were examined on rocky shores, and where rocks were present, along mudflats. At rocky and mixed bottom localities, empty bivalve shells, maerl and small stones were also investigated. Localities were visited both during day and night during the study period. At fouling community localities, ca 20 – 30 m long transects along both sides (where possible) of floating jetties were investigated from land. This was done by visually searching the upper 50 cm (including macro algae attached to docks) for nudibranchs. Depending on the locality, bare surfaces as well as existing fouling organisms along the jetties were investigated approximately every 4 m of the transect. Macro algae were gently investigated on both sides of the blades. Ropes or other debris found submerged along the transects were investigated by turning these around and visually searching for nudibranchs before returning them as they were found. At both intertidal and fouling communities, 1.0 – 3.5 hours long inventories were conducted which is in excess of what has previously been demonstrated to be sufficient time for adequate assessment of diversity and species numbers of nudibranchs in intertidal assemblages (Nybakken 1978). During the polar night period (27 November – 15 January) or during night-time visits to the localities outside the midnight sun period (18 May – 25 July) a Nitecore MH40GT and a Orcatorch D850 torchlight was used for illumination. For animals possible to identify without closer inspection, animals were identified *in situ*. When closer examination was required, animals were carefully picked by hand and transferred back to the laboratory

Material examined

For each species observed during the field inventory a small subset of specimens were picked out for detailed examination. These specimens, presented under the heading "Material examined" in the Results section, were collected individually by hand *in situ*. They were then brought back to the laboratory where they were identified (see the following section), measured (Risso-Dominguez 1963) and photographed *ex situ*. Species identification was performed using a Zenith MBS-10 and a Neo Zoom 7-45x trinocular stereo microscope. Live animals were photographed using a Nikon D4s DSLR camera with an AF Micro-Nikkor 105 mm 1:2.8 D macro lens. In a few cases, specimen examination was carried out *in situ* and was only

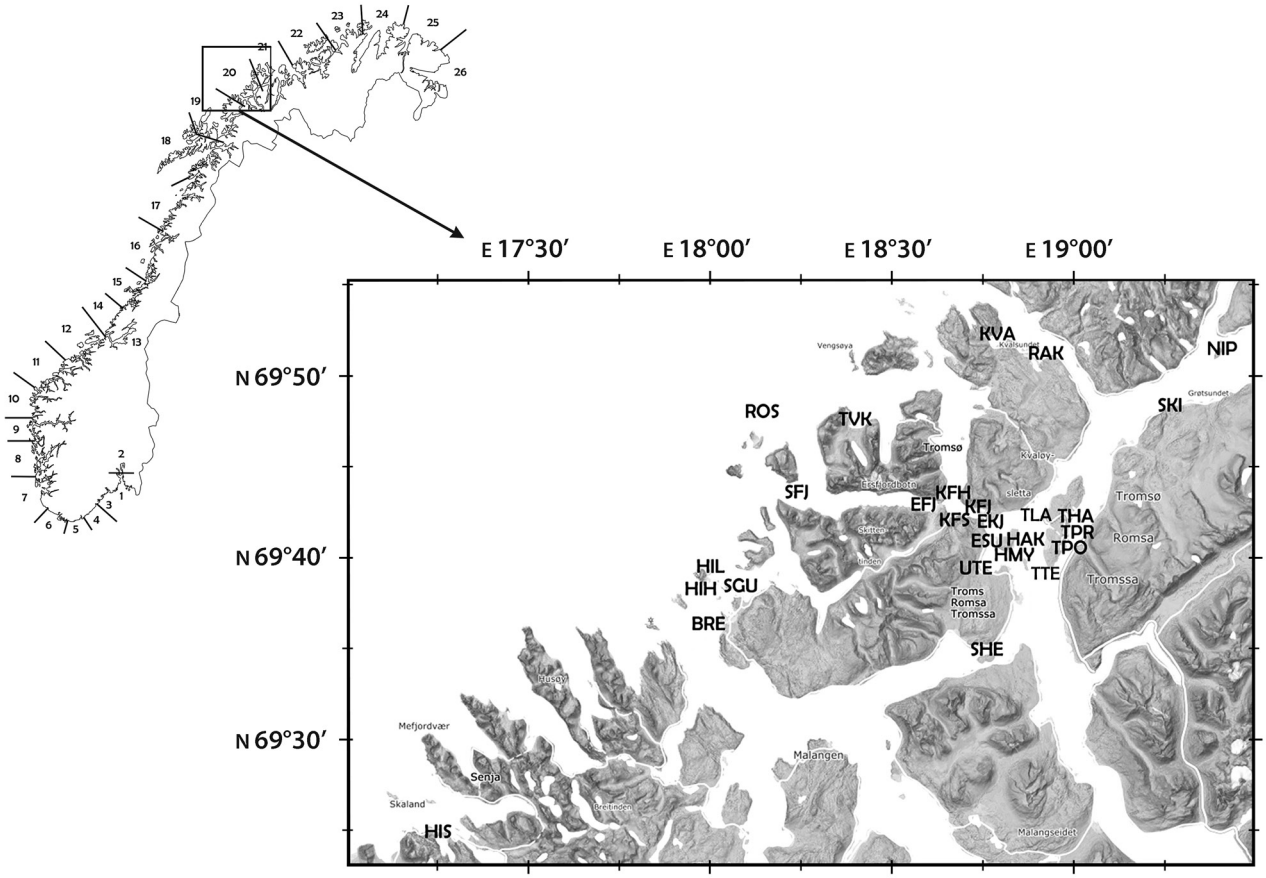

Figure 1. Map of Norway showing the Norwegian coast divided into 26 sectors. Inset shows the study area around Tromsø (sector 20) in northern Norway. Sampling localities are shown with acronyms given in Table 1. Map redrawn after Brattegard & Holte (1997).

documented with photographic records of specimens. Specimens brought back to the laboratory, were transferred to labelled glass vials containing 96% vol Ethanol (AnalaR NORMAPUR, VWR), and deposited in the NUIT collection (NUIT, NUdibranchs In Troms) housed at Fredrik Broms, Straumsvegen 238, NO-9109 Kvaløya, Norway. Specimens in the NUIT collection are currently in the process of being deposited in the NTNU University Museum, Norwegian University of Science and Technology (NTNU-VM), Trondheim, Norway (Bakken *et al*. 2024b) with the intention to allow for future cross-verification of species identities. Most individuals have been integrated in the NTNU-VM collection, and where specimens referred to in the text is part of a collection, this is indicated by voucher information in brackets. For each species in the "Material examined" section, the information is registered in the following format: number of specimens, locality (acronym), sampling date, length (when available), collector name, reference ID number (when available). All records presented in this study have been registered and are publicly available at the Species Map Service (Artskart 2024); a mapping service provided by the Norwegian Biodiversity Information Centre (NBIC) (Artsdatabanken).

Species identification and classification

Identification of nudibranchs was based on investigation of external morphology with reference to relevant available literature. A combination of sources was used, including 1) descriptions and diagnostic key features in peer-reviewed literature, 2) original descriptions, 3) expert-reviewed identification literature for the region (Malmberg & Lundin 2015; Lundin *et al*. 2020; Moen & Svensen 2020; Picton & Morrow 2023) and 4) the online resource "Arter på Nett" (Species online) containing regularly updated information on Norwegian nudibranchs (Bakken *et al*. 2024a). Where new taxonomical knowledge emerged during the course of the study, identifications were updated based on latest available knowledge by re-examining photos and preserved specimens. When identification to species level was not possible based on external morphology, observations were recorded to the lowest possible taxonomical level. Where no anatomical characters to delimit species currently exist, or where large natural variability make available characters subjective, a restrictive approach was adopted. In such cases, specimens were identified only to genus or family level. For specimens where external characteristics fully match the description of a known species but where recent taxonomic studies indicate that molecular analysis or radula examination may be required for positive identification the designation "cf." (confer) has been used to express a likely identity. Juvenile animals were not identified to species level and were not included in the overview. Names of species are treated according to the International Code of Zoological Nomenclature (ICZN), and the classification and nomenclature for species follows the Molluscabase (Molluscabase 2024) as well as the World Register of Marine Species (WoRMS) database for species (WoRMS 2024). The higher taxa are organized systematically with the species ordered alphabetically within families.

Geographic distribution

The findings from the present study were compared to previous records from the region as described below. For historical records and records

up until 2005, comparison was made with the exhaustive literature review by Evertsen and Bakken (2005). For more recent records a combination of sources was used. Sources included data published in peer-reviewed literature, expert-reviewed identification literature work from the region (Lundin *et al*. 2020), the Norwegian Red List for Species (Artsdatabanken 2021) and the Species Map Service (Artskart 2024). The Artskart portal is a service developed jointly by the Norwegian Biodiversity Information Centre (NBIC) and the open data portal The Global Biodiversity Information Facility (GBIF). Artskart contains data from numerous primary databases from scientific institutions, organizations, consulting firms and naturalists. Both verified and unverified records from Artskart were investigated and are discussed, but only verified records were included in the overview (Table 2). Where species occurring in older taxonomic inventories have shifted names, synonymous names have been updated with valid scientific names in accordance with WoRMS (WoRMS 2024). Where taxonomic splitting or lumping has occurred, often putting in doubt the true identity of older records, this has been mentioned under "Remarks" in the Results section. All recent taxonomic changes, as well as known incorrect identifications in previously published works, have, to the best of my knowledge, been addressed. Most previous overviews of the distribution of nudibranchs in Norway have used a sector-wise division of the Norwegian coastline (Brattegaard & Holthe 1997; Høisæter *et al.* 1997; Evertsen & Bakken 2002, 2005, 2013). For purposes of comparison, this sector-wise division of Norway has been used also by the present study (Figure 1). According to this sector-wise division, the study area around the Tromsø region in the present paper, corresponds to sector 20, and throughout the text the "Tromsø region" has been synonymized with sector 20.

RESULTS

Marine nudibranchs were collected from 27 sampling sites in the Tromsø region in northern Norway. All sampling was carried out from land in very shallow waters. In total, 49 species or taxa belonging to 19 different families were recorded from May 2020 to December 2023. Compared with previously published records (Evertsen & Bakken 2005; Lundin *et al.* 2020; Artsdatabanken 2021; Artskart 2024), 31 species are here reported from the region for the first time. New geographical distribution range records for Norwegian waters are presented for 20 species. At intertidal localities, 29 species belonging

Table 1. Sampling localities with acronyms, geographical coordinates (decimal degrees) and locality characteristics. Station type "Main" indicates localities visited at all seasons of the study period and "spot" indicates localities visited only occasionally. Intertidal localities (INT) are natural habitats whereas fouling community (FC) localities refer to artificial substrates such as floating jetties in marinas. One open ocean (OO) locality is also included, where animals were found associated with free-floating marine debris.

Locality	Acronym	Latitude	Longitude	Station	Habitat	Description
Brensholmen	BRE	69.6054	18.0325	Spot	INT	Soft-bottom (exposed)
Eidjordnessundet	ESU	69.6631	18.7677	Main	INT	Soft-bottom (current-exposed)
Eidkjosen	EKJ	69.6751	18.7507	Main	FC	Harbour (floating jetty)
Ersfjordbotn	EFJ	69.6983	18.6158	Spot	FC	Harbour (floating jetty)
Hamn i Senja	HIS	69.4166	17.1661	Spot	FC	Harbour (floating jetty)
Hillesøy	HIL	69.6367	18.0024	Main	FC	Harbour (floating jetty)
Hillesøy harbour	HIH	69.6343	17.9956	Main	FC	Harbour (floating jetty)
Håkøya	HAK	69.6522	18.8199	Spot	INT	Mixed-bottom (exposed)
Håkøya Myrvoll	HMY	69.6470	18.8010	Spot	INT	Mixed-bottom (exposed)
Kaldfjord harbour	KFJ	69.6871	18.7373	Spot	FC	Harbour (floating jetty)
Kaldfjord Henrikvik	KFH	69.6895	18.6482	Spot	FC	Floating jetty (sheltered)
Kaldfjord Sjurelv	KFS	69.6851	18.6980	Spot	FC	Floating jetty (sheltered)
Kvaløyvågen	KVA	69.8508	18.8199	Main	FC	Harbour (concrete and floating jetties)
Nipøya Grøtsundet	NIP	69.8244	19.4188	Spot	FC	Floating jetty (exposed)
Rakkfjord	RAK	69.8314	18.9641	Main	INT	Shellsand (current-exposed)
Røssholmen	ROS	69.7904	18.1451	Spot	INT	Soft-bottom (sheltered)
Sessøyfjorden	SFJ	69.7130	18.2503	Spot	OO	Open ocean (exposed)
Skittenelv Steinneset	SKI	69.7774	19.3336	Spot	FC	Harbour (floating jetty)
Sommarøy Guraviken	SGU	69.6344	18.0187	Spot	INT	Shellsand (sheltered)
Straumhella	SHE	69.5575	18.7250	Spot	INT	Rocky-bottom (current-exposed)
Tromsø harbour	THA	69.6503	18.9629	Main	FC	Harbour (floating jetty)
Tromsø Langnes	TLA	69.6847	18.9004	Spot	INT	Soft-bottom (exposed)
Tromsø Polarhavna	TPO	69.6429	18.9506	Main	FC	Harbour (floating jetty)
Tromsø Prostneset	TPR	69.6468	18.9562	Main	FC	Harbour (concrete jetty)
Tromsø Telegrafbukta	TTE	69.6341	18.9037	Main	INT	Rocky-bottom (exposed)
Tromvik harbour	TVK	69.7757	18.4003	Main	FC	Harbour (floating jetty)
Uteng	UTE	69.6452	18.7360	Main	INT	Soft-bottom (sheltered)

to 15 families were recorded. At fouling community localities, 47 species belonging to 17 families were recorded. 26 of the species were found at both types of localities. Highest recorded species richness during a single locality visit of an intertidal locality was 8 species (ESU, 29 September 2021). Highest recorded species richness during a single locality visit of a fouling community locality was 24 species (HIL, 14 November 2023). All species or higher taxonomical entities recorded by this study are listed below with the species in alphabetical order within each higher taxa followed by a short remark on distribution and biology. All localities where a certain species was recorded are listed in alphabetical order (acronyms according to Table 1). In the Material Examined section for each species those specimens deposited in the NUIT and/or NTNU-VM collections are referred to by their collection ID-numbers (see Materials and Methods). Finally, the results from the present study were merged with all previously published records from the region (literature records and online sources) and a comprehensive checklist of nudibranchs observed from the Tromsø region was compiled resulting in 58 species (Table 2).

Table 2. Checklist of nudibranch species found in the Tromsø region based on data from the literature as reviewed by Evertsen and Bakken (2005), records from peer-reviewed literature, online records from the Species Map Service (Artskart 2024) and records from the present study (2020–2023). Species found by this study are denoted as such with corresponding reference to Figure. Where species names recorded in the literature are synonymous with present names they have been updated according to WoRMS (2024) and have been left without a note. Where species names previously recorded in the literature are known to be erroneous this has been corrected according to information given by Bakken *et al.* (2024a). For recently described species the year of description is given (Authority). For literature records in need of re-examination to verify species identity this has been indicated by an asterisk *) below.

Family	Species	Authority	Figure	Reference
Doridiidae	*Doris pseudoargus*	(Rapp, 1827)	2A	Artskart 2024, This study
Cadlinidae	*Cadlina laevis*	(Linnaeus, 1767)	2B	Evertsen & Bakken 2005, Artskart 2024, This study
Discodoridiidae	*Rostanga* sp.	(Bergh, 1879)		Artskart 2024
Goniodorididae	*Ancula gibbosa*	(Risso, 1818)	2C	Evertsen & Bakken 2005, Artskart 2024*, This study
Goniodorididae	*Okenia nodosa*	(Montagu, 1808)		Artskart 2024
Goniodorididae	*Okenia pulchella*	(Alder & Hancock, 1854)		Evertsen & Bakken 2005
Onchidorididae	*Acanthodoris pilosa*	(Abildgaard in Müller, 1789)	2D	Evertsen & Bakken 2005, Artskart 2024, This study
Onchidorididae	*Atalodoris pusilla*	(Alder & Hancock, 1845)		Artskart 2024
Onchidorididae	*Onchidoris bilamellata*	(Linnaeus, 1767)	2E	Artskart 2024, This study
Onchidorididae	*Onchidoris muricata*	(Müller, 1776)	2F	Evertsen & Bakken 2005, Artskart 2024, This study
Aegiridae	*Aegires punctilucens*	(d'Orbigny, 1837)	2G	This study
Polyceridae	*Colga villosa*	(Odhner, 1907)		Evertsen & Bakken 2005, Artskart 2024
Polyceridae	*Limacia clavigera*	(Müller, 1776)	2H	Artskart 2024, This study
Polyceridae	*Palio dubia*	(Sars, 1829)	2I	Artskart 2024, This study
Polyceridae	*Palio nothus*	(Johnston, 1838)	2J	This study
Polyceridae	*Polycera norvegica*	(Sørensen, Rauch, Pola & Malaquias, 2020)	2K	This study
Polyceridae	*Polycera quadrilineata*	(Müller, 1776)	2L	Artskart 2024, This study
Heroidae	*Hero formosa*	(Lovén, 1844)	3A	Evertsen & Bakken 2005, This study
Dendronotidae	*Dendronotus* cf. *europaeus*	(Korshunova, Martynov, Bakken & Picton, 2017)	3B	Artskart 2024, This study
Dendronotidae	*Dendronotus* cf. *frondosus*	(Ascanius, 1774)	3C	Evertsen & Bakken 2005*, Artskart 2024, This study
Dendronotidae	*Dendronotus* cf. *lacteus*	(Thompson, 1840)	3D	This study
Dendronotidae	*Dendronotus robustus*	(Verrill, 1870)	3E	Evertsen & Bakken 2005*, This study
Dotidae	*Doto coronata*	(Gmelin, 1791)	3F	Evertsen & Bakken 2005, This study
Dotidae	*Doto* cf. *fragilis*	(Forbes, 1838)	3G/3H	This study
Dotidae	*Doto* cf. *maculata*	(Montagu, 1804)	3I	This study
Dotidae	*Doto* cf. *millbayana*	(Forbes, 1838)	3J	This study
Tritoniidae	*Candiella plebeia*	(Johnston, 1828)	3K	This study
Tritoniidae	*Tritonia hombergii*	(Cuvier, 1803)		Evertsen & Bakken 2005
Aeolidiidae	*Aeolidia filomenae*	(Kienberger, Carmona, Pola, Padula, Gosliner & Cervera, 2016)	3L	This study
Aeolidiidae	*Aeolidia papillosa*	(Linnaeus, 1761)	4A	Evertsen & Bakken 2005*, Artskart 2024, This study

Table 2. Continued.

Family	Species	Authority	Figure	Reference
Aeolidiidae	*Aeolidiella glauca*	(Alder & Hancock, 1845)	4B	This study
Facelinidae	*Facelina auriculata*	(Müller, 1776)	4C	This study
Facelinidae	*Facelina bostoniensis*	(Couthouy, 1838)	4D	Artskart 2024, This study
Facelinidae	*Favorinus branchialis*	(Rathke, 1806)	4E	This study
Coryphellidae	*Coryphella borealis*	(Odhner, 1922)		Evertsen & Bakken 2005*
Coryphellidae	*Coryphella browni*	(Picton, 1980)	4F	This study
Coryphellidae	*Coryphella chriskaugei*	(Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)	4G	This study
Coryphellidae	*Coryphella gracilis*	(Alder & Hancock, 1844)	4H	This study
Coryphellidae	*Coryphella lineata*	(Lovén, 1846)	4I	Evertsen & Bakken 2005*, This study
Coryphellidae	*Coryphella* cf. *monicae*	(Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)	4J	This study
Coryphellidae	*Coryphella nobilis*	(Verrill, 1880)		Evertsen & Bakken 2005*, Artskart 2024*
Coryphellidae	*Coryphella* cf. *orjani*	(Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)	4K	This study
Coryphellidae	*Coryphella verrucosa*	(Sars, 1829)	4L/5A	Evertsen & Bakken 2005, Artskart 2024, This study
Flabellinidae	*Carronella* sp.	(Alder & Hancock, 1843)	5B	This study
Flabellinidae	*Edmundsella pedata*	(Montagu, 1816)	5C	This study
Paracoryphellidae	*Ziminella salmonacea*	(Couthouy, 1838)		Evertsen & Bakken 2005, Artskart 2024
Cuthonellidae	*Cuthonella concinna*	(Alder & Hancock, 1843)	5D	This study
Cuthonidae	*Cuthona nana*	(Alder & Hancock, 1842)	5E	Evertsen & Bakken 2005, Artskart 2024, This study
Eubranchidae	*Amphorina andra*	(Korshunova, Malmberg, Prkić, Petani, Fletcher, Lundin & Martynov, 2020)	5F/5G/5H	This study
Eubranchidae	*Amphorina pallida*	(Alder & Hancock, 1842)	5I/5J	This study
Eubranchidae	*Eubranchus exiguus*	(Alder & Hancock, 1848)	5K	This study
Eubranchidae	*Eubranchus rupium*	(Møller, 1842)	5L	This study
Eubranchidae	*Eubranchus scintillans*	(Grishina, Schepetov & Ekimova, 2022)	6A	This study
Tergipedidae	*Tergipes tergipes*	(Forsskål in Niebuhr, 1775)	6B	This study
Trinchesiidae	*Catriona aurantia*	(Alder & Hancock, 1842)	6C	This study
Trinchesiidae	*Trinchesia foliata*	(Forbes & Goodsir, 1839)	6D	This study
Trinchesiidae	*Zelentia ninel*	(Korshunova, Martynov & Picton, 2017)	6E	Broms *et al.* 2023, This study
Trinchesiidae	*Zelentia pustulata*	(Alder & Hancock, 1854)	6F	This study

Annotated and illustrated inventory of Nudibranchia from the Tromsø region.

Class Gastropoda (Cuvier, 1795)
Subclass Heterobranchia (Burmeister, 1837)
Order Nudibranchia (Ducrotay-Blainville, 1814)

Family **Doridididae** (Rafinesque, 1815)

Doris pseudoargus (Rapp, 1827)

Figure 2A

Material examined: One specimen, THA, 08 February 2022, 19 mm, FB, NUIT-1122; One specimen, HIH, 12 February 2022, 75 mm, FB, NTNU-VM-84407/NUIT-1126 (Figure 2A); One specimen, HIL, 08 April 2022, 22 mm, FB, NTNU-VM-85652/NUIT-1157; One specimen; HIL, 26 May 2022, 15 mm, FB, NTNU-VM-85693/NUIT-1164.

Localities: EFJ, ESU, HIH, HIL, KFJ, TLA, TPR, TTE

Distribution and remarks:
Doris pseudoargus is widely distributed along the Norwegian coast from the Swedish border in the south to the Russian border in the north (Evertsen & Bakken 2005). While reported in Russian waters for the first time as late as 2000 (Redkin & Martynov 2001) *D. pseudoargus* is now considered a common species there. In Tromsø, animals were frequently observed all year round. Observations were made both in the intertidal and at fouling communities where animals were mainly found associated with the sponge *Halichondria panicea* Pallas, 1766. Spawning was observed at all seasons. Together with other recent records from northern Norway (Artskart 2024) the findings of the present study demonstrate that *D. pseudoargus* has a well-established presence in the Tromsø region.

Family **Cadlinidae** (Bergh, 1891)

Cadlina laevis (Linné, 1767)

Figure 2B

Material examined: One specimen, HAT, 22 April 2023, 21 mm, FB, NUIT-1277 (Figure 2B); Two specimens, HAM, 03 July 2023, 19, 20 mm, FB, NUIT-1292, NUIT-1293; One specimen, HAM, 06 August 2023, 39 mm, FB, NUIT-1312.

Localities: HAM, HAT

Distribution and remarks: *Cadlina laevis* has previously been recorded along most of the Norwegian coast including the Tromsø region (Evertsen & Bakken 2005; Artskart 2024). In Tromsø, animals were mainly observed under rocks in the stony intertidal where they were associated with the sponge *Halisarca* Johnston, 1842. The observations in this study verify the species presence in the region.

Family **Goniodorididae** (H. & A. Adams, 1854)

Ancula gibbosa (Risso, 1818)

Figure 2C

Material examined: One specimen, HIL, 08 October 2021, FB, NTNU-VM-85735/NUIT-1009 (Figure 2C); One specimen, HIL, 27 November 2021, 6 mm, FB, NTNU-VM-84547/NUIT-1073; One specimen, TPO; 16 February 2022, 15 mm, FB; NUIT-1136; One specimen, SHE, 10 June 2022, 14 mm, FB, NTNU-VM-85643/NUIT-1171; One specimen, HIL, 15 October 2022, 7 mm, FB, NUIT-1252.

Localities: EKJ, HIL, KVA, SHE, TPO, TTE

Distribution and remarks: *Ancula gibbosa* has previously been reported to occur along most of the Norwegian coast including the Tromsø region (Evertsen & Bakken 2005). Animals were found both in the intertidal and at fouling community localities where they were typically observed in low numbers on *Saccharina latissima*. All examined specimens were of the pale variant. Animals were found all year round. Prior to this study, only a single unverified record made in June 2018 by the Ocean Genome Legacy Collection exists from Tromsø (Artskart 2024). The records by the present study confirm the presence of *A. gibbosa* in the Tromsø region.

Family **Onchidoridididae** (J. E. Gray, 1854)

Acanthodoris pilosa (Abildgaard, 1789)

Figure 2D

Material examined: One specimen, ESU, 29 September 2021, FB, NTNU-VM-85732/NUIT-1063; One specimen, ESU, 14 October 2021, FB, NTNU-VM-84417/NUIT-1002; One specimen, UTE, 17 November 2021, 16 mm, FB, NTNU-VM-84546/NUIT-1019 (Figure 2D); One specimen, UTE, 04 June 2022, 18 mm, FB, NTNU-VM-85670/NUIT-1174; One specimen, UTE, 04 July 2022, 29 mm, FB, NUIT-1184; Two specimens, UTE, 28 October 2022, 19, 18 mm, FB, NUIT-1239, NUIT-1240.

Localities: EKJ, ESU, HIL, SGU, TLA, TTE, UTE

Distribution and remarks: *Acanthodoris pilosa* is a commonly occurring species along the entire Norwegian coast (Evertsen & Bakken 2005, Artskart 2024). It is also fairly common along the Murman coast in Russia (Martynov *et al*. 2006). In Tromsø, animals were observed all year round in the intertidal. Animals were mainly found associated with the bryozoan *Flustrellidra hispida* Fabricius, 1780 in the *Ascophyllum nodosum* belt. This study verifies the presence of *A. pilosa* in the Tromsø region.

Onchidoris bilamellata (Linnaeus, 1767)

Figure 2E

Material examined: One specimen, SGU, 24 May 2020, FB, photographic record (Figure 2E); Three specimens, TVK, 12 December 2021, 27, 18, 22 mm, FB, NTNU-VM-85734/NUIT-1079, NUIT-1080, NTNU-VM-84587/NUIT-1081; One specimen, HIL, 03 December 2022, 30 mm, FB, NUIT-1253.

Localities: EKJ, ESU, HAK, RAK, SGU, SHE, THA, TLA, TTE, TVK, UTE

Distribution and remarks: *Onchidoris bilamellata* occur along the entire Norwegian coast (Evertsen & Bakken 2005; Artskart 2024) and has also been recorded in Russia (Martynov *et al*. 2006). In the present study, animals were found both in the intertidal and at fouling communities. The species was recorded all year round. Spawning was frequently observed in spring and autumn. Animals were mainly associated with the barnacles *Balanus crenatus* Bruguière, 1789 and *Balanus balanus* Linnaeus, 1758. The present records are the first published records from the Tromsø region.

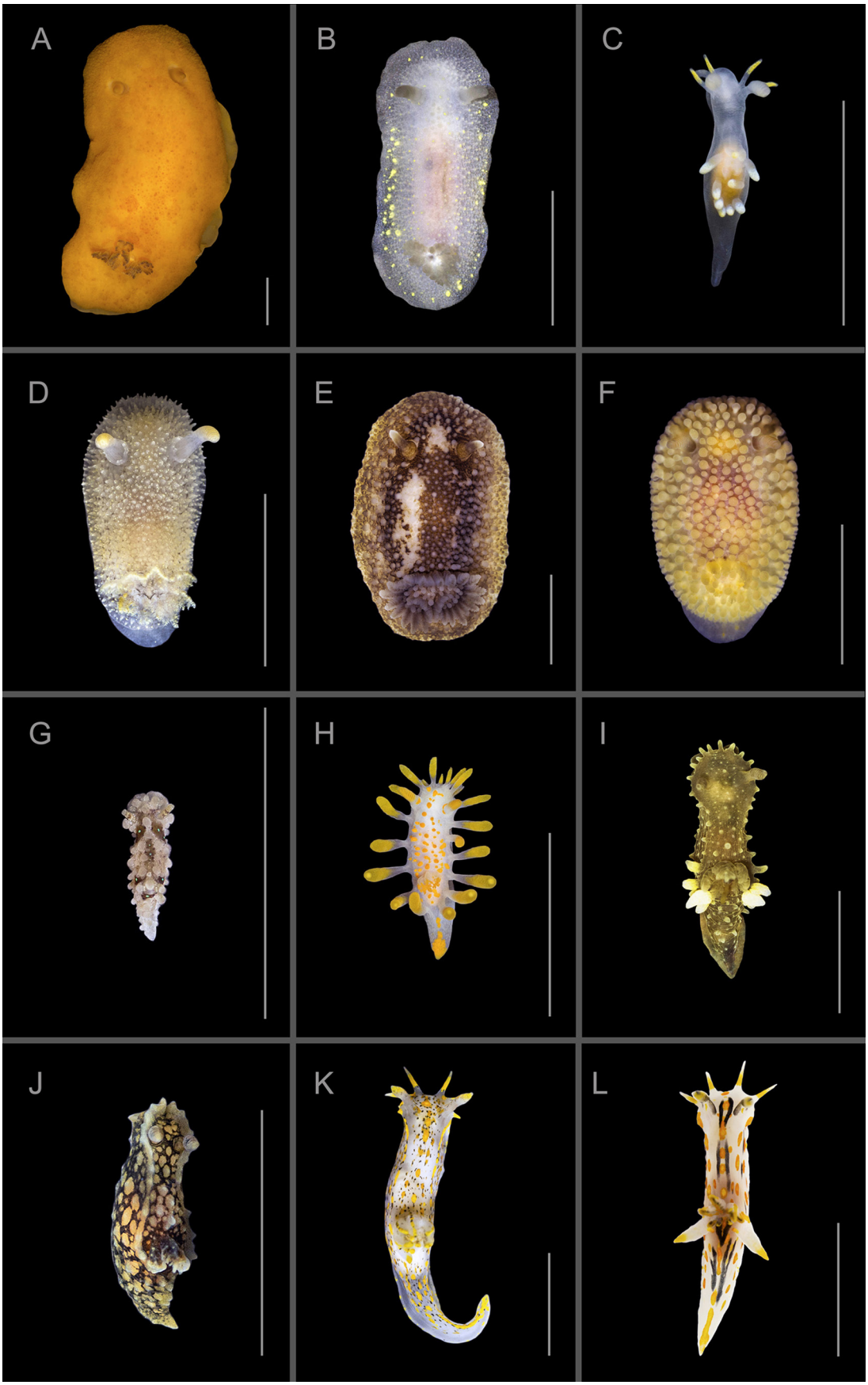

Figure 2. A. *Doris pseudoargus,* NTNU VM-84407/NUIT-1126, B. *Cadlina laevis,* NUIT-1277, C. *Ancula gibbosa,* NTNU VM-85735/NUIT-1009-1, D. *Acanthodoris pilosa,* NTNU VM-84546/NUIT-1019, E. *Onchidoris bilamellata,* photo record, 25 May 2020, F. *Onchidoris muricata*, photo record, 06 November 2021, G. *Aegires punctilucens*, NTNU VM-84437/NUIT-1001, H. *Limacia clavigera*, NUIT-1308, I. *Palio dubia*, photo record, 26 August 2020, J. *Palio nothus*, NUIT-1326, K. *Polycera norvegica*, NTNU VM-85641/NUIT-1218, L. *Polycera quadrilineata*, photo record, 09 October 2020. Scale bar: 10 mm. All photos: Fredrik Broms.

Onchidoris muricata (Müller, 1776)

Figure 2F

Material examined: One specimen, THA, 06 November 2021, 16 mm, FB, photographic record (Figure 2F); One specimen, KVA, 14 November 2021, 11 mm, FB, NTNU-VM-85737/NUIT-1027; One specimen, THA, 25 November 2021, 14 mm, FB, NTNU-VM-84488/NUIT-1069; One specimen, EKJ, 06 March 2022, 17 mm, FB, NUIT-1145.

Localities: EKJ, ESU, HIH, HIL, KVA, RAK, SHE, THA, TPO, TPR, TTE, TVK, UTE

Distribution and remarks: *Onchidoris muricata* is widely distributed along the entire Norwegian coast (Evertsen & Bakken 2005). The present study found the species to be commonly occurring at all months of the year where it was predominantly found on *Saccharina latissima* at fouling community localities.

Family **Aegiridae** (P. Fischer, 1883)

Aegires punctilucens (Orbigny, 1837)

Figure 2G

Material examined: One specimen, 19 February 2021, 6 mm, FB, NTNU-VM-84437/NUIT-1001 (Figure 2G); One specimen, 14 November 2023, 5.5 mm, FB, NUIT-1336.

Localities: HIL, KVA

Distribution and remarks: *Aegires punctilucens* is known to occur in southern to mid-Norway (Evertsen & Bakken 2005) and has also been reported north to Saltstraumen in Nordland (Moen & Svensen 2020). Observations are very few due to the small size and the exceptionally good camouflage of the species. The only previously known observations from intertidal waters stem from the conscientious investigations by Carl Dons in Trøndelag (Dons 1932, 1942a). The observations by the present study are the first records from the Tromsø region and significantly extends the northern range of *A. punctilucens*.

Family **Polyceridae** (Alder & Hancock, 1845)

Limacia clavigera (O. F. Müller, 1776)

Figure 2H

Material examined: One specimen, HIS, 31 July 2023, 9 mm, FB, NUIT-1308 (Figure 2H).

Localities: HIS

Distribution and remarks: *Limacia clavigera* is a commonly occurring species along most of the Norwegian coast north to southern Troms. Further north, only a single unverified record from Finnmark has been reported (Artskart 2024) and the study region seem to constitute the current northern limit in the species distribution. The specimen was found on *Saccharina latissima* with encrusting bryozoans. The present finding is the first documented record from the Tromsø region and the northernmost published record of the species.

Palio dubia (M. Sars, 1829)

Figure 2I

Material examined: One specimen, ESU, 26 August 2020, FB, photographic record (Figure 2I); One specimen, HIL, 08 April 2022, 16 mm, FB, NTNU-VM-85686/NUIT-1159; One specimen, 28 October 2022, 24 mm, FB, NUIT-1238.

Localities: EKJ, ESU, HIL, KVA, THA, TPR, UTE

Distribution and remarks: *Palio dubia* has previously been found along the entire Norwegian coast (Evertsen & Bakken 2005) including one online record from Tromsø (Artskart 2024). *P. dubia* has been reported to occur on hard-bottom at 10 – 100 m depth (Moen & Svensen 2020; Lundin & Malmberg 2021) with most observations deeper than 20 m (Evertsen & Bakken 2005). By contrast, this study found most specimens in the *Ascophyllum nodosum* belt where they were often found emersed above water between tides. Animals were observed at all months of the year except during summer. This study verifies the species presence in the region.

Palio nothus (Johnston, 1838)

Figure 2J

Material examined: One specimen, KVA, 23 October 2021, 8 mm, FB, NUIT-1040; One specimen, UTE, 17 November 2021, 7 mm, FB, NUIT-1018; One specimen, HIL, 15 October 2022, 9 mm, FB, NUIT-1227; One specimen, HIL, 24 September 2023, 7 mm, FB, NUIT-1326 (Figure 2J).

Localities: HIL, KVA, UTE

Distribution and remarks: *Palio nothus* has sometimes been confused with the more common and widespread *Palio dubia* in the literature. Consequently, when historical records of *P. nothus* from Norway were reviewed only two records of *P. nothus* were found from Norwegian waters (Evertsen & Bakken 2005). In addition, a third, more recent, observation from Vestland County was reported in 2013 (Evertsen & Bakken 2013) suggesting that the species is very rare in Norway. A few unpublished online records from southern Norway also exist (Artskart 2024). All four specimens recorded by the present study were found during autumn (September – November.) One specimen was found in the *Ascophyllum nodosum* belt in the intertidal. The other three were found at fouling community localities on bare surfaces or on *Desmarestia aculeata* encrusted with *Electra pilosa*. The present records are the first records from the Tromsø region and significantly extends the known range of distribution of the species to 69 degrees N.

Polycera norvegica (Sørensen, Rauch, Pola & Malaquias, 2020)

Figure 2K

Material examined: One specimen, HIL, 27 November 2021, FB, NUIT-1071; Four specimens, HIL, 04 September 2022, 22, 27, 25, 22 mm, FB, NTNU-VM-85678/NUIT-1213, NTNU-VM-85659/NUIT-1216, NTNU-VM-85663/NUIT-1217, NTNU-VM-85641/NUIT-1218 (Figure 2K); One specimen, HIL, 15 October 2022, 20 mm, FB, NTNU-VM-85673/NUIT-1234; Two specimens, EKJ, 21 September 2023, 24, 23 mm, FB, NUIT-1323, NUIT-1324; One specimen, HIL, 14 November 2023, 16 mm, FB, NUIT-1339.

Localities: EKJ, HIL, TVK

Distribution and remarks: *Polycera norvegica* is a newly described species which was recently separated from *Polycera quadrilineata* (Sørensen *et al.* 2020). Earlier records of the species are, therefore, naturally sparse. The present study found *P. norvegica* to be a commonly occurring nudibranch in the Tromsø region during autumn and winter. Animals were typically found associated with the bryozoans *Electra pilosa* and *Membranipora membranacea* growing on *Desmarestia aculeata* and *Saccharina latissima* respectively. Specimens belonging to chromatic variants II, III, and IV (Korshunova *et al.* 2021) were observed. In addition, several very dark specimens, presumably belonging to a previously unknown chromatic variant, were recorded (e.g. NTNU-VM-85659/NUIT-1216, NUIT-1323, NUIT-1324). The current observations are the first published records of *Polycera norvegica* from the Tromsø region.

Polycera quadrilineata (Müller, 1776)

Figure 2L

Material examined: One specimen, TVK, 09 October 2020, FB, photographic record (Figure 2L); One specimen, KVA, 14 November 2021, 20 mm, FB, NUIT-1023; One specimen, SKI, 06 August 2022, 23 mm, FB, NTNU-VM-85700/NUIT-1201; One specimen, EKJ, 05 October 2022, 14 mm, FB, NTNU-VM-85667/NUIT-1223.

Localities: EKJ, HIH, HIL, KFS, KVA, SKI, THA, TPO, TPR, TTE, TVK, UTE

Distribution and remarks: Considered a southernly species (Evertsen & Bakken 2005), *Polycera quadrilineata* has recently been recorded north to Lofoten (Artsdatabanken 2021) and southern Troms (Moen & Svensen 2020; Sørensen *et al.* 2020; Lundin & Malmberg 2021). In Russian waters the species was observed for the first time in 2005 (Martynov *et al.* 2006). Previous records of *Polycera quadrilineata* are, however, in need re-examination as recent taxonomic revision has recently separated a morphologically similar species *Polycera norvegica* (see this species) from *P. quadrilineata* (Sørensen *et al.* 2020; Korshunova *et al.* 2021; Malaquias *et al.* 2021). The present study found both "true" *P. quadrilineata* and *P. norvegica* sympatrically in the same habitat. Whereas both species were found mainly on *Saccharina latissima* encrusted with *Membranipora membranacea, P. quadrilineata* seemed to prefer *M. membranacea* while *P. norvegica* was more often observed associated with *Electra pilosa*. Specimens of *P. quadrilineata* observed during this study belonged mainly to chromatic variants II and IV as described by Korshunova *et al.* (2021). A few individuals of variants V and VI as well as one specimen of variant VII were also observed. The present records are the first records of *P. quadrilineata* from the Tromsø region.

Family **Heroidae** (Gray, 1857)

Hero formosa (Lovén, 1844)

Figure 3A

Material examined: One specimen, THA, 17 February 2021, FB, NUIT-1044 (Figure 3A); One specimen, SFJ, 04 July 2021, FB, NTNU-VM-84428/NUIT-1047.

Localities: SFJ, THA

Distribution and remarks: *Hero formosa* is regarded a rare and mainly deep-water species, both in Norway and elsewhere in the Northeast Atlantic (Lundin *et al.* 2020; Moen & Svensen 2020; Lundin & Malmberg 2021; Picton & Morrow 2023). Previous records are few and mainly from southern Norway Evertsen & Bakken 2005). The findings by the present study show that *H. formosa* may also be found in shallow waters. Spawning was observed. Krause (1895) reported four specimens of *H. formosa* from Skattøra in Tromsø 129 years ago and to my knowledge his record is the only previous observation of the species from Tromsø. The present study verifies the presence of *H. formosa* in the Tromsø region.

Family **Dendronotidae** (Allman, 1845)

Dendronotus europaeus (Korshunova, Martynov, Bakken & Picton, 2017)

Dendronotus cf. *europaeus*

Figure 3B

Material examined: One specimen, KFJ, 13 October 2020, 85 mm, FB, photographic record (Figure 3B); One specimen, TPR, 19 December 2021, 54 mm, FB, NTNU-VM-83919/NUIT-1092; One specimen, KFJ, 17 November 2022, 80 mm, FB, NTNU-VM-85640/NUIT-1244; One specimen, THA, 19 November 2022, 52 mm, FB, NTNU-VM-85658/NUIT-1248; One specimen, HIL, 03 December 2022, 65 mm, FB, NTNU-VM-85664/NUIT-1262.

Localities: EKJ, HIL, KFJ, THA, TPO, TPR

Distribution and remarks: *Dendronotus europaeus* was described as a new species in 2017. It is currently not possible to reliably identify specimens based solely on external morphology (Korshunova *et al.* 2017c). Large animals (typically between 50 - 90 mm in total body length) displaying all external morphological features typical for *Dendronotus europaeus* (Korshunova *et al.* 2017c) are, nevertheless, reported here as *Dendronotus* cf. *europaeus* indicating likely identity. Specimens were observed mainly during autumn, both in the intertidal and at fouling communities. The present records are the first records from the Tromsø region and represent a new northernly distribution record for the species.

Dendronotus frondosus (Ascanius, 1774)

Dendronotus cf. *frondosus*

Figure 3C

Material examined: One specimen, THA, 17 August 2021, 15 mm, FB, photographic record; Two specimens, THA, 28 July 2022, 16, 10 mm, FB, NTNU-VM-85688/NUIT-1189, NTNU-VM-85684/NUIT-1190; One specimen, EKJ, 08 August 2022, 24 mm, FB, NTNU-VM-85642/NUIT-1199 (Figure 3C).

Localities: EKJ, ESU, HIL, KFH, KFJ, KFS, KVA, RAK, SGU, SKI, THA, TLA, TPO, TPR, TTE, TVK, UTE

Distribution and remarks: The three species *Dendronotus frondosus, Dendronotus europaeus* and *Dendronotus lacteus* cannot reliably be identified without radula examination or molecular analysis (Korshunova *et al.* 2017c). Specimens displaying all external morphological features typical for *D. frondosus* are here reported as *D.* cf. *frondosus* indicating likely identity. *D. frondosus* has previously been reported to be commonly occurring along the whole Norwegian coast, including Tromsø, as well as on the Murman coast in northern Russia. However, in light of newly emerged taxonomic knowledge great care must be taken when assessing the information on the reported distribution and earlier records of *D. frondosus* in the literature may include records of other species. The present study

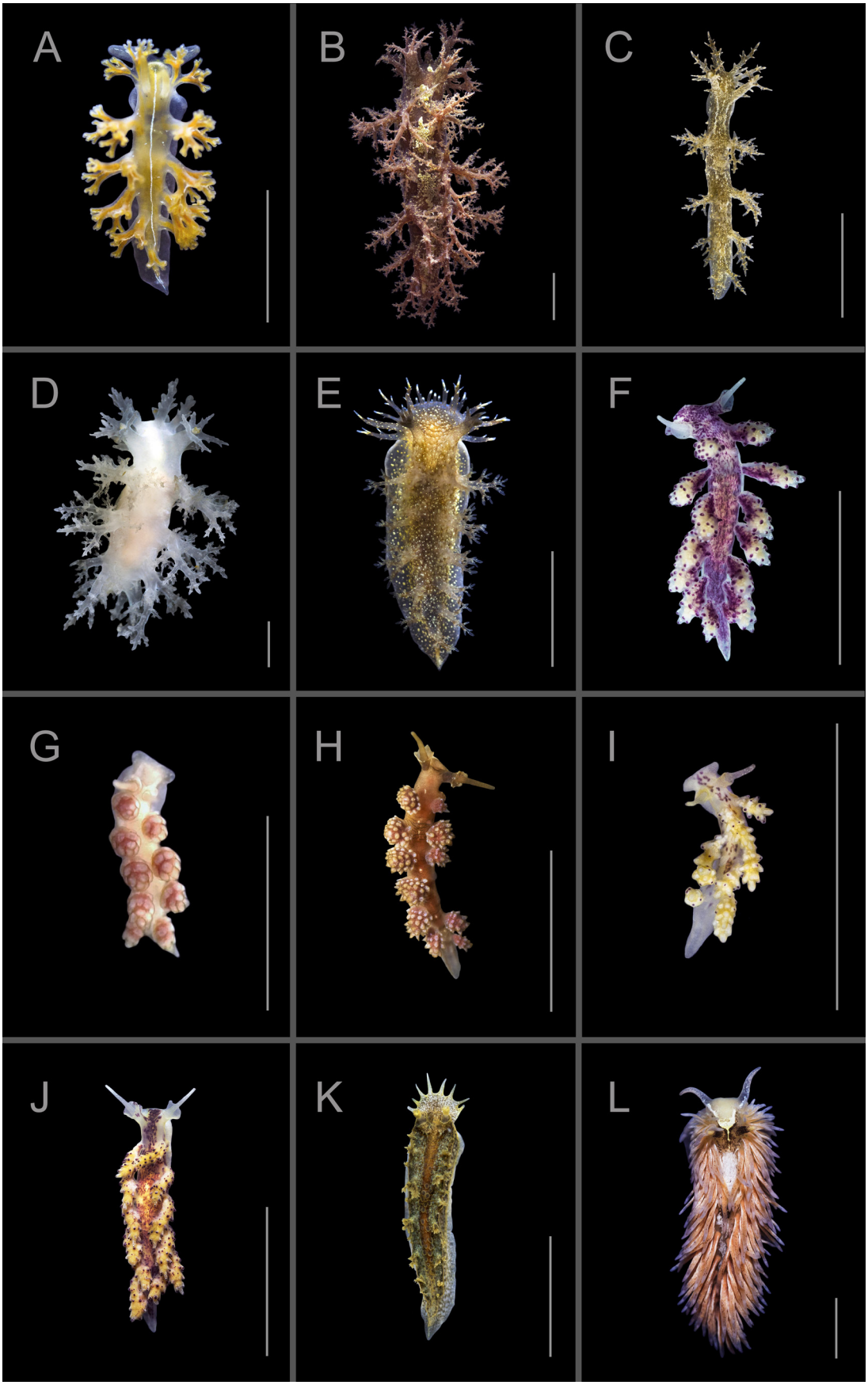

Figure 3. A. *Hero formosa,* NUIT-1044, B. *Dendronotus* cf. *europaeus,* photo record, 30 October 2020, C. *Dendronotus* cf. *frondosus*, NTNU VM-85642/NUIT-1199, D. *Dendronotus* cf. *lacteus*, photo record, 31 July 2023, E. *Dendronotus robustus*, NTNU VM-83910/NUIT-1014, F. *Doto coronata*, NTNU VM-85690/NUIT-1165, G. *Doto* cf. *fragilis,* NUIT-1042, H. *Doto* cf. *fragilis,* NTNU VM-84506/NUIT-1058, I. *Doto* cf. *maculata,* NTNU VM-85736/NUIT-1147, J. *Doto* cf. *millbayana*, photo record 21 August 2021, K. *Candiella plebeia,* NUIT-1345. L. *Aeolidia filomenae*, NTNU VM-84388/NUIT-1140. Scale bar: 10 mm. All photos: Fredrik Broms.

found the species to be a commonly occurring nudibranch in the region at all months of the year.

Dendronotus lacteus (W. Thompson, 1840)

Dendronotus cf. *lacteus*

Figure 3D

Material examined: One specimen, EKJ, 13 November 2021, FB, NTNU-VM-83913/NUIT-1038; One specimen, TVK, 12 December 2021, 58 mm, FB, NTNU-VM-83915/NUIT-1083; One specimen, HIL, 04 September 2022, 55 mm, FB, NTNU-VM-85681/NUIT-1219; One specimen, BRE, 31 July 2023, FB, photographic record (Figure 3D).

Localities: BRE, EKJ, HIL, KFJ, KVA, RAK, THA, TVK

Distribution and remarks: Previous works do not list *Dendronotus lacteus* as part of the Norwegian fauna (Evertsen & Bakken 2005). Currently, however, *D. lacteus* is thought to occur along most of the Norwegian coast (Bakken *et al.* 2024a) and the fact that *D. lacteus* was not previously included in the Norwegian fauna is possibly because it had previously been recorded as *D. frondosus*. More recent studies have further demonstrated challenges in identifying sympatric *Dendronotus* species without additional radula examination or molecular analysis (Korshunova *et al.* 2017c). Only large animals displaying all external morphological features and coloration patterns characteristic for *D. lacteus* are therefore here reported as *Dendronotus* cf. *lacteus*. Uniformly milky white individuals as well as deep-red animals with large white spots dorsally on the body dominated. The present records are the first records from the Tromsø region and represent a new northernmost distribution record for the species. The identity should, however, be confirmed by radula examination or molecular analysis.

Dendronotus robustus (Verrill, 1870)

Figure 3E

Material examined: One specimen, EKJ, 10 August 2021, 27 mm, FB, NTNU-VM-83910/NUIT-1014 (Figure 3E); One specimen, EKJ, 16 October 2021, 37 mm, FB, NTNU-VM-83912/NUIT-1037; One specimen, THA, 28 July 2022, 12 mm, FB, NTNU-VM-85660/NUIT-1188; One specimen, EKJ, 08 August 2022, 16 mm, FB, NTNU-VM-85656/NUIT-1203; One specimen, EKJ, 17 September 2022, 16 mm, FB, NUIT-1222; One specimen, EKJ, 29 July 2023, 25 mm, FB, NUIT-1304; One specimen, TPO, 09 August 2023, 19 mm, FB, NUIT-1314.

Localities: EKJ, THA, TPO

Distribution and remarks: There has been considerable confusion in the literature about this species and several old records have turned out to be misidentifications. For example, records from southern Norway were revised and demonstrated to be *D. frondosus* already in 1926 (Odhner 1926). Furthermore, in a recent paper Lundin *et al.* (2017) demonstrated that two different distinct species have previously been mixed up under the name "*Dendronotus robustus*"; namely *Dendronotus robustus* and *Dendronotus velifer* Sars, 1878. Lundin and co-workers found *D. velifer* to occur in deep waters (50 – 300 m) whereas "true" *D. robustus* was found to inhabit shallower waters. According to the authors, "true" *D. robustus* have never been positively reported from shallow areas of Norway or Sweden. True *D. robustus* has, however, reliably been reported from areas in the high Arctic such as Svalbard and Jan Mayen (Moen & Svensen 2020). For the Tromsø region, Krause (1895) reported *D. robustus* from the area in the late 19th century (Krause 1895) but whether this and other records previously reported from the Norwegian mainland (Evertsen & Bakken 2005) refer to *D. velifer* or to true *D. robustus* remains unknown. This study presents the first reliably documented records of true *D. robustus* from the Norwegian mainland. Specimens were found exclusively on *Saccharina latissima* with encrusting bryozoans at fouling communities. Animals were observed during the same time period over several consecutive years with juveniles starting to appear in July. Specimens then gradually grew in size until they disappeared in late October – early November. The species is, therefore, considered to have a well-established presence in the Tromsø region and is anticipated to have a wider distribution along the coast of the Norwegian mainland than is currently known.

Family **Dotidae** (Gray, 1853)

Doto coronata (Gmelin, 1791)

Figure 3F

Material examined: One specimen, EKJ, 27 January 2021, 10 mm, FB, photographic record; One specimen, TPR, 17 August 2021, 12 mm, FB, photographic record; Three specimens, HIL, 26 May 2022, 14, 11, 12 mm, FB; NTNU-VM-85690/NUIT-1165 (Figure 3F), NTNU-VM-85691/NUIT-1166, NTNU-VM-85692/NUIT-1168.

Localities: EKJ, ESU, HIH, HIL, KVA, ROS, SFJ, THA, TPO, TPR, TVK

Distribution and remarks: *Doto coronata* has previously been reported to be common along the entire Norwegian coast, including Troms, all year round from shallow waters down to ca 200 m (Evertsen & Bakken 2005). This study found animals at all months of the year, both in the intertidal and at fouling community localities. The present records confirm the presence in the Tromsø region.

Doto fragilis (Forbes, 1838)

Doto cf. *fragilis*

Figure 3G, 3H

Material examined: One specimen, THA, 09 February 2021, 4 mm, FB, NUIT-1042 (Figure 3G); Four specimens, SFJ, 04 July 2021, FB, NTNU-VM-84447/NUIT-1057, NTNU-VM-84506/NUIT-1058 (Figure 3H), NUIT-1059, NUIT-1060; One specimen, THA, 08 February 2022, 10 mm, FB, NTNU-VM-85711/NUIT-1123.

Localities: SFJ, THA, TPR

Distribution and remarks: *Doto fragilis* has previously been reported from most of Norway (Evertsen & Bakken 2005; Lundin *et al.* 2020; Moen & Svensen 2020). Further to the northeast, in Russian waters, *D. fragilis* was observed for the first time in 2006 (Martynov *et al.* 2006). In addition, larvae have been detected in the meroplankton in the Barents Sea (Descôteaux *et al.* 2021). Ongoing taxonomic work indicate that *D. fragilis* belongs to a species complex with three separate clades; a "white morph", a "red morph" and also *Doto hystrix* Picton & Brown, 1981 which, despite absence of detectable differences is still treated as a separate species (Martinsson *et al.* 2021). Considering the ongoing taxonomic challenges in the *D. fragilis* complex, the specimens recorded by the present study are here reported as *Doto* cf. *fragilis*. Both "white morph" (Figure 3G) and "red morph" (Figure 3H) individuals, as outlined by Martinsson *et al.* (2021) were found. The present records are the first records of the species from the Tromsø region.

Doto maculata (Montagu, 1804)

Doto cf. *maculata*

Figure 3I

Material examined: One specimen, THA, 16 March 2022, 6.5 mm, FB, NTNU-VM-85736/NUIT-1147 (Figure 3I); One specimen, THA, 04 June 2022, 6 mm, FB, NTNU-VM-85694/NUIT-1170; One specimen, THA, 14 January 2023, 6 mm, FB, NTNU-VM-85696/NUIT-1267.

Localities: THA

Distribution and remarks: *Doto maculata* has been reported from southern to mid Norway (Artskart 2024). Drifting larvae has also been recorded from the Barents Sea (Descôteaux *et al.* 2021). Recent work on species delimitation of *Doto*, however, indicate that extreme care should be taken regarding identification of *D. maculata* (Martinsson *et al.* 2021). Specimens in the present study fully matched the morphological description of *D. maculata* and had neither pigment dots on apical tubercules nor red markings on the inner side of the dorsolateral appendages but are nevertheless reported here as *Doto* cf. *maculata*. The present records are the first records from the Tromsø region and the first records of adult animals from northern Norway.

Doto millbayana (Lemche, 1976)

Doto cf. *millbayana*

Figure 3J

Material examined: One specimen, ESU, 26 August 2021, 24 mm, FB, photographic record (Figure 3J); One specimen, EKJ, 29 July 2023, 15 mm, FB, NUIT-1303.

Localities: EKJ, ESU

Distribution and remarks: *Doto millbayana* has previously only been recorded from southern Norway (Artskart 2024). All morphological characters of the specimens examined in the present study fully match the description for *Doto millbayana*. However, due to insufficient knowledge on the taxonomy of the genus specimens are reported here only as *Doto* cf. *millbayana*. The present records are the first records from the Tromsø region.

Family **Tritoniidae** (Lamarck, 1809)

Candiella plebeia (G. Johnston, 1828)

Figure 3K

Material examined: Three specimens, KVA, 19 February 2021, 2.5, 15, 20 mm, FB, NTNU-VM-84397/NUIT-1049-1, NTNU-VM-84397/NUIT-1049-2, NTNU-VM-84397/NUIT-1049-3; One specimen, KVA, 30 January 2022, 7 mm, FB, NTNU-VM-84398/NUIT-1120; KVA, 26 December 2022, 26 mm, FB, NTNU-VM-85710/NUIT-1260; One specimen, KVA, 25 November 2023, 22 mm, FB, NUIT-1345 (Figure 3K).

Localities: HIL, KVA, TVK

Distribution and remarks: *Candiella plebeia* has previously been recorded north to Trøndelag in mid-Norway (Evertsen & Bakken 2005; Lundin *et al.* 2020; Moen & Svensen 2020). Relatively few observations are known, possibly because of the species superb camouflage which makes it very difficult to observe. All specimens were found in direct association with its preferred prey *Alcyonium digitatum* Linnaeus, 1758. As *A. digitatum* is only very infrequently found in such shallow waters as those investigated by this study it seems plausible that the species has a well-established presence in the region. The present records are the first from the Tromsø region and significantly extends the known range in distribution for the species.

Family **Aeolidiidae** (Gray, 1827)

Aeolidia filomenae (Kienberger, Carmona, Pola, Padula, Gosliner and Cervera, 2016)

Figure 3L

Material examined: One specimen, HIL, 08 October 2021, FB, NTNU-VM-84388/NUIT-1140 (Figure 3L); One specimen, HIL, 09 January 2022, 45 mm, FB, NTNU-VM-84446/NUIT-1113; One specimen, HIL, 08 April 2022, 36 mm, FB, NTNU-VM-85645/NUIT-1158; One specimen, HIL, 12 June 2022, 50 mm, FB, NTNU-VM-85741/NUIT-1177. One specimen, HIS, 04 August 2023, 11 mm, FB, NUIT-1311.

Localities: ESU, HIH, HIL, HIS, KFS, KVA, TPO, TVK

Distribution and remarks: *Aeolidia filomenae* was recently described when the cosmopolitan species *Aeolidia papillosa* was shown to be part of a species complex of four sibling species (Kienberger *et al.* 2016). While information on the distribution is naturally sparse, recent records indicate a fairly wide distribution in Norway (Moen & Svensen 2020; Artskart 2024). The present study found *A. filomenae* to be a common species all year round both in the intertidal and at fouling community localities. Specimens were often found sandwiched between blue mussels. Spawning was mainly observed during spring and summer. The present records are the first from the Tromsø region and constitute a new northerly distribution record for the species.

Aeolidia papillosa (Linnaeus, 1761)

Figure 4A

Material examined: One specimen, KVA, 06 March 2021, 85 mm, FB, photographic record Two specimens, HIL, 27 November 2021, 25, 50 mm, FB, NTNU-VM-84508/NUIT-1076, NTNU-VM-84517/NUIT-1077; Three specimens, TVK, 12 December 2021, 20, 40, 60 mm, FB, NTNU-VM-84477/NUIT-1086, NTNU-VM-84486/NUIT-1087, NTNU-VM-84408/NUIT-1088; Three specimens, HIL, 09 January 2022, 20, 30, 50 mm, FB, NTNU-VM-84518/NUIT-1106, NTNU-VM-84526/NUIT-1107, NTNU-VM-84527/NUIT-1108; One specimen, THA, 16 March 2022, 30 mm, NTNU-VM-85674/NUIT-1146. One specimen, KVA, 26 November 2022, 50 mm, NUIT-1257 (Figure 4A).

Localities: ESU, HIH, HIL, HMY, KFH, KVA, RAK, SGU, THA, TPO, TTE, TVK

Distribution and remarks: *Aeolidia papillosa* is known from all the coast of Norway (Evertsen & Bakken, 2005) and north-western Russia (Martynov *et al.* 2006). *A. papillosa* was, however, recently shown to be part of a species complex of four sibling species (Kienberger *et al.* 2016). Previous records of *A. papillosa* may, therefore, refer to either *A. papillosa* or *A. filomenae*. The species was commonly observed all year round both in the intertidal and at fouling community localities. Spawning was observed from April – July and juveniles were typically observed in November - December. This study documents the presence of "true" *A. papillosa* in the Tromsø region.

Aeolidiella glauca (Alder & Hancock, 1845)

Figure 4B

Material examined: One specimen, HIS, 31 July 2023, 52 mm, FB, NUIT-1309 (Figure 4B).

Localities: HIS

Distribution and remarks: *Aeolidiella glauca* is an uncommon species in Norway with a scattered distribution range (Evertsen & Bakken 2005). The relatively few records are from southern and western Norway. The specimen in the present study was found on *Saccharina latissima* growing at a fouling community. The present record constitutes a new northernmost distribution record and a significant range extension for the species.

Family **Facelinidae** (Bergh, 1889)

Facelina auriculata (Müller, 1776)

Figure 4C

Material examined: One specimen, KVA, 14 November 2021, 15 mm, FB, NUIT-1031; One specimen, HIL, 12 February 2022, 15 mm, FB, NUIT-1127; One specimen, HIL, 12 June 2022, 30 mm, FB, NTNU-VM-85680/NUIT-1175 (Figure 4C); One specimen, SKI, 06 August 2022, 28 mm, FB, NTNU-VM-85699/NUIT-1200.

Localities: HIL, KFS, KVA, SFJ, SGU, SKI, THA, TPR

Distribution and remarks: *Facelina auriculata* has previously been recorded from most of the Norwegian coast (Evertsen & Bakken 2005) but not from Russian waters. In this study, *F. auriculata* was a commonly encountered species. It was found all year round both in the intertidal and at fouling communities. Spawning was mainly observed in July and juveniles were predominantly found in November - December. The present records are, however, the first documented records from the Tromsø region.

Facelina bostoniensis (Couthouy, 1838)

Figure 4D

Material examined: Four specimens, HIL, 18 October 2020, FB, photographic record (Figure 4D); One specimen, HIL, 03 December 2022, 22 mm, FB, NTNU-VM-85712/NUIT-1255.

Localities: HIL, KFS, TVK

Distribution and remarks: *Facelina bostoniensis* has previously been recorded north to Nordland (Evertsen & Bakken 2005) with a few recent unverified observations as far north as Troms (Artskart 2024). In the present study, animals were found associated with *Ectopleura larynx* Ellis & Solander, 1786 at fouling communities. All records were made during autumn – winter. The present records are the first documented records of the species from the Tromsø region.

Favorinus branchialis (Rathke, 1806)

Figure 4E

Material examined: One specimen, HIL, 18 October 2020, FB, photographic record (Figure 4E); Three specimens, KVA, 14 November 2021, 7, 10, 5 mm, FB, NTNU-VM-85706/NUIT-1028, NTNU-VM-85721/NUIT-1029, NUIT-1030; One specimen, HIL, 10 April 2022, 9 mm, FB, NTNU-VM-85662/NUIT-1154; One specimen, HIL, 12 June 2022, 14 mm, FB, NUIT-1172; One specimen, HIL, 14 November 2023, 7 mm, FB, NUIT-1341.

Localities: EKJ, HIL, KFS, KVA, TVK, UTE

Distribution and remarks: *Favorinus branchialis* has been reported from most of the Norwegian coast north to Nordland (Evertsen & Bakken 2005; Moen & Svensen 2020). Old records from Russian waters were later removed due to misidentifications (Martynov *et al.* 2006). In the present study, *F. branchialis* was found to be a fairly common nudibranch occurring all year round. Specimens were found mainly during autumn in association with eggs by *Onchidoris muricata* and *Polycera* spp. on *Saccharina latissima.* The present records are the first records from the Tromsø region and the northernmost known observations of the species.

Family **Coryphellidae** (Bergh, 1889)

Coryphella browni (Picton, 1980)

Figure 4F

Material examined: One specimen, ESU, 08 January 2022, 50 mm, FB, NTNU-VM-83908/NUIT-1103; One specimen, HIL, 09 January 2022, 15 mm, FB, NTNU-VM-84427/NUIT-1104 (Figure 4F); One specimen, HIL, 25 December 2023, 40 mm, FB, NUIT-1347.

Localities: ESU, HIL

Distribution and remarks: The information on *Coryphella browni* in the literature is confusing. The species was considered not to be part of the Norwegian nudibranch fauna by Evertsen and Bakken (2005), but after rectification of misidentifications it is now considered an abundant species with a wide distribution (T. Bakken, NTNU, pers. comm., 2024). The present study found the species at most seasons of the year. The present records are the first records from the Tromsø region and constitute a new northernmost distribution record of the species.

Coryphella chriskaugei (Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)

Figure 4G

Material examined: One specimen, HIL, 18 October 2020, FB, photographic record (Figure 4G); One specimen, HIL, 27 November 2021, 22 mm, FB, NUIT-1072; Three specimens, HIL, 15 October 2022, 22, 31, 15 mm, FB, NUIT-1226, NUIT-1233, NTNU-VM-85704/NUIT-1250; One specimen, HIL, 14 November 2023, 16 mm, FB, NUIT-1340.

Localities: HIL, SFJ

Distribution and remarks: *Coryphella chriskaugei* was described as recently as in 2017 (Korshunova *et al.* 2017a). While described under the name *Fjordia chriskaugei* it is currently placed under the genus *Coryphella* (Ekimova *et al.* 2022; WoRMS 2024). Prior to 2017 it was included under the name *Flabellina lineata* Lovén, 1846. However, following recent major revision and reclassification (Korshunova *et al.* 2017a) animals previously recorded as *Flabellina lineata* may now refer to any of several different species. According to the review by Evertsen and Bakken (2005), *Flabellina lineata* was found to be distributed along the entire Norwegian coast, including the Tromsø region but as indicated above it is not known which species was recorded. In this study, *C. chriskaugei* was observed mainly during winter in association with *Ectopleura larynx* but was also found once during summer on *Tubularia indivisa* Linnaeus,

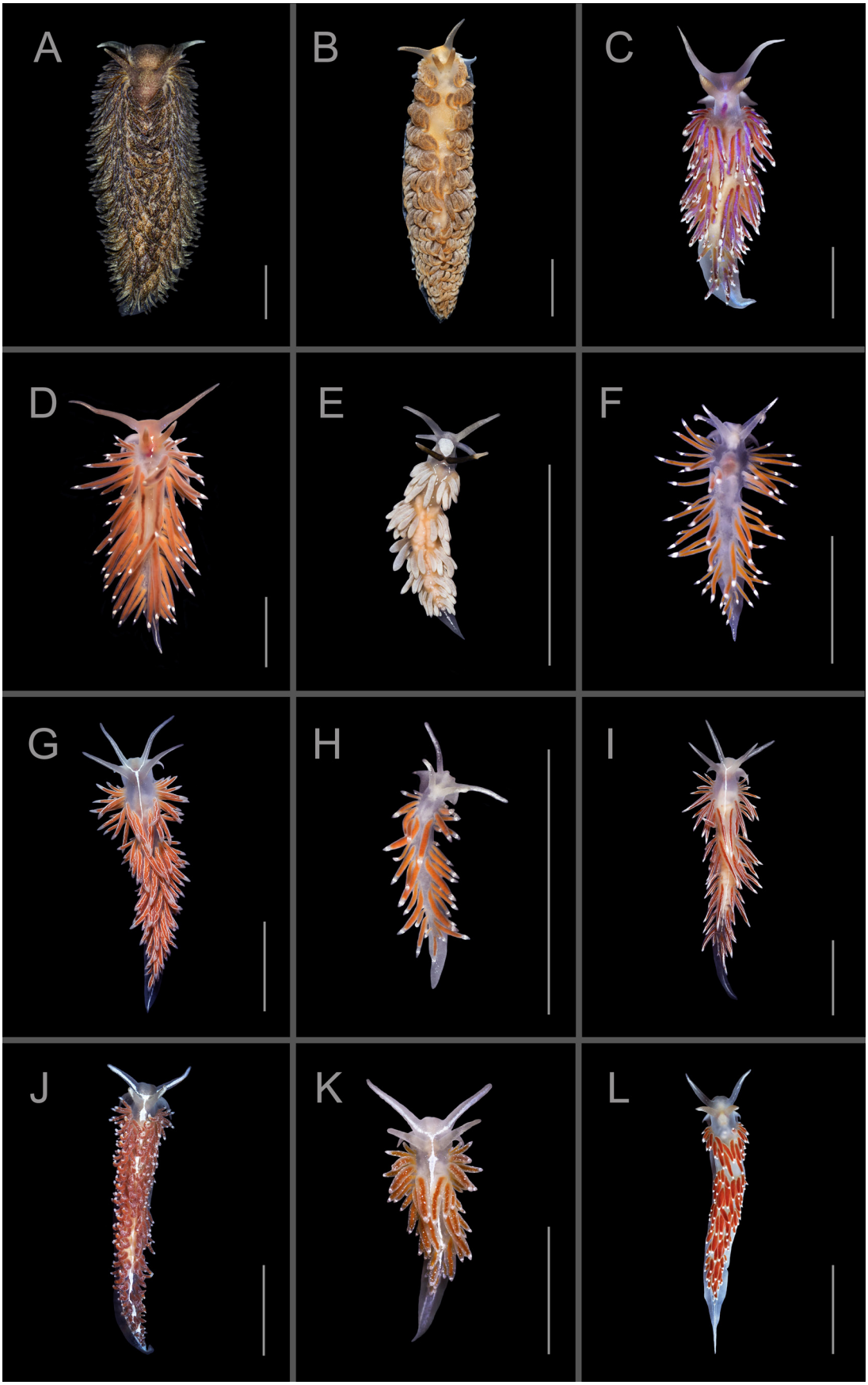

Figure 4. A. *Aeolidia papillosa,* NUIT-1257, B. *Aeolidiella glauca,* NUIT-1309, C. *Facelina auriculata*, NTNU VM-85680/NUIT-1175, D. *Facelina bostoniensis*, photo record, 18 October 2020, E. *Favorinus branchialis*, photo record, 18 October 2020, F. *Coryphella browni*, NTNU VM-84427/NUIT-1104, G. *Coryphella chriskaugei*, NUIT-1233, H. *Coryphella gracilis*, NTNU VM-85715/NUIT-1066, I. *Coryphella lineata,* NUIT-1232, J. *Coryphella* cf. *monicae,* NUIT-1275, K. *Coryphella* cf. *orjani*, NTNU VM-85713/NUIT-1124, L. *Coryphella verrucosa, rufibranchialis* form, NTNU VM-85655/NUIT-1263. Scale bar: 10 mm. All photos: Fredrik Broms.

1758. The present records are the first records from Tromsø and the northernmost known records of the species.

Coryphella gracilis (Alder & Hancock, 1844)

Figure 4H

Material examined: One specimen, THA, 28 September 2020, FB, photographic record; One specimen, TPR, 22 November 2021, 7 mm, FB, NTNU-VM-85715/NUIT-1066 (Figure 4H); Two specimens, TPO, 16 February 2022, 11, 10 mm, NTNU-VM-84568/NUIT-1134, NUIT-1135; One specimen; THA, 24 March 2022, 9 mm, FB, NTNU-VM-85682/NUIT-1151; One specimen; TPO, 07 October 2023, 10 mm, FB, NUIT-1328

Localities: ESU, HIH, HIL, THA, TPO, TPR

Distribution and remarks: Records of *Coryphella gracilis* are relatively few and the species has been categorized as having a southernly distribution in Norway (Evertsen & Bakken 2005). Using DNA barcoding, larvae of *C. gracilis* have, however, recently been detected in the meroplankton in the Barents Sea (Descôteaux *et al.* 2021, 2022). The present study found *C. gracilis* to be a commonly occurring nudibranch in the Tromsø region. Animals were observed all year around where they were mainly associated with *Eudendrium* sp. hydroids. Spawning was mainly observed during April – June but was also observed in the autumn. The present records are the first records from the Tromsø region and constitute a new northernmost distribution record of adult specimens of the species.

Coryphella lineata (Lovén, 1846)

Figure 4I

Material examined: One specimen, HIL, 15 October 2022, 36 mm, FB, NUIT-1232 (Figure 4I).

Localities: HIL

Distribution and remarks: *Coryphella lineata* was, together with several other species, previously known under the name *Flabellina lineata*. *Flabellina lineata* has been recorded from the entire Norwegian coast including one record from Tromsøsundet in 1885 (Sparre-Schneider 1885). All old records are, however in need of re-examination to be able to verify species identity. Following the characters given in the recent taxonomic reassessment of the family Flabellinidae (Korshunova *et al.* 2017a), the present record is the first published record of *Coryphella lineata* from the Tromsø region.

Coryphella monicae (Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)

Coryphella cf. *monicae*

Figure 4J

Material examined: One specimen, TPO, 25 March 2023, 31 mm, FB, NUIT-1275 (Figure 4J).

Localities: TPO

Distribution and remarks: The species was described in 2017 and was placed in a new genus *Gulenia* which then comprised three different species; *Gulenia borealis*, *Gulenia monicae* and *Gulenia orjani*. More recent work has placed the species in the genus *Coryphella* under the name *Coryphella monicae* (Ekimova *et al.* 2022). While *C. monicae* and *C. orjani* cannot reliably be identified to species level without DNA barcoding, subtle differences in external morphology may aid in identification (Korshunova *et al.* 2017a). The animal found in the present study had a narrow body and short cerata suggesting *Coryphella monicae*. The specimen is, however, recorded here only as *Coryphella* cf. *monicae* indicating likely identity. *Coryphella monicae* is so far only known from a few specimens found in southern Norway from Sognefjorden to Trondheimsfjorden (Picton & Morrow 2023; Artskart 2024). The present record is the first record from the Tromsø region and represents a significant range extension in distribution.

Coryphella orjani (Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)

Coryphella cf. *orjani*

Figure 4K

Material examined: One specimen, THA, 08 February 2022, 15 mm, FB, NTNU-VM-85713/NUIT-1124 (Figure 4K).

Localities: THA

Distribution and remarks: The species was described in 2017 and was placed in a new genus *Gulenia* which then comprised three different species; *Gulenia borealis, G. monicae* and *G. orjani*. More recent work has placed the species in the genus *Coryphella* under the name *Coryphella orjani* (Ekimova *et al.* 2022). While *C. orjani* and *C. monicae* cannot reliably be identified to species level without DNA barcoding, subtle differences in external morphology may aid in identification (Korshunova *et al.* 2017a). The animal found in the present study had a broad body, long cerata and a fairly long tail, suggesting *Coryphella orjani*. The specimen is, however, recorded here only as *Coryphella* cf. *orjani* indicating likely identity. *Coryphella orjani* is so far known only from a handful different localities in southern Norway north to Trondheimsfjorden (Picton & Morrow 2023; Artskart 2024). The present record is the first record from the Tromsø region and represents a significant range extension in distribution.

Coryphella verrucosa (M. Sars, 1829)

Figure 4L/5A

Material examined: Three specimens, ESU, 07 November 2021, 38, 30, 25 mm, FB, NTNU-VM-84467/NUIT-1007, NTNU-VM-84418/NUIT-1012, NTNU-VM-84578/NUIT-1013; One specimen, KVA, 14 November 2021, 35 mm, FB, NTNU-VM-85709/NUIT-1050; One specimen, TPR, 19 December 2021, 40 mm, FB, NTNU-VM-85714/NUIT-1101; One specimen, HIL, 09 January 2022, 20 mm, FB, NUIT-1110; Two specimens, HIL, 03 December 2022, 32, 30 mm, FB, NTNU-VM-85676/NUIT-1261 (Figure 5A), NTNU-VM-85655/NUIT-1263 (Figure 4L); Two specimens, HIL, 14 November 2023, 22, 22 mm, FB, NUIT-1337, NUIT-1338.

Localities: EKJ, ESU, HIH, HIL, HMY, KVA, SGU, SKI, THA, TLA, TPO, TPR, TTE, TVK, UTE

Distribution and remarks: *Coryphella verrucosa* has previously been reported from almost the entire Norwegian coast (Evertsen & Bakken 2005; Moen & Svensen 2020). In Tromsø, *C. verrucosa* was found to be a commonly occurring species. Both the long-cerata "rufibranchialis" (Figure 4L) and short-cerata "verrucose" (Figure 5A) morphological morphs were found. The "rufibranchialis" morph was, however, by far the most common. Occasionally, individuals with

bright lemon-yellow cerata were observed alongside other individuals with more typical reddish cerata. The species was found at all months of the year in a wide variety of habitats. Spawning was mainly observed in April – July with juveniles typically appearing in the autumn. Adult animals were very common during winter. The present study verifies the presence of *C. verrucosa* in the Tromsø region.

Family **Flabellinidae** (Bergh, 1889)

Carronella (Korshunova, Martynov, Bakken, Evertsen, Fletcher, Mudianta, Saito, Lundin, Schrödl & Picton, 2017)

Carronella sp.

Figure 5B

Material examined: One specimen, HIL, 09 January 2021, FB, photographic record; One specimen, HIL, 27 November 2021, 17 mm, FB, NTNU-VM-84536/NUIT-1070; Two specimens, HIL, 09 January 2022, 27, 20 mm, FB, NUIT-1114, NTNU-VM-84537/NUIT-1115; One specimen, THA, 08 February 2022, 35 mm, FB, NTNU-VM-84466/NUIT-1121 (Figure 5B); One specimen, HIL, 12 February 2022, 25 mm, FB, NTNU-VM-84507/NUIT-1129; One specimen, HIL, 03 December 2022, 34 mm, FB, NUIT-1256.

Localities: HIL, THA, TPO

Distribution and remarks: There are two known species within the genus *Carronella*; *Carronella pellucida* Alder and Hancock, 1843 and *Carronella enne* Korshunova *et al.* 2017. It is currently not possible to identify the two *Carronella* species based on external morphology (Korshunova *et al.* 2017a). Both species have, however, been recorded from Norway based on DNA barcoding (Bakken *et al.* 2024a). Prior to 2017, the two species were treated as one under the name *Flabellina pellucida*. *F. pellucida* has been recorded north to Trøndelag in mid-Norway (Evertsen & Bakken 2005). Recently, *F. pellucida* was also reported from Russian waters for the first time (Ekimova *et al.* 2019). The present study found *Carronella* to be commonly occurring in the Tromsø region, thus bridging the gap in distribution between mid-Norway and Russia. Animals were found all year round except during summer. Spawning was observed in spring. True identity of the specimens collected in the present study (here reported as *Carronella* sp.) as well as from other regions remains to be ascertained. The records in the present study are the first of *Carronella* from the Tromsø region.

Edmundsella pedata (Montagu, 1816)

Figure 5C

Material examined: One specimen, SFJ, 04 July 2021, FB, NUIT-1035 (Figure 5C).

Localities: SFJ

Distribution and remarks: *Edmundsella pedata* has, under the name *Flabellina pedata,* previously been recorded in southern Norway (Evertsen & Bakken 2005; Lundin *et al.* 2020). Moen and Svensen (2020) also mention observations north to Nordland. The present record is the first record from the Tromsø region and represents a significant range extension in distribution.

Family **Cuthonellidae** (Miller, 1971)

Cuthonella concinna (Alder and Hancock, 1843)

Figure 5D

Material examined: One specimen, UTE, 03 November 2021, 10 mm, FB, NUIT-1011 (Figure 5D); Three specimens, UTE, 17 November 2021, 11, 10, 8 mm, FB, NTNU-VM-84576/NUIT-1020, NTNU-VM-84566/NUIT-1021, NTNU-VM-84577/NUIT-1022; One specimen, ESU, 05 May 2022, 11 mm, FB, NTNU-VM-85698/NUIT-1163; One specimen, RAK, 29 May 2022, 24 mm, FB, NTNU-VM-85701/NUIT-1169.

Localities: ESU, RAK, SGU, UTE

Distribution and remarks: *Cuthonella concinna* was previously reported only from southern Norway (Evertsen & Bakken 2005). Recent observations indicate also a more northerly distribution (Lundin *et al.* 2020; Artskart 2024). *C. concinna* has also been reported from northern Russia (Martynov *et al.* 2006) and larvae have been detected in the meroplankton in the Barents Sea (Descôteaux *et al.* 2021). These findings agree well with the results from this study where *C. concinna* was found to be a common species in the Tromsø region. Most animals were found in close proximation to the hydroid *Dynamena pumila* Linnaeus, 1758 in the *Ascophyllum nodosum* belt. Animals were recorded all year round. Spawning occurred from May – July and juvenile animals appeared in October – November. Animals were often found emerged above water during low tide, also in winter when they could be found totally surrounded by ice crystals. The present records are the first records from the Tromsø region.

Family **Cuthonidae** (Odhner, 1934)

Cuthona nana (Alder and Hancock, 1842)

Figure 5E

Material examined: Two specimens, TPO, 16 February 2022, 6, 10 mm, FB, NTNU-VM-85731/NUIT-1131, NUIT-1137; Three specimens, THA, 10 November 2022, 9, 15, 13 mm, FB, NUIT-1241, NTNU-VM-85646/NUIT-1242 (Figure 5E), NUIT-1245; One specimen, THA, 14 January 2023, 13 mm, FB, NTNU-VM-85647/NUIT-1268.

Localities: HIL, KVA, THA, TPO, TPR

Distribution and remarks: *Cuthona nana* has previously been reported from the entire Norwegian coast (Evertsen & Bakken 2005). There are also three known records from the Barents Sea (Martynov *et al.* 2006). The species is typically found on hermit crab shells where it feeds on *Hydractinia echinata* Fleming, 1828 (Lundin *et al.* 2020). Despite being reported to be found mainly at ca 10-35 m depth and almost exclusively on places with colonies of *Hydractinia echinata* the present study found *C. nana* to be commonly occurring in shallow waters. Animals were typically found crawling on artificial surfaces with little identifiable prey. In such habitats, specimens were, nonetheless, observed both copulating and spawning. The species was observed during all seasons except summer and reproduction seemed to occur almost all year round. The present study verifies the presence of *C. nana* in the Tromsø region.

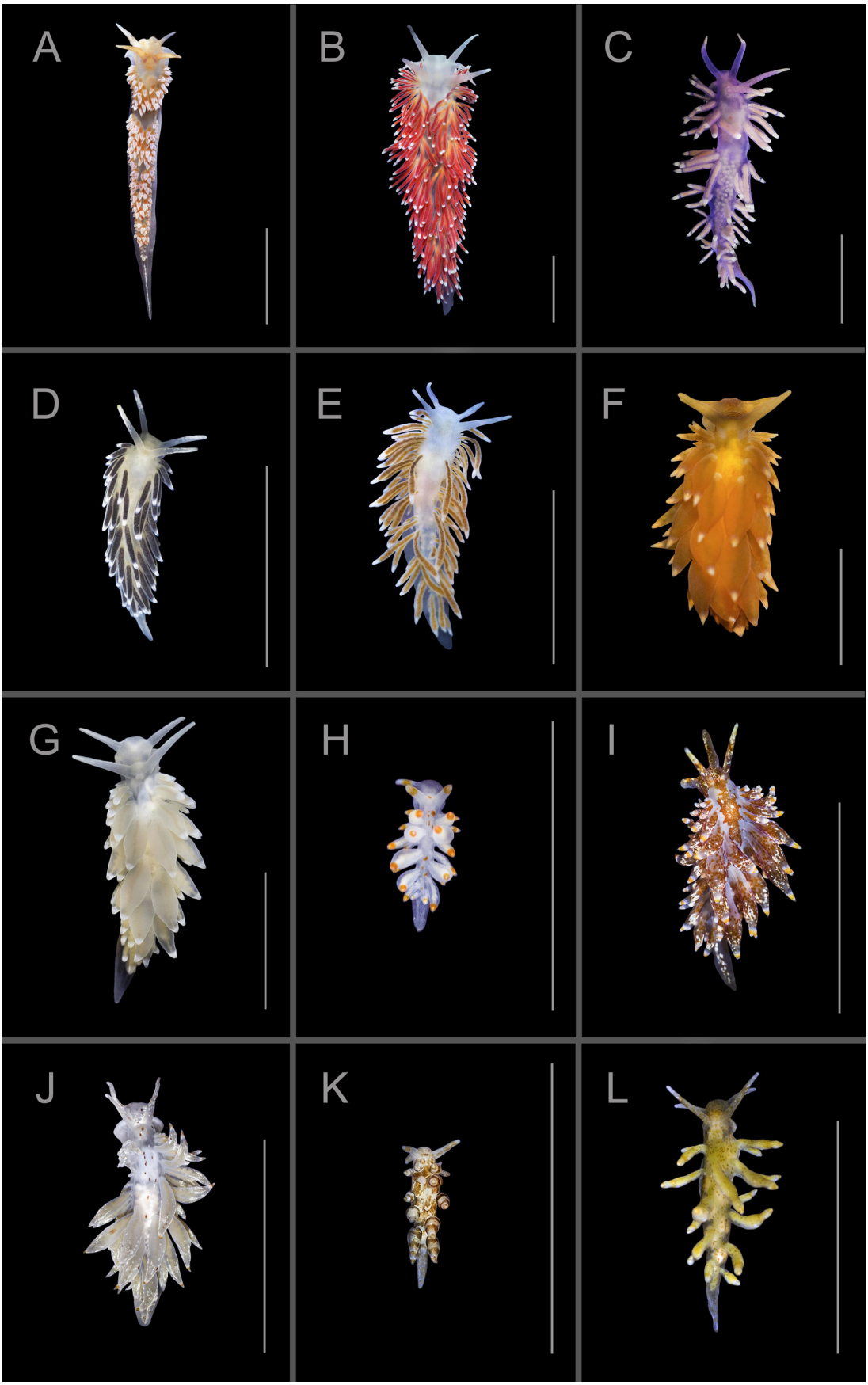

Figure 5. A. *Coryphella verrucosa, verrucosa* form, NTNU-VM-85676/NUIT-1261, B. *Carronella* sp., NTNU VM-84466/NUIT-1121, C. *Edmundsella pedata,* NUIT-1035, D. *Cuthonella concinna*, NUIT-1011, E. *Cuthona nana,* NTNU VM-85646/NUIT-1242, F. *Amphorina andra*, yellow form, NTNU-VM-85702/NUIT-1236, G. *Amphorina andra,* white form, NTNU-VM-84468/NUIT-1032, H. *Amphorina andra*, white-orange form, NTNU-VM-84496/NUIT-1006-1, I. *Amphorina pallida*, strongly pigmented form, photo record, 12 December 2020, J. *Amphorina pallida*, pale form, photo record, 01 February 2022, K. *Eubranchus exiguus*, NUIT-1334, L. *Eubranchus rupium,* photo record, 17 August 2021. Scale bar: 10 mm. All photos: Fredrik Broms.

Family **Eubranchidae** (Odhner, 1934)

Amphorina andra (Korshunova, Malmberg, Prkić, Petani, Fletcher, Lundin & Martynov, 2020)

Figure 5F/5G/5H

Material examined: Two specimens, KVA, 19 February 2021, FB, NTNU-VM-84496/NUIT-1006-1 (Figure 5H), NTNU-VM-84496/NUIT-1006-2; One specimen, ESU, 29 September 2021, FB, NTNU-VM-84468/NUIT-1032 (Figure 5G), One specimen, ESU, 08 January 2022, 12 mm, FB, NTNU-VM-84558/NUIT-1102; One specimen, UTE, 26 August 2022, FB, photographic record; Two specimens, UTE, 24 October 2022, 20, 26 mm, FB, NTNU-VM-85702/NUIT-1236 (Figure 5F); NTNU-VM-85672/NUIT-1237. One specimen, UTE, 24 September 2023, 18 mm, FB, NUIT-1322.

Localities: ESU, KVA, UTE

Distribution and remarks: *Amphorina andra* was described as recently as 2020 (Korshunova *et al.* 2020b). Records of the species are therefore sparse but include findings north to Trondheimsfjorden (Moen & Svensen 2020) and Bodø in Nordland (Lundin *et al.* 2020). The species occurs in several different colour forms and subdivisions (Korshunova *et al.* 2020b). In Tromsø, three different colour forms were observed; a uniformly bright golden yellow form (Figure 5F), a uniformly transparent-white form with a completely pale body and cerata (Figure 5G) and a moderately transparent white form with orange-yellow pigment on the tips of the cerata (Figure 5H). In the literature, a strict water depth differentiation between *A. andra* and the closely related *Amphorina viriola* has been described. While *A. viriola* has been found associated with low salinity above the halocline, *A. andra* is associated with higher salinity below the halocline (Korshunova *et al.* 2020b). In the present study, *A. andra* was found to be commonly occurring in the *Ascophyllum nodosum* belt in the intertidal where animals and spawn were occasionally even found emersed above water between tides. The species may thus inhabit more shallow waters than previously known. The present observations are the first records from the Tromsø region and represent a new northerly distribution record for the species.

Amphorina pallida (Alder and Hancock, 1842)

Figure 5I/5J

Material examined: One specimen, EKJ, 12 December 2020, FB, photographic record (Figure 5I); One specimen, KVA, 23 October 2021, FB, NTNU-VM-85730/NUIT-1062; Three specimens, KVA, 14 November 2021, 9, 8, 7 mm, FB, NTNU-VM-84556/NUIT-1051, NTNU-VM-85668/NUIT-1052, NTNU-VM-84588/NUIT-1053; One specimen, THA, 19 December 2021, 7 mm, FB, NTNU-VM-84567/NUIT-1091; One specimen, KVA, 01 February 2022, FB, photographic record (Figure 5J).

Localities: EKJ, ESU, HIL, KFH, KVA, THA, TVK, UTE

Distribution and remarks: *Amphorina pallida* has been reported from most of the Norwegian coast (Evertsen & Bakken 2005; Lundin *et al.* 2020). The species exists in different colour variations (Korshunova *et al.* 2020b). In the present study, two different colour forms were observed. The most common form included specimens with extensive red-brown pigment (Figure 5I). A less frequent form included pale specimens with white pigment on the head and cerata but with none or few small reddish pigment dots on the body (Figure 5J). The species has been described as sparse and occurring mainly on hard bottom at 20-50 m depth (Moen & Svensen 2020; Lundin *et al.* 2020). In the present study, *A. pallida* was, however, found to be common in shallow waters, both at fouling communities and in the intertidal. The species was recorded during all months of the year. The present records are the first records from the Tromsø region.

Eubranchus exiguus (Alder & Hancock, 1848)

Figure 5K

Material examined: One specimen, THA, 17 February 2021, FB, photographic record; One specimen, HIL, 14 November 2023, 4 mm, FB, NUIT-1334 (Figure 5K).

Localities: HIL, THA

Distribution and remarks: *Eubranchus exiguus* has previously been reported from most of Norway (Evertsen & Bakken 2005) and also from the Murman coast in Russia (Martynov *et al.* 2006). However, recent revision of the genus demonstrated the existence of a pseudocryptic new species hidden under the name *E. exiguus* (Grishina *et al.* 2022). The new species, *Eubranchus scintillans,* was previously considered a colour form of *E. exiguus.* As both species are found sympatrically in the Barents and the North Seas (Grishina *et al.* 2022) earlier published records of *E. exiguus* may refer to either of the two species and are in need of re-examination to verify identity. Only two specimens of "true" *E. exiguus* were recorded by this study. The present observations are the first published records of "true" *E. exiguus* from the Tromsø region. The distributional status of "true" *E. exiguus* in Norway remains to be investigated.

Eubranchus rupium (Møller, 1842)

Figure 5L

Material examined: One specimen, THA, 17 August 2021, 11 mm, FB, photographic record (Figure 5L); One specimen, UTE, 17 November 2021, 9,5 mm, FB, NTNU-VM-84438/NUIT-1016; Two specimens, EKJ, 05 May 2022, 12, 11 mm, FB, NTNU-VM-85703/NUIT-1161, NTNU-VM-85650/NUIT-1162; One specimen, HIL, 12 June 2022, 13 mm, FB, NUIT-1179; One specimen, TPO, 16 March 2023, 11 mm, FB, NUIT-1274; One specimen, EKJ, 29 July 2023, 10.5 mm, FB, NUIT-1305.

Localities: EKJ, HIH, HIL, SKI, THA, TPO, UTE

Distribution and remarks: *Eubranchus rupium* was reported as a new species for the Norwegian fauna in 2013 (Evertsen & Bakken 2013). In Russia, *E. rupium* has been reported from the Barents and White Sea (Martynov *et al.* 2006). Using DNA barcoding Descôteaux and co-workers also recently found *E. rupium* larvae north of the polar front (Descôteaux *et al.* 2021). The present study found *E. rupium* to be a commonly occurring nudibranch both at fouling communities and in the intertidal. Animals were found all year round, mainly in association with *Obelia* hydroids growing on *Saccharina latissima*. Spawning was mainly observed in May – August but was also recorded during October - November. These observations together with recent information on the species in Norway (Evertsen & Bakken 2013, Bakken *et al.* 2024a) strongly indicate that the distribution of *E. rupium* in Norway is much wider than previously known. The records from the present study are however the first known records of *E. rupium* from the Tromsø region.

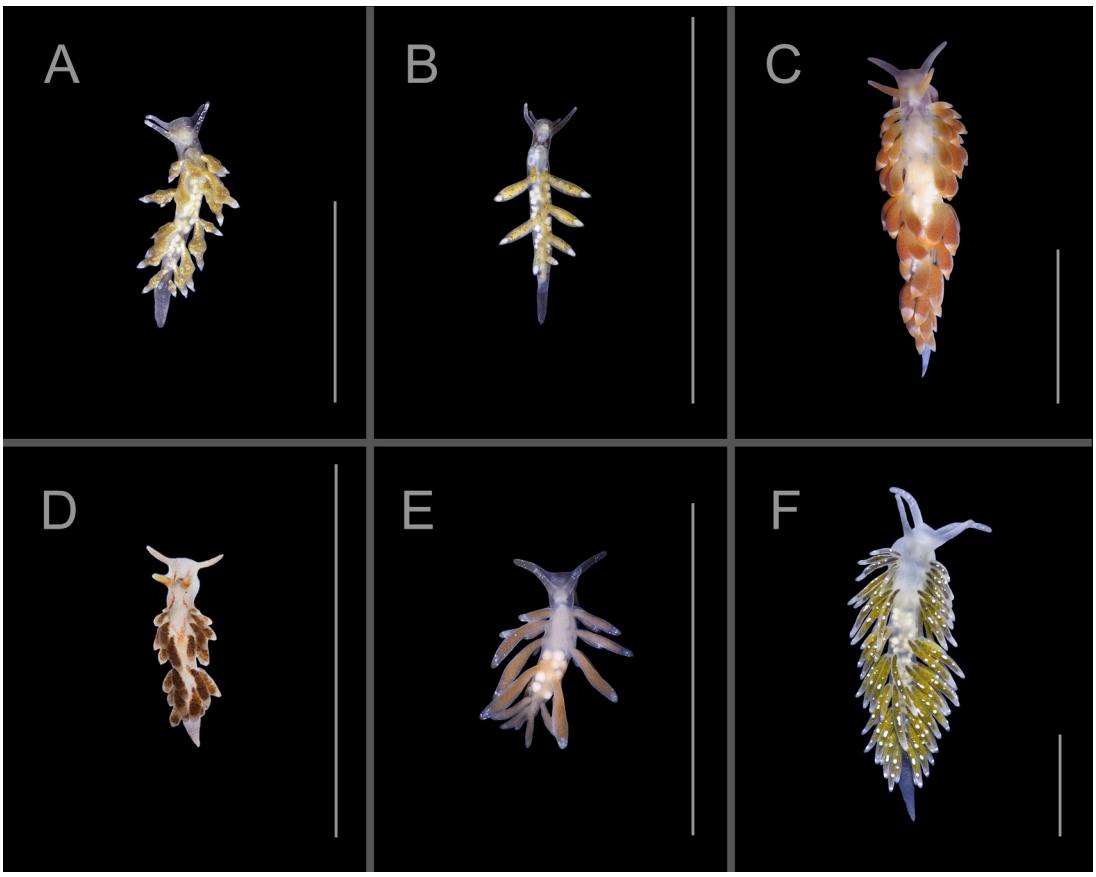

Figure 6. A. *Eubranchus scintillans,* NTNU VM-85695/NUIT-1183, B. *Tergipes tergipes,* NTNU VM-84516/NUIT-1068, C. *Catriona aurantia,* photo record, 18 October 2020, D. *Trinchesia foliata*, NUIT-1335, E. *Zelentia ninel,* NUIT-1149, F. *Zelentia pustulata,* NUIT-1133. Scale bar: 10 mm. All photos: Fredrik Broms.

Eubranchus scintillans (Grishina, Schepetov & Ekimova, 2022)

Figure 6A

Material examined: One specimen, THA, 19 December 2021, 4 mm, FB, NTNU-VM-85739/NUIT-1094; One specimen, THA, 16 March 2022, 3 mm, FB, photographic record; One specimen, THA, 21 June 2022, 10 mm, FB, NTNU-VM-85695/NUIT-1183 (Figure 6A); One specimen, TPO, 07 October 2023, 6 mm, FB, NUIT-1327.

Localities: EKJ, ESU, HIL, KVA, NIP, SKI, THA, TPO, TPR, TTE, UTE

Distribution and remarks: *Eubranchus scintillans* is a newly described species which was until recently considered a colour form of *E. exiguus* (Grishina *et al.* 2022). Recent records of the species are therefore few although Grishina and co-workers noted that both species occur together in the Barents and the North Seas (Grishina *et al.* 2022). In Tromsø, *E. scintillans* was found to be a commonly occurring species. Animals were found at all seasons of the year and were mainly found associated with *Obelia* hydroids growing on *Saccharina latissima.* The present records are the first records of *E. scintillans* in the Tromsø region.

Family **Tergipedidae** (Bergh, 1889)

Tergipes tergipes (Forsskål in Niebuhr, 1775)

Figure 6B

Material examined: One specimen, THA, 06 September 2020, 5 mm, FB, photographic record; One specimen, THA, 25 November 2021, 5 mm, FB, NTNU-VM-84516/NUIT-1068 (Figure 6B); One specimen, THA, 19 November 2022, 6 mm, FB, NTNU-VM-85651/NUIT-1246.

Localities: EKJ, HIL, KVA, NIP, RAK, ROS, THA, TPO, TPR

Distribution and remarks: *Tergipes tergipes* is known from most of the Norwegian coast (Evertsen & Bakken 2005) and has also been reported to be common along the Murman coast (Martynov *et al.* 2006). In Tromsø, the species was commonly encountered all year round. Specimens were mainly associated with *Obelia* hydroids growing on *Saccharina latissima*. Spawning was observed most seasons of the year. The present records are, however, the first records from the Tromsø region.

Family **Trinchesiidae** (F. Nordsieck, 1972)

Catriona aurantia (Alder and Hancock, 1843)

Figure 6C

Material examined: One specimen, 18 October 2020, HIL, FB, photographic record (Figure 6C); Two specimens, HIL, 27 November 2021, 24, 16 mm, FB, NTNU-VM-84458/NUIT-1074, NTNU-VM-85717/NUIT-1075; One specimen, HIL, 26 May 2022, 8 mm, FB, NTNU-VM-85687/NUIT-1167; One specimen, HIL, 15 October 2022, 22 mm, FB, NUIT-1231.

Localities: HIL, SFJ

Distribution and remarks: *Catriona aurantia* has been reported to have a wide but scattered distribution in Norway (Evertsen &

Bakken 2005; Moen & Svensen 2020; Lundin *et al.* 2020). Very few records exist from northern Norway. A single specimen was collected from Dalne-Zelenetskaya Inlet, Russia in 2006 (Martynov *et al.* 2006). The present study found the species all year round. Animals were always found in close association with the hydroid *Ectopleura larynx*. Spawning was observed continuously over the year and egg masses were found close to the basal stolons of the *Ectopleura* colonies. The present records are the first records from the Tromsø region.

Trinchesia foliata (Forbes & Goodsir, 1839)

Figure 6D

Material examined: One specimen, HIL, 29 July 2020, FB, photographic record; One specimen, KVA, 23 October 2021, 4 mm, FB, NUIT-1055; Two specimens, KVA, 25 December 2021, 5, 2 mm, FB, NTNU-VM-84538/NUIT-1098, NTNU-VM-85725/NUIT-1099; One specimen, HIL, 09 January 2022, 2.8 mm, FB, NTNU-VM-85705/NUIT-1116; One specimen, KVA, 30 January 2022, 3.5 mm, FB, NUIT-1118; One specimen, HIL, 03 December 2022, 5 mm, FB; NUIT-1254; One specimen, HIL, 14 November 2023, 6 mm, FB; NUIT-1335 (Figure 6D).

Localities: ESU, HIL, KVA, SFJ, TVK

Distribution and remarks: *Trinchesia foliata* has previously been recorded north to Helgeland (Evertsen & Bakken 2005) and Lofoten (Lundin *et al.* 2020) in Norway. Only very few and scattered records exist. In the Tromsø region, *T. foliata* was found to occur all year round at fouling community localities. The present records are the first from the Tromsø region and significantly extends the known range in distribution for the species northwards to 69 degrees N.

Zelentia ninel (Korshunova, Martynov & Picton, 2017)

Figure 6E

Material examined: One specimen, TPR, 19 December 2021, 7.0 mm, FB, NUIT-1097; Two specimens, THA, 16 March 2022, 4, 6 mm, FB, NTNU-VM-85727/NUIT-1148, NUIT-1149 (Figure 6E); One specimen, TTE, 02 April 2022, 4.9 mm, FB, NTNU-VM-85644/NUIT-1153; One specimen, THA, 10 November 2022, 6 mm, FB, NUIT-1243; Three specimens, THA, 29 December 2022, 1.9, 7.1, 3.8 mm, FB, NTNU-VM-85653/NUIT-1264, NUIT-1265, NTNU-VM-85665/NUIT-1266; Two specimens, THA, 14 January 2023, 5.0, 6.5 mm, FB, NTNU-VM-85675/NUIT-1269, NUIT-1270; One specimen, TPO, 03 March 2023, 2.9 mm, FB, NUIT-1271; One specimen, TPO, 16 March 2023, 5.1 mm, FB, NUIT-1273; One specimen, EKJ, 29 July 2023, 5.9 mm, FB, NUIT-1302; One specimen, TPO, 09 August 2023, 5.0 mm, FB, NUIT-1313.

Localities: EKJ, HMY, KVA, THA, TPO, TPR, TTE

Distribution and remarks: *Zelentia ninel* was described as a new species in 2017 and was then only known from the Barents Sea coast of northern Russia (Korshunova *et al.* 2017d). The first records from Norway, where *Z. ninel* was reported to occur in Troms and Finnmark, were recently published (Broms *et al.* 2023). In Tromsø, the species was observed both at fouling community localities and in the stony intertidal. Animals were mainly encountered during winter but were also occasionally found during summer. Adult animals with eggs inside their bodies were observed at all seasons. Together with recently published records from the Tromsø region these records constitute a new southernmost distribution record and a considerable range extension for the species.

Zelentia pustulata (Alder & Hancock, 1854)

Figure 6F

Material examined: One specimen, TPR, 30 December 2020, FB, photographic record; One specimen, TPO, 16 February 2022, 13 mm, FB, NUIT-1133 (Figure 6F).

Localities: TPO, TPR

Distribution and remarks: *Zelentia pustulata* is a rare species in Norway with only a few scattered observations (Evertsen & Bakken 2005; Artskart 2024). The species has also been registered around Jan Mayen and Svalbard in the Arctic. The records by the present study were made during winter at fouling community localities and are the first records of the species from the Tromsø region.

DISCUSSION

This study presents an annotated and illustrated inventory of the marine nudibranch fauna in shallow water habitats of the Tromsø region. Data were collected during field surveys from land between May 2020 and December 2023. In total, 49 species or taxa, belonging to 19 different families were recorded during the study period. This corresponds to more than double the number of species previously reported from northern Norway. New northerly distribution records are presented for approximately a quarter of the Norwegian nudibranch fauna. In the most recent review of nudibranch distribution and diversity along the Norwegian coast, 18 different species have previously been recorded from the Tromsø region (Evertsen & Bakken 2005). Thirteen of these 18 species were observed also by the present study, whereas six of the species were not found (Table 2). These all include deep-water species. Online records from the Tromsø region (Artskart 2024) have recorded three further species or taxa not recorded by the present study: *Atalodoris pusilla* Alder & Hancock, 1845, *Okenia nodosa* Montagu, 1808 and *Rostanga* sp. Bergh, 1879. When comparing the findings of this study with the latest available checklists from neighboring areas to the north (Svalbard, Palerud *et al.* 2004) and north-east (Russia, Martynov *et al.* 2006), almost all species reported from these areas were also found in Tromsø. By such direct comparisons as above, the species richness recorded by this study, is considerably higher than what has previously been reported from the Tromsø region. In fact, the number of recorded species compare more favorably with areas such as the Maldivian Archipelago in the Indian Ocean, where 52 different species of nudibranchs were collected (Cunha *et al.* 2023). Similarly, from the Gujarat coast in India, 65 different nudibranch species were presented in a recent checklist based on sampling from the area between 2014-2019 (Vadher *et al.* 2020). While such comparisons make little or no sense, the reason for the high species richness found in the shallow waters investigated in the Tromsø region needs to be addressed. Several reasons may explain the high species richness. First of all, rapid advances in DNA-based taxonomy and phylogeny over the past decades, has dramatically increased the knowledge on species diversity. Consequently, several new nudibranch taxa have recently been uncovered in northern and Arctic regions (e.g. Ekimova *et al.* 2015, 2019, 2022; Shipman & Gosliner 2015; Kienberger *et al.* 2016; Korshunova *et al.* 2016, 2017a, 2017b, 2017c, 2017d, 2018, 2020a, 2020b, 2020c, 2021, 2023a, 2023b; Lundin *et al.* 2017; Martynov & Korshunova 2017; Sørensen *et al.* 2020; Descôteaux *et al.* 2021; Martinsson *et al.* 2021; Neuhaus *et al.* 2021; Korshunova & Martynov 2022). While it is beyond the scope of this study to compile or update checklists outside of the study area, the true diversity in the larger

geographic region of the high north is unquestionably far higher than what is reflected by regional checklists. The fact that most regional checklists are outdated in nomenclature and composition gives rise to several concerns that must be kept in mind when comparing older taxonomic inventories with more recent ones. When a species is split into several new species, old records should ideally be re-examined to avoid spurious occurrence data, but are typically left with the name they were recorded under. For example, many of the "old" records in Table 2 are records of species which has later undergone splitting, so that it is impossible to reliably compare records without re-examination. In this study, the nature of such records has, to the best of my knowledge, been addressed. It is, however, important to acknowledge that updated information of the fauna in a region is a necessary prerequisite, before it is possible to make direct comparisons or attribute new distributional data as shifts in geographical ranges (Nakhaev 2016). Indeed, many recent studies have ascribed previously low sampling effort as one of the chief factors, explaining observations of higher recorded diversity in an area compared with previous knowledge (Bouchet *et al.* 2002; Evertsen & Bakken 2013; Cunha *et al.* 2023). Other influencing factors include sampling methodology, as well as spatial and temporal variations in populations (e.g. Nybakken 1978; Evertsen & Bakken 2002; Domenech *et al.* 2002; Betti *et al.* 2017; Cyrne *et al.* 2018; Lombardo & Marletta 2021). As for methodology, all sampling in the present study was conducted from land in very shallow waters, with most observations being made at depths no greater than 0.5 meters. Surveys were also to a large degree conducted at fouling community localities. Such localities are difficult to compare with natural habitats, as they may be affected by anthropogenic activities which can increase connectivity between distant localities (Bishop *et al.* 2017). Of the few studies that have investigated nudibranch diversity in shallow waters, Clarke (1975) found that the maximum occurrence of most species occurred in a zone extending from the low subtidal to a depth of about 3 m below mean low water. Whereas highest diversity was found in this shallow belt, most species did not utilize the actual intertidal zone despite the presence of food items there (Clarke 1975). The low diversity of intertidal species was instead explained by the high thermal sensitivity of nudibranchs, and the wide temperature range of the intertidal. Other studies have reported high diversity in the intertidal (Morley & Hayward 2015). Some nudibranchs have even been found to tolerate emersion above water during low tides (Cyrne *et al.* 2018). This phenomenon was frequently observed also in the present study. Even in wintertime in Tromsø, when ice formed rapidly between tides, several species (*Acanthodoris pilosa*, *Cuthonella concinna*, *Dendronotus frondosus* and *Palio dubia*) were found to tolerate emersion between tides (F. Broms, personal observation). Previous studies from northern Norway have emphasized SCUBA-diving as a crucial methodology for documentation of this otherwise difficult to sample species group (Evertsen & Bakken, 2002). The area investigated by the present study, have next to no overlap with previous sampling conducted by SCUBA divers, or traditional sampling techniques from research vessels. The diversity recorded here is, therefore, likely to only represent a fraction of the true diversity of the region. Yet, while SCUBA diving probably remains the most versatile sampling method for nudibranchs, it may, nonetheless, under-sample shallow habitats. While sampling in shallow waters miss out on deeper living species, the accessibility of the habitat makes it possible to carry out more exhaustive surveys. The risk of overlooking small species is also reduced compared with SCUBA diving. Of even higher importance is probably spatial and temporal variations in populations. If we want to understand species richness in an area, long-term observations of populations are crucial, but such data is very scarce in the literature. Most nudibranch species are short-lived, and sudden and dramatic changes in nudibranch populations have been widely reported by many authors (Nybakken 1978; Todd 1981; Claverie & Kamenos 2008). Peaks in occurrence are therefore easily missed, unless long-term monitoring of populations are conducted (Larkin *et al.* 2017). In addition, annual and interannual variation in water temperature may have profound effects on dispersal, settling and survival of larvae and thus diversity (Clarke 1975). The present study is by no means a complete inventory of the nudibranch fauna of the Tromsø region. Long term survey efforts of assemblages are needed to study whether newly recorded occurrences reflect actual range expansions, or only temporary appearances due to favorable environmental conditions. Whereas it is beyond the scope of the present study to investigate seasonal occurrence in the area, locality surveys were nevertheless performed at all seasons of the year, during both night and day during a total study period spanning 44 months. It is therefore likely that this study was able to document most of the species occurring in shallow water habitats in the region. While all the above-mentioned factors may influence the diversity recorded in regional inventories, the high diversity recorded in the Tromsø region is, nonetheless, striking. While no comparative measurements of diversity were performed, species richness was found to be high both at fouling community localities and in the intertidal. Maximum number of recorded species during a single locality survey was 24 species. The fact that a higher number of species was recorded on a single locality visit, than the number of species previously recorded historically from the two northernmost counties in Norway pooled together, is noticeable. Such species richness compares, or even exceeds, that recorded at the biodiversity hot spot "Scoglio del Corallo" in the Tyrrhenian Sea, Italy. There, 23 different species of nudibranchs were found using SCUBA-diving during a project period spanning between 2013 – 2015 (Furfaro & Mariottini 2016). Other recent studies reporting high diversity, include a survey from the coastal western Mediterranean where 16 nudibranch species were recorded throughout a year (Salvador *et al.* 2022). A survey across the Indonesian coral reef ecosystem recorded 18 nudibranch species from 16 localities (Dharmawan *et al.* 2021). While many new records presented by the present study are, likely, a result of increased sampling effort, there is also strong reason to believe that several species have expanded their distribution northwards in recent years. Many of the species found in Tromsø for the first time were fairly large and conspicuous and were found in easily accessible habitats. Such factors, together with the fact that many of the records were made of spawning populations over several consecutive years, indicate possible real shifts in distribution patterns. Several of the species that were found to be commonly occurring in Tromsø, while never previously recorded from the region, include species that have recently been found for the first time in Arctic Russia. Such species, where poleward range extensions have been attributed to climate warming (Martynov *et al.* 2006; Ekimova *et al.* 2019; Korshunova *et al.* 2021), include *Catriona aurantia, Carronella* sp., *Doris pseudoargus, Doto fragilis, Eubranchus scintillans, Polycera quadrilineata* and *Tergipes tergipes*. These species do, in all probability, have a wide distribution along all the coast from Tromsø to the Russian border. Several other species are likely to belong to the same category, e.g.: *Aeolidia filomenae*, *Amphorina andra*, *Candiella plebeia, Coryphella browni, Coryphella chriskaugei, Coryphella gracilis, Coryphella lineata, Dendronotus europaeus, Dendronotus lacteus, Dendronotus robustus, Facelina auriculata, Favorinus branchialis* and *Polycera norvegica.* None of these species have previously been recorded in the Tromsø region, yet

they were found to be commonly occurring during this study. These species are therefore anticipated to have a wider distribution along the Norwegian coast than currently known. However, as pointed out in the Results, re-examination of old records is needed to establish if these species have already been recorded in northern Norway, but under other names. Yet other, more inconspicuous species, such as *Cuthonella concinna, Doto* cf. *maculata, Eubranchus rupium, Trinchesia foliata* and *Zelentia ninel* probably also have well established populations in northern Norway. Because of their tiny size and low sampling effort in shallow waters, they may simply have been overlooked previously. Most of these species have also been recorded from Russian waters, and the present findings from Tromsø do not imply any recent change in distribution. Species only rarely encountered in this study such as *Aegires punctilucens, Aeolidiella glauca, Coryphella* cf. *monicae, Coryphella* cf. *orjani, Doto* cf. *millbayana, Edmundsella pedata, Eubranchus exiguus, Facelina bostoniensis, Hero formosa, Limacia clavigera, Palio nothus* and *Zelentia pustulata* probably reflect true rarity, spatio-temporal rarity, or species that are only infrequently encountered in such shallow waters as those investigated by the present study. In conclusion, this study reports on a high species richness from a region which is positioned in a biogeographic transition area from boreal to Arctic waters (Spalding *et al.* 2007; Jirkov 2013). While several studies have found recent shifts in nudibranch distribution ranges to be explained by climate change, or other changes in environmental factors (Schultz *et al.* 2011; Nimbs & Smith 2018; Goddard *et al.* 2018), range shifts have also been explained by the lack of pre-existing baseline data or improvement of previous knowledge due to increased search effort and differences in sampling methodology (Bertsch 2014; Nekhaev 2016; Chow *et al.* 2022; Salvador *et al.* 2022; Cunha *et al.* 2023). In light of this, the results from this study highlights the importance of an updated understanding of the distribution of marine species for effective monitoring of marine systems. As such knowledge requires reliable identifications, this study underscores the indispensability of adding molecular methods, such as DNA barcoding, to delimit species in future studies. Furthermore, the need for long term monitoring of spatial and temporal variability in nudibranch occurrences, is crucial in order to understand the persistence of species in their new ranges and determine whether the observed occurrences are persistent or temporary. Long term monitoring in relation to life history traits and environmental factors should be investigated across a wider biogeographical region in the sub-Arctic and Arctic sectors of the Northeast Atlantic. By presenting baseline biodiversity data of nudibranchs from the Tromsø region for the first time, this study hopes to serve as a baseline for more detailed studies focused on monitoring biodiversity in the Arctic region in the future.

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