New and lesser-known caridean (Pandalidae) and penaeoid (Aristeidae, Solenoceridae) shrimp seen from the Maritimes Ecosystem Research Vessel Surveys in Atlantic Canada

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NEW AND LESSER-KNOWN CARIDEAN (PANDALIDAE) AND PENAEOID (ARISTEIDAE, SOLENOCERIDAE) SHRIMP SEEN FROM THE MARITIMES ECOSYSTEM RESEARCH VESSEL SURVEYS IN ATLANTIC CANADA

by

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ABSTRACT

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Reviewing preserved specimens and at-sea photos confirmed ten new and one lesser-known species of shrimp of families Aristeidae, Solenoceridae, and Pandalidae sampled on the Maritimes Ecosystem Research Vessel Surveys between 2017-2025 on the Scotian Shelf of the northwest Atlantic. Seven species were new records for Canada since 1990: *Aristaeomorpha foliacea, Hadropenaeus modestus, Plesionika acanthonotus, Plesionika holthuisi, Plesionika longipes, Plesionika martia,* and *Plesionika tenuipes.* Two species, *Aristeus antillensis* and *Hymenopenaeus debilis,* were known in Canada in 2011 and another*, Faxonia robusta*, was known since 1990, but all three had not been previously recorded on the survey. Species were confirmed in 81 records from 60 sets on 13 surveys, although two sets with *P. acanthonotus* and *P. holthuisi* also had intermediate forms that will need further review. Some shrimp may have been recent strays from southern waters, while others may have been present but were misidentified as the lesser-known species *Aristaeopsis edwardsiana* that was also examined here for comparison. While catches of the new species were infrequent and sparse, this summary will help with future records of shifting distributions in the face of climate change.

RÉSUMÉ

Nozères, C., Murillo, F. J., Cosham, J., Emberley, J. 2026. New and lesser-known caridean (Pandalidae) and penaeoid (Aristeidae, Solenoceridae) shrimp seen from the Maritimes Ecosystem Research Vessel Surveys in Atlantic Canada. Can. Manuscr. Rep. Fish. Aquat. Sci. 3346: v + 58 p. https://doi.org/10.60825/k5m3-x357

La revue des spécimens préservés et des photos prises en mer ent dévoilé dix nouvelles et une méconnue espèces de crevettes des familles des Aristeidae, Solenoceridae et Pandalidae lors des relevés écosystématiques des Maritimes de 2017 à 2025 conduit sur le plateau néo-écossais, dans l'Atlantique Nord-Ouest. Sept espèces ont été nouvelles pour le Canada depuis 1990 : *Aristaeomorpha foliacea, Hadropenaeus modestus, Plesionika acanthonotus, Plesionika holthuisi, Plesionika longipes, Plesionika martia* et *Plesionika tenuipes*. Deux espèces, *Aristeus antillensis* and *Hymenopenaeus debilis,* étaient déjà connues au Canada en 2011 and une autre*, Faxonia robusta*, était connue depuis 1990, mais toutes les trois n'étaient pas enregistrées avant au relevé des Maritimes. En total, 81 observations en 60 traits venant de 13 relevés étaient confirmées. Cependant, deux captures de *P. acanthonotus* et *P. holthuisi* présentaient des variations et nécessiteront un examen plus approfondi. Certaines crevettes pourraient être récemment arrivées des eaux méridionales, tandis que d'autres ont pu être confondues avec l'espèce méconnue *Aristaeopsis edwardsiana*, également examinée à titre de comparaison. Bien que les prises des nouvelles espèces aient été rares et peu nombreuses, ce résumé pourrait s'avérer utile pour les futures observations de l'évolution des répartitions des face aux changements climatiques.

INTRODUCTION

In 2017, a Strategic Program for Ecosystem-Based Research and Advice (SPERA) project "Benthic Community Mapping on the Scotian Shelf" contributed to a special effort to document epibenthic invertebrates in the Maritimes Region of Canada's Department of Fisheries and Oceans (DFO), including at-sea participation of F.J. Murillo on a Research Vessel (RV) survey (Murillo *et al.* 2018, 2024). In the catch, several examples of species were noticed as being either new or rare records. Specimens were preserved for validation in the lab, and some species names were added to the survey list. Recently, an effort was made to document these species as a publication. Since this review began, additional new species were recorded, and the review was expanded to cover surveys up to the summer of 2025. Crabs and other epibenthic invertebrates will be presented in future publications, while this report summarizes the new shrimp species seen on the surveys.

Shrimp may refer to different kinds of crustaceans, several that have shifted in relationships over time (*e.g.,* Williams 1984). In the current classification, it refers here to two groups in the Order Decapoda and infraorders Caridea and Dendrobranchiata. For Atlantic Canada, shrimp species in Caridea are the commonly encountered kinds, while shrimp of Dendrobranchiata (superfamilies Penaeoidea and Sergestoidea) are usually limited to a few deepwater species (Pohle 1988, Squires 1990). In recent decades, additional species have been noticed, although records have not always been formally published. Some observations may be of extralimital strays, while others may have been present for some time but had gone unnoticed, perhaps because they were similar in appearance to local species. This review was thus undertaken to confirm if the new species on recent surveys were also records of new species for Atlantic Canada.

Taxonomic references of shrimp for Atlantic Canada such as Squires (1990) have summarized the species (56 in total, 8 of Penaeoidea, 48 of Caridea) as encountered on fisheries surveys. DFO conducts research vessel bottom trawl surveys annually across the northwest Atlantic, operated by Gulf Region, Maritimes Region, Newfoundland and Labrador Region, and Quebec Region. These Research Vessel (RV) surveys, also called multispecies or ecosystem surveys, perform bottom trawl sampling to evaluate trends in abundance for most groundfish and other fish and invertebrate species (*e.g.,* Emberley and Clark 2012, DFO 2024). The RV surveys also serve as platforms of opportunity to document biodiversity, typically of megafaunal epibenthos such as sponges, echinoderms, molluscs, and decapod crustaceans. Observations of new species in the regions may then be useful as ecosystem indicators and thus the interest in confirming such changes (Lawlor *et al.* 2024). Reports for the Gulf of St. Lawrence (Savard and Nozères 2012, Isabel *et al.* 2024) have listed some new species (*Aristeus antillensis, Hymenopenaeus debilis, Plesionika martia*), while several have yet to be formally documented as new distributions in the Maritimes Region for the Atlantic waters off the Canadian province of Nova Scotia, as will be examined here.

Reporting regional species distributions can take on a variety of forms. Historically, books and articles would compile lists with expected ranges of taxa, as seen in Squires (1990) for Atlantic Canada and Williams (1988) and Nizinski (2003) for the Atlantic US. An extralimital observation of a new species may also be published as a short note (Moriyasu *et al.* 2001, Wilson and Pohle 2016). Apart from RV surveys, research programs are another source of regional observations, for example, by performing pelagic net surveys to sample species that are abundant in the water

column but rarely collected in bottom trawls (MacIsaac 2011, MacIsaac *et al.* 2014, Shea and Kenchington 2024, Lirette and Kenchington 2026).

Another source has been underwater camera surveys collecting imagery, to document and sometimes sample shrimp, for example the NOAA OER Atlantic survey EX1905L2 in Canadian and US waters in 2019, including a dive (https://www.ncei.noaa.gov/waf/okeanos-rov-cruises/ex1905l2/) that observed and collected *Plesionika holthuisi* for the Smithsonian museum (http://n2t.net/ark:/65665/3526d57e7-ed51-45aa-8730-c7b8c4a53838). As the shrimp in this review were common in the south, images from other dive surveys on the OER expedition website were also reviewed for presence of shrimp species in southern US waters (https://www.ncei.noaa.gov/waf/okeanos-rov-cruises/ex1903l2/). Searching for examples of species was conducted on the SeaTube platform by Ocean Networks Canada (ONC) which hosts annotated videos from DFO and NOAA expeditions (https://data.oceannetworks.ca/SeaTube).

Other resources may include checklists, such as the national and regional lists provided on the Canadian Register of Marine Species (https://www.marinespecies.org/CaRMS/checklist.php), a thematic node of the World Register of Marine Species (WoRMS, https://www.marinespecies.org/index.php). Records of marine species occurrences are also available online with the Ocean Biodiversity Information System (OBIS, https://obis.org/). This data portal primarily hosts records from RV surveys, with scientific names matched to the current taxonomy in WoRMS, thus providing a level of quality control over synonyms and misspellings. OBIS records are aggregated to the Global Biodiversity Information Facility (GBIF, https://www.gbif.org/), which also collects records of preserved specimens from institutions such as the National Museum of Natural History (NMNH), the Canadian Museum of Nature (CMN), and the Royal Ontario Museum (ROM). Some museum records provide images to confirm the records, while all others are presumed to be valid, but cannot be confirmed unless the source provider has more information. For this review, museums were not contacted regarding their shrimp species records. An additional source of observations is iNaturalist (https://www.inaturalist.org/). When identifications are confirmed by community users, these records become published to GBIF. The photo-based observations on iNaturalist have become important sources of regional information, for shrimp and other taxa, with contributions and discussions by the public along with scientists and fisheries personnel, as may be seen in this project (https://www.inaturalist.org/projects/marine-biodiversity-of-atlantic-canada).

Rather than analyzing all observations for Atlantic Canada from various sources, this document seeks to review species not in Squires (1990) that were also new or poorly recorded on the Maritimes Region RV surveys. An exception was *Dichelopandalus leptocerus*, a widespread species in NW Atlantic waters that had gone unnoticed for decades on surveys because the striped body coloration resulted in misidentification with another common pandalid shrimp, *Pandalus montagui* (Figure 1), as was noticed with online photos from nearshore surveys in 2017 (https://www.gbif.org/occurrence/1699368141). On the Maritimes RV survey, there was an unconfirmed record of *D. leptocerus* in 2016 (https://www.gbif.org/occurrence/3081849619), then several were examined and confirmed from the 2017 survey (Murillo *et al.* 2018). The species has since been confirmed as present in its historical distribution across the Gulf of Maine, the Scotian Shelf, southern Gulf of St. Lawrence, and southwestern Newfoundland: https://www.gbif.org/species/2222507. It is mentioned here to highlight its presence in the study

area but was not reviewed as a new species (Squires 1990). Another exception was the inclusion of the rare but known species *Aristaeopsis edwardsiana*, presented for reference because it was noticed as the source of confusion for the new species of Aristeidae in this review.

Figure 1. Comparing coloration of *Dichelopandalus leptocerus* (top) with another striped shrimp, *Pandalus montagui* (bottom), as seen on a Bay of Fundy survey in 2019. Photo: DFO-T. Hansen.

Additional resources consulted were the available genetic reference sequences for the presented species, especially for specimens in the western Atlantic. Genetic groupings indexed in Barcode of Life Data Systems (BOLD, https://www.boldsystems.org) were included in each of the species summaries, as noted in the Material and Methods section.

A final consideration for this review of shrimp species was the availability of evidence supporting the identification, including photo records from other surveys. Identifying all biodiversity sampled on a RV survey while at-sea is not practical unless there are dedicated personnel and adequate resources as may occur on some surveys, such as the DFO Greenland Halibut survey in Davis Strait-Baffin Bay (Nozères *et al.* 2019). Some surveys photograph the captures which may then help to validate these records post-survey (Nozères *et al.* 2022). In Maritimes Region, at-sea photos from surveys were available for some shrimp records, and some had preserved specimens that could be photographed. It is these catch records that could be validated with photos and samples that are presented in this report.

MATERIALS AND METHODS

Catches of shrimp records were reviewed from the annual DFO Maritimes Ecosystem RV Surveys conducted in winter/spring and summer periods. The winter survey covers Georges Bank (NAFO 5Ze) including US waters, and extends to the western Scotian Shelf, Gulf of Maine and

into the Bay of Fundy (NAFO 4X), as time allows (blue, Figure 2). The summer survey also covers the Bay of Fundy and the Gulf of Maine, then extends west across the Scotian Shelf to the Laurentian Channel (red, Figure 2). Maritimes RV survey records are published online, including on OBIS/GBIF for winter: Regnier-McKellar (2022a), and summer: Regnier-McKellar (2022b). Additions and corrections will follow in future versions.

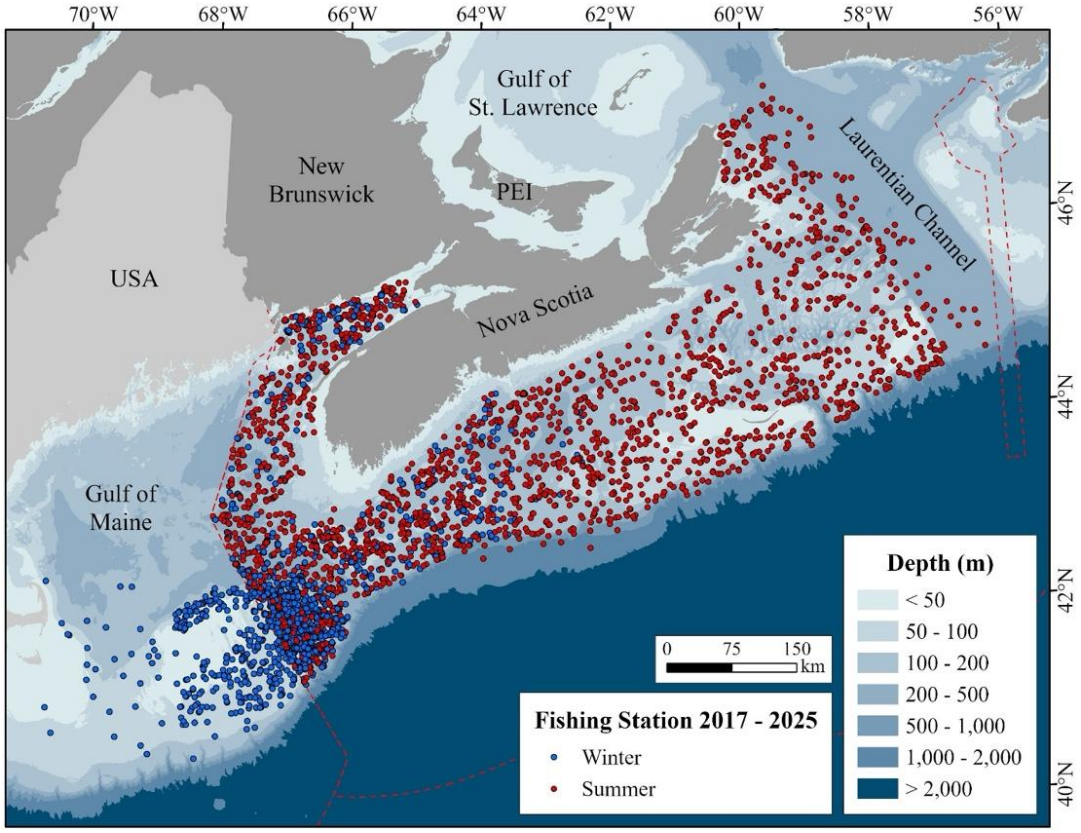

Figure 2. Maritimes Region RV Survey sampling area coloured by depth strata and season between 2017 and 2025, with winter sets in blue and summer sets in red. The Canadian Exclusive Economic Zone (EEZ) is delineated by the red dashed line.

Fishing stations, or sets, on the RV surveys are allocated using a stratified random sampling design. Between 2017 and 2022, sets were performed with standardized 30 min bottom tows at vessel speed of approximately 3.5 knots using a Western IIA bottom trawl gear with a 19 mm mesh lining in the codend (Tremblay *et al.* 2007). With the change to a new vessel since 2022, fishing operations are now carried out with NEST gear and 20-minute tows at a speed of 3 knots for a standard distance of 1 nautical mile (Yin *et al.* 2025). The catches are reported by their regional survey catch code (Losier and Waite 1989) and tow set number. Several codes have been added to the database since 1989 to represent more species. More details are available in Clark and Emberley (2021) and DFO (2024). In past years, catches may have been photographed, although not all catches, years or sets were done so consistently. As of 2025, the survey at-sea database incorporates images into the records for each recorded type in the catch. Specimens may be preserved, especially when seeking to confirm identification. For the 2017 summer survey, F.-J. Murillo preserved several unidentified decapods (shrimp and crabs), with more done by Jamie Emberley, Jessica Cosham, and other survey personnel in subsequent years.

While this review initially examined specimens from 2017, the exercise was expanded to include all shrimp records and the validation of available photos to uncover more examples and variations of new species, some that first appeared in more recent years. In the first step, while at-sea, specimens from 2017 were preserved whole in 70% ethanol (Murillo *et al.* 2024). In later years, specimens were placed in plastic bags with a paper label and frozen at-sea at -20°C, then thawed when examined in the laboratory, and preserved whole in 95% ethanol. The specimens from 2017 were reviewed in 2024. Additional at-sea photos and frozen specimens were reviewed from surveys between 2018-2025, with current identifications made in 2026. Generally, compact digital cameras were used at-sea, replaced by a tablet (iPad) in recent years. Smartphones with macro lenses were used for lab photos. All identifications were based on morphology and documented in photos. While no molecular analyses were performed, DNA sequences from BOLDsystems were consulted for supporting information about the species (see below).

The review process began by examining preserved specimens in the laboratory using taxonomic resources, including original descriptions, identification guides and keys or discussion articles (*e.g.*, Smith 1881, Pequegnat 1970, Williams 1984, Cardoso *et al*. 2019). General features of shrimp morphology are illustrated in Figure 3. Some specimens were in better condition than others, and thus not all were easy to examine with taxonomic keys and resources as cited in the individual species summaries. Through comparisons and including at-sea photos of fresh specimens, identifications based on morphology were refined for the results of the sets shown in this report. The species were deemed sufficiently distinctive in visible features that identifications were considered acceptable for the presented photos from each set. A few sets were identified with less-than-optimal photos (blurry) but were considered likely correct based on shape, size, coloration, and location. Sets with shrimp photos considered to be too poor for identification, or those with no photos, were not included here. Photos of examined specimens and at-sea photos were compiled in an image catalogue (Adobe Lightroom Classic v.13). The photos were tagged for location with fishing set information (see next step below) and given keywords of taxonomic names for each species in view in a photo. This enabled quick comparisons by filtering for photos between sets and species names in the image database.

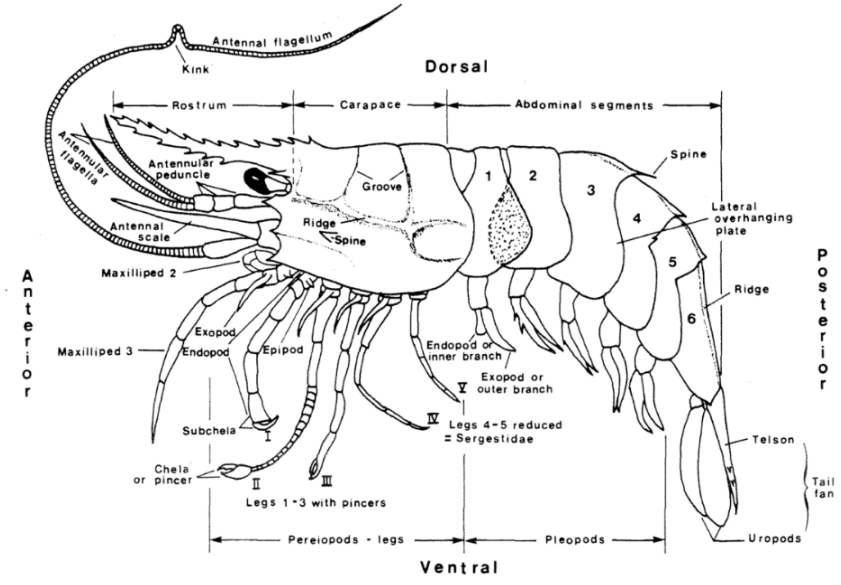

Figure 3. Generalized illustration of a shrimp, adapted from Fig. 1 in Pohle (1988).

The next step was to match photos by fishing set and species to their original record. The Maritimes Region RV Survey database records were extracted by F. J. Murillo on 2026-01-05, then used as a spreadsheet, with all catch records reviewed for potential instances of new shrimp species. Crustacean records coded to a general level (genus, family, order or Crustacea) were flagged as potential decapods for review. Unknown crustaceans of about 10 g or more (calculated as the mean individual weight from total catch weight and total count) were highlighted for verification as large shrimp species such as aristeids. Common species were also tagged as decapods but not highlighted for review unless later noticed as misidentified from catalogued photos (see below). All records coded as Unidentified were also highlighted for later verification if confirmable in images at-sea or in preserved specimens.

Cross-checking of shrimp records was then done in conjunction with the image catalogue. In some instances, photos might reveal that a record contained more than one species, which would eventually require splitting the entries and creating additional records for each species in that set for the catch database. During the review, a few records were noticed as suspect for a species due to location, depth, or estimated size (weight/number in catch) but only those records with adequate photos were resolved in this review. Once each species by set in the catalogue had a matching record, the spreadsheet was tagged for an example photo, to be shown in species accounts below.

After examining preserved specimens and reviewing at-sea photos, resources were also consulted to evaluate if the identified species represented new distributional records in Atlantic Canada, in addition to being new to the Maritimes RV survey. New species were defined relative to historical publications, specifically Squires (1990), and biodiversity data portals. Records from GBIF were privileged as the portal aggregated several sources such as OBIS, iNaturalist, and museum records. Records on GBIF were manually examined on the web site using its mapping tools to review Aristeidae, Solenoceridae, and Pandalidae in Atlantic Canada. Global records of these families were also reviewed, to reveal their nearest occurrences.

The results are presented here as species accounts (in a selected, not alphabetical order) summarizing key characteristics and examined records from the surveys. Also included are links for information from WoRMS and related records on GBIF. Specimens with DNA sequences published on BOLD are presented when available, with comments about the geographically nearest specimens as well as the groupings indexed with BOLD Identification Numbers, or BINs.

RESULTS

General overview

Across 28 surveys from 2017-2025, 13 had at-sea or conserved specimen photos of new and lesser-known shrimp species (Table 1). The 81 confirmed species records are summarized in Table 2, with the occurrences by year listed in Table 3. The relative locations of species records are provided in Figure 4. Some sets had several species and thus shown here with overlapping place markers. Individual maps by species are provided in the species accounts, while all 81 records from the 13 surveys and 60 sets are listed in the Appendix.

Table 1. List of Maritimes RV surveys conducted in 2017-2025, indicating those surveys with photos from at-sea and conserved specimens confirming the new and lesser-known shrimp species.

			New shrimp photos	
Cruise	**Year**	**Season**	**At-sea**	**Conserved**
NED2017002	2017	spring		
NED2017020	2017	summer	present	present
NED2017102	2017	spring		
TEL2017002	2017	spring		
TEL2018023	2018	summer	present	
VEN2018002	2018	spring		
NED2019002	2019	spring		
NED2019030	2019	summer	present	present
NED2019102	2019	spring	none	present
NED2020025	2020	summer		present
TEL2020002	2020	spring	none	
TEL2020102	2020	spring	none	
CAR2021240	2021	summer	present	present
CAR2021241	2021	summer		
NED2021008	2021	summer		
TEL2021002	2021	spring	none	
CAR2022102	2022	spring	none	
CAB2022010	2022	summer	none	
TEL2022010	2022	summer	present	present
CAR2023002	2023	spring	present	present
VEN2023001	2023	spring	none	
CAR2023011	2023	summer	present	present
TEL2023010	2023	summer	present	present
CAB2024003	2024	spring	none	
TEL2024002	2024	spring	none	
CAR2024010	2024	summer	present	present
CAR2025002	2025	spring	present	present
CAR2025010	2025	summer	present	present

Eleven species of shrimp (Order Decapoda), six in families Aristeidae and Solenoceridae (suborder Dendrobranchiata) and five in family Pandalidae (infraorder Caridea), were confirmed from the review: 10 were new to the Maritimes surveys and one was the lesser-known species, *Aristaeopsis edwardsiana* (Table 2). Seven species were new to Canada, with three others had confirmed elsewhere (*Aristeus antillensis, Hymenopenaeus debilis*) or were known (*Faxonia robusta*) but not previously recorded on the Maritimes surveys. Two of the new species, *Plesionika longipes* from 2022 and *Plesionika tenuipes* from 2023, have since been published on GBIF (see

links in the species profiles) during the preparation of this report, having been submitted to the ROM. From other occurrences published on GBIF, four species known in southern USA waters appear to be wholly new to Canadian waters: *Aristaeomorpha foliacea, Hadropenaeus modestus, Plesionika acanthonotus,* and *Plesionika holthuisi*. The most frequent species were *Plesionika tenuipes* in 16 sets followed by *P. martia* in 15 sets. The least frequent species were *H. debilis, P. acanthonotus*, and *P. longipes*, recorded in three sets each.

Table 2. Sum of species by group, family, set and examined specimens (Spec.) from 2017-2025, as compared to records on the portal of GBIF (March 2026) labelled here as present (Atlantic Canada), recent (2022 or 2023), or known nearby (off New Jersey, Delaware, or Cape Cod).

Group	Family	Species	Sets	Spec.	GBIF
Penaeoidea	Aristeidae	*Aristaeopsis edwardsiana*	4	4	present
		Aristaeomorpha foliacea	9	20	New Jersey
		Aristeus antillensis	5	14	present
	Solenoceridae	*Faxonia robusta*	8	9	present
		Hadropenaeus modestus	9	14	Delaware
		Hymenopenaeus debilis	3	3	present
Caridea	Pandalidae	*Plesionika acanthonotus*	3	3	New Jersey
		Plesionika holthuisi	6	5	Cape Cod
		Plesionika longipes	3	4	2022
		Plesionika tenuipes	16	42	2023
		Plesionika martia	15	26	present

Table 3. Confirmed species occurrences in sets by year from 2017 to 2025.

Species	2017	2018	2019	2020	2021	2022	2023	2024	2025
Aristaeopsis edwardsiana	1						2	1	
Aristaeomorpha foliacea	1		2				1	4	1
Aristeus antillensis	1		1				1	1	1
Faxonia robusta		1	2		1	1	2		1
Hadropenaeus modestus	3			1		2	3		
Hymenopenaeus debilis	3								
Plesionika acanthonotus	1				1				1
Plesionika holthuisi	2				1				3
Plesionika longipes						1	2		
Plesionika tenuipes				1			7	3	5
Plesionika martia	1		4		1		1	3	5

Identifications were achieved for each species from examining preserved specimens (Spec. in Table 2), then some sets with at-sea photos-only were deemed reliable to add additional records. Several species had only a few records and most sets were all preserved and examined, which was

preferable as they were more difficult to identify. The more frequent species of *A. antillensis, A. foliacea, F. robusta, P. tenuipes,* and *P. martia* were all visually distinctive and confirmed from sets even if only shown in at-sea photos. The sole unresolved difficulty arose with shrimp identified as *Plesionika acanthonotus* and *Plesionika holthuisi* because in two sets (CAR2021040 set 68, CAR2025010 set 90), there were several individuals that had rostrum shape and length ranging from short and curved (*P. acanthonotus*) to long and straight (*P. holthuisi*), and others that appeared to be intermediate in form. Both sets are presently labelled as containing both species, however, the total number by species in each is uncertain.

In terms of distributions, eight species were sampled from the outer margin of the Scotian Shelf, mostly in the west from Browns Bank to Sable Island Bank, with aristeids also recorded on the shelf margin to the east, between the Gully Canyon and the Laurentian Channel (Figure 4). The solenocerid *Faxonia robusta* was sampled from both the shelf margin and the inner basins, while the latter was the only area from where the pandalid *Plesionika tenuipes* was sampled. The pandalid species *Plesionika martia* had the widest range in records, extending from the Gulf of Maine to the Laurentian Channel.

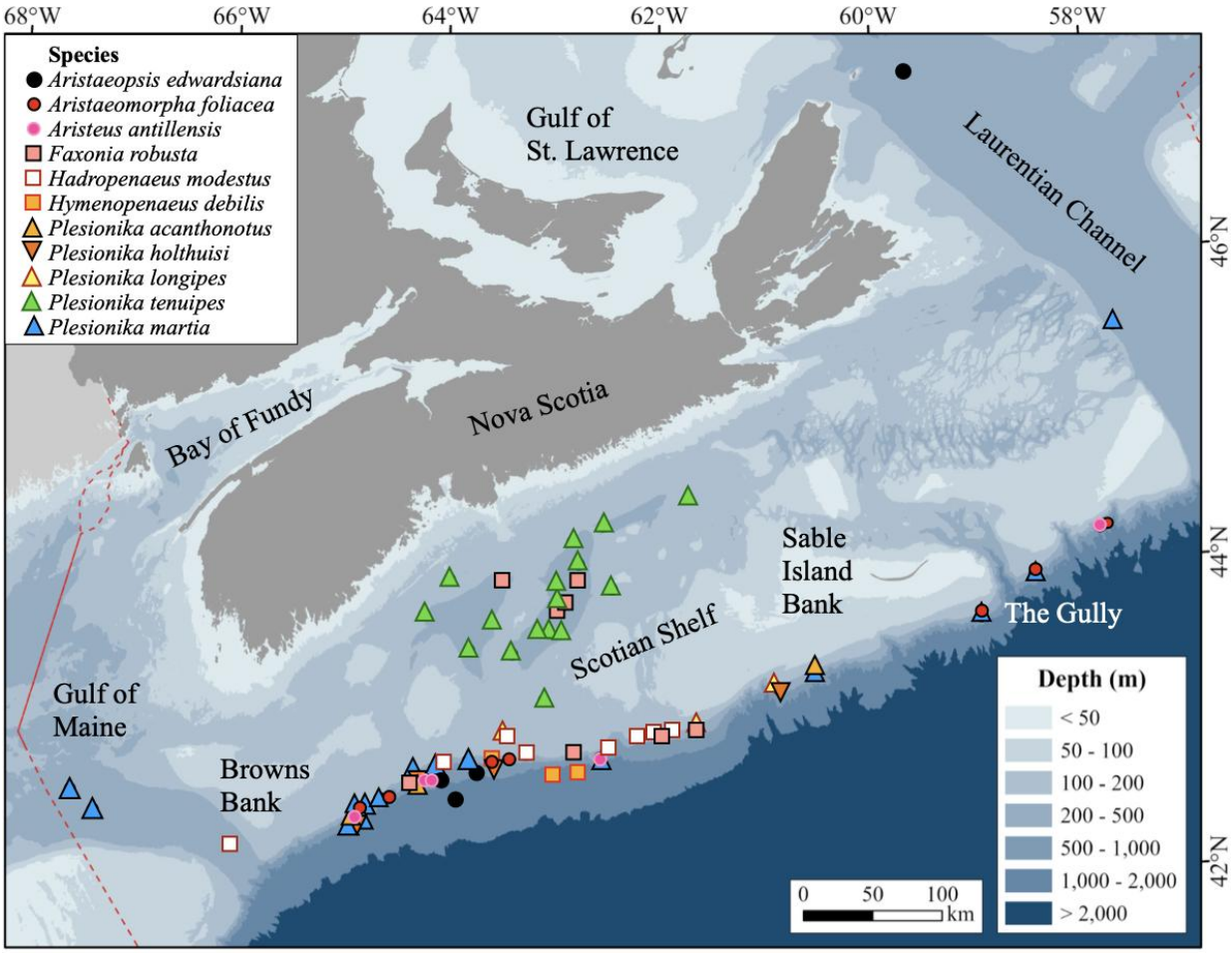

Figure 4. Map by species of confirmed records of the reviewed shrimp sampled from the Maritimes RV Surveys between 2017-2025. Canadian EEZ is delineated by the red line.

Species accounts

Individual species summaries, photo examples, and occurrence maps are presented below. Examined records from the individual surveys and sets are summarized in the Appendix.

***Aristaeopsis edwardsiana* (Johnson, 1868)**

Infraorder Penaeoidea, Family Aristeidae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=240796

Diagnosis: A very large, scarlet red shrimp with a rostrum bearing only three, well-spaced teeth; moderately long in females and juvenile males, shorter in adult males. Strong carina or ridges on carapace, along with middorsal carina on 3rd-6th abdominal segments (Squires 1990, Perez-Farfante and Kensley 1997).

Examined specimens: NED2017020 set 263 (Figure 5); CAR2023002, sets 166, and 167; CAR2024010 set 211. Photos confirmed the four sets (Figures 6 and 7), while seven other records were of other aristeids (see the following profiles).

Distribution: Gulf of Mexico to Labrador (Squires 1990). Survey captures were from depths of 474-1348 m.

DNA barcoding had one BIN group (BOLD: AAB2201), sampled from the Atlantic and Australia.

Figure 5. *Aristaeopsis edwardsiana*, sampled from NED2017020 set 263, carapace length: 86 mm.

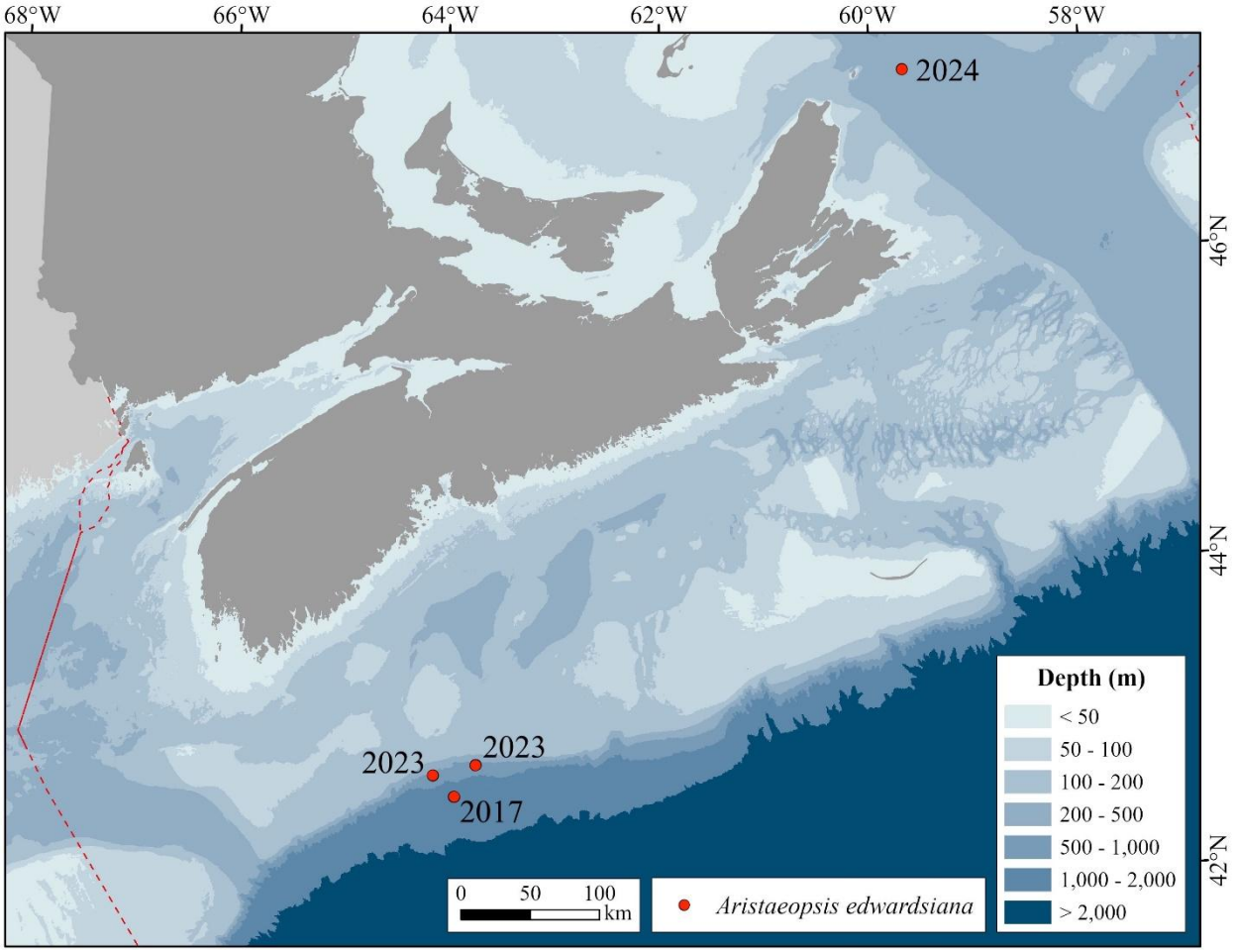

Figure 6. Map of confirmed occurrences by year for *Aristaeopsis edwardsiana* sampled from the Maritimes RV surveys between 2017-2025.

NED2017020 set 263

CAR2024010 set 211

CAR2023002 set 166

CAR2023002 set 167

Figure 7. Examples of photos from four confirmed sets with *Aristaeopsis edwardsiana*.

***Aristaeomorpha foliacea* (Risso, 1827)**

Infraorder Penaeoidea, Family Aristeidae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=158326

Diagnosis: A very large, scarlet red shrimp with a rostrum bearing more than three teeth. Rostrum is elongated in females and juvenile males, but shorter in adult males.

Examined specimens: NED2017020 set 130; CAR2024010 set 105, set 106 (Figure 8), and set 267. Photos confirmed nine sets on the shelf margin (Figures 9 and 10), originally recorded as *Aristaeopsis edwardsiana* (with one from CAR2023002 set 138 conserved at the ROM: https://www.gbif.org/occurrence/5070802701), the family Aristeidae, Shrimp (Decapoda), or Unidentified. Captures were from 302-488 m depth.

Distribution: Gulf of Mexico to Massachusetts (Perez-Farfante and Kensley 1997); one observed from nearby Bear Seamount in 2002: https://www.gbif.org/occurrence/350568600.

DNA barcoding on BOLD had four groupings, mostly in the Atlantic with BOLD:AAD9249, and other specimens from the Indo-Pacific.

Figure 8. *Aristaeomorpha foliacea*, sampled from CAR2024010 set 106, carapace length: 33 mm.

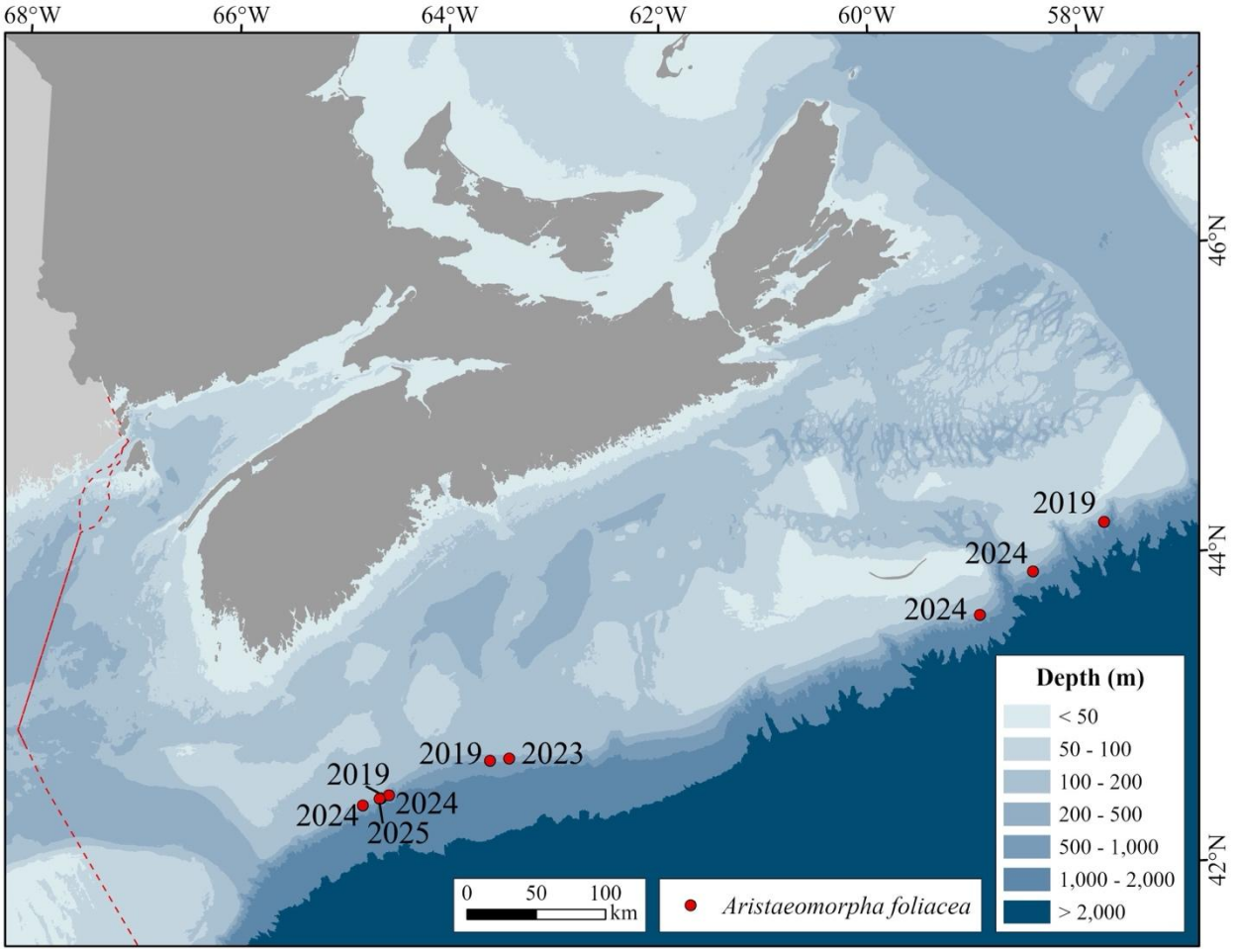

Figure 9. Map of confirmed occurrences by year of *Aristaeomorpha foliacea* sampled from the Maritimes RV surveys between 2017-2025.

Figure 10. Examples of photos from nine confirmed sets with *Aristaemorpha foliacea*.

***Aristeus antillensis* A. Milne-Edwards & Bouvier, 1909**

Infraorder Penaeoidea, Family Aristeidae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=158327

Diagnosis: Carapace lacking a vertical ridge (hepatic carina) unlike *Aristaeopsis edwardsiana* and having a rostrum with only 3 dorsal spines unlike *Aristaemorpha foliacea*. Males have a short rostrum that is elongated in juveniles and females (Pérez Farfante and Kensley 1997). Coloration is typically less scarlet and more purplish-white relative to the other local aristeid species.

Examined specimens: NED2017020 set 121 (Figure 11); CAR2024010 set 250; CAR2025002 set 90. Photos confirmed five sets on the shelf margin (Figures 12 and 13) with individuals originally recorded as *Aristaeopsis edwardsiana*, *Plesionika martia*, Shrimp (Decapoda), or Unidentified. Captures were from 386-624 m depth.

Distribution: Brazil to Gulf of Mexico, with outliers up to Baltimore, MD. Previous Canadian records: Several reports in Laurentian Channel (historically misidentified as *Aristaeopsis edwardsianus*) to the edge of Grand Banks (Moriyasu *et al.* 2001).

iNaturalist has observations near Grand Banks in 2006 and 2024 and the Laurentian Channel in 2011 and 2013: https://www.inaturalist.org/observations?place_id=any&taxon_id=295629.

DNA barcoding of COI has been published on Indian and Pacific Oceans species of *Aristeus*, but not the Caribbean *A. antillensis*. A 16S rRNA sequence was published for *A. antillensis* in Vázquez-Bader *et al.* (2004), along with one for *Aristaeopsis edwardiana*.

Figure 11. *Aristeus antillensis* sampled from NED2017020 set 121, carapace length: 37 mm.

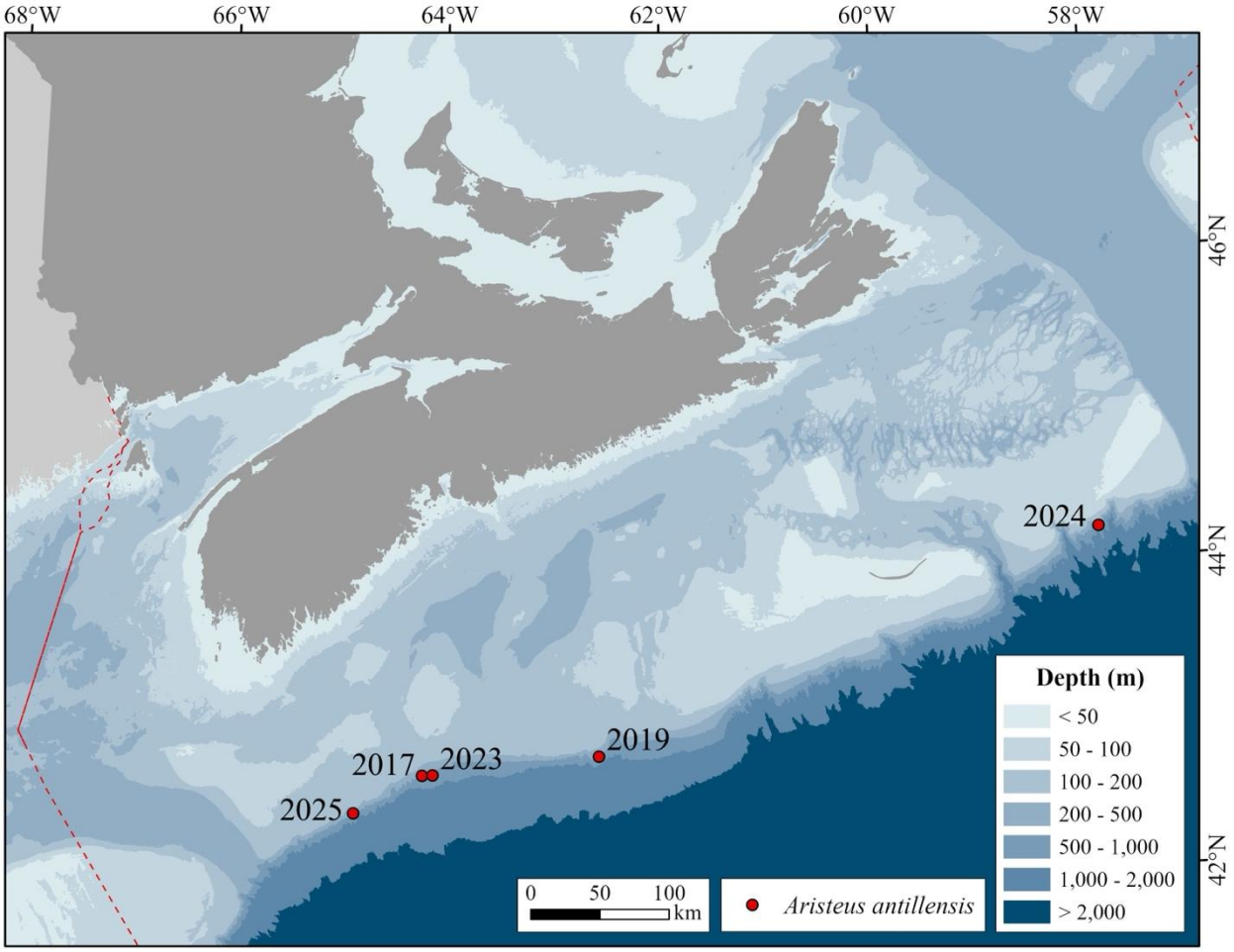

Figure 12. Map of confirmed occurrences by year of *Aristeus antillensis* sampled from the Maritimes RV surveys between 2017-2025.

NED2017020 set 121

NED2017020 set 121

NED2019030 set 133

CAR2023002 set 166

CAR2024010 set 250

CAR2025002 set 090

Figure 13. Examples of photos from five confirmed sets with *Aristeus antillensis*.

***Faxonia robusta* (Smith, 1885)**

Infraorder Penaeoidea, Family Solenoceridae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=1806299

Diagnosis: A large pink to red shrimp with large eyes and a rostrum reaching to about the end of the antennular peduncle, bearing 10-12 dorsal teeth (Pérez Farfante 1988, Pohle 1988).

Examined specimens: NED2019030 set 132; CAR2021240 set 68 (Figure 14); TEL2022010 set 161; CAR2023011 set 217; CAR2025010 set 122. Photos confirmed eight sets (Figures 15 and 16) from the shelf margin and inner basins originally recorded as *Pandalus borealis*, Shrimp (Decapoda), or Unidentified. Captures were from 199-355 m depth.

Distribution: French Guiana to Gulf of Mexico with outliers to New York and Massachusetts (Pérez Farfante 1988), and occasional strays to the Scotian Shelf (Pohle 1988), including one in 2007 conserved at the ROM: https://www.gbif.org/occurrence/5070747244.

iNaturalist has two observations by Joe Kunkel from a survey in the Gulf of Maine in 2010, for example: https://www.inaturalist.org/observations/18375130.

DNA barcoding has some as *Pleoticus robustus* (synonym), mostly in BOLD:ACY7592 with *Pleoticus muelleri*, an important species in the Southwest Atlantic (Brazil to Argentina). Targeted analyses of *P. mulleri* have revealed it as distinct from *P. robustus* (Carvalho-Batista *et al.* 2018).

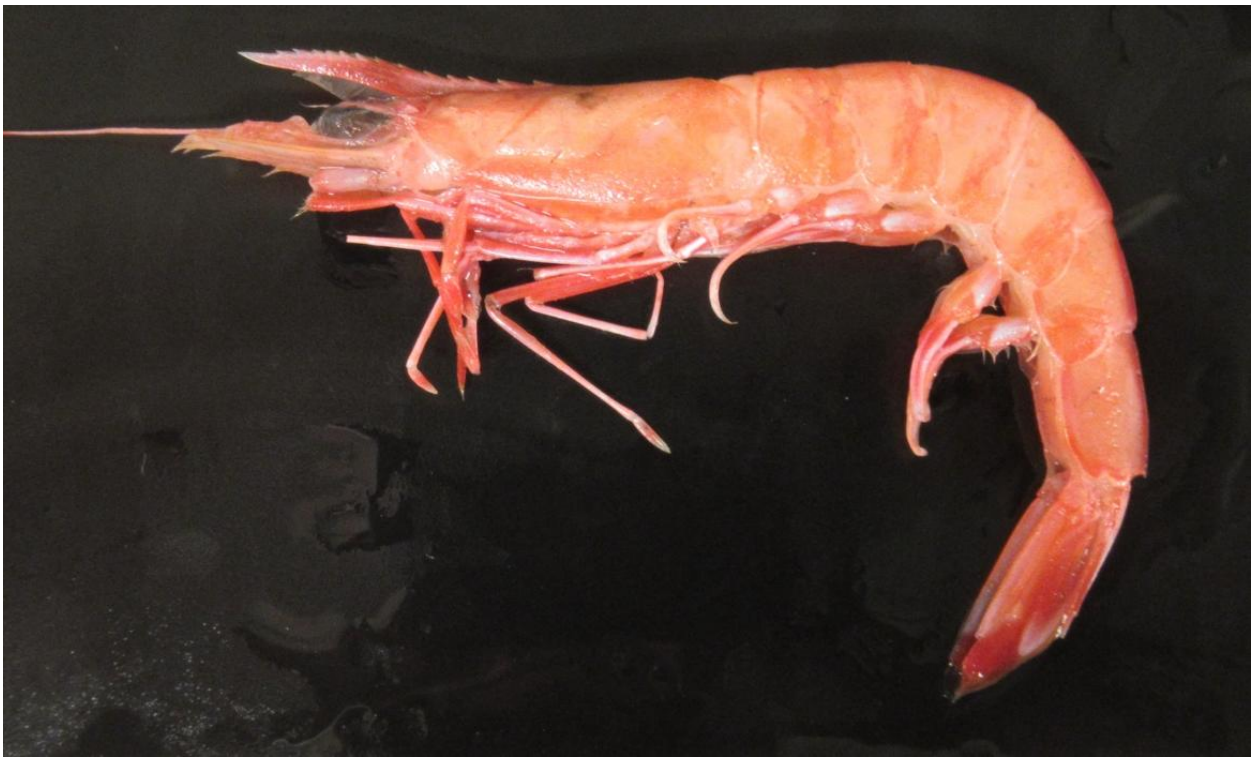

Figure 14. *Faxonia robusta* sampled from CAR2021240 set 68, carapace length: 60 mm.

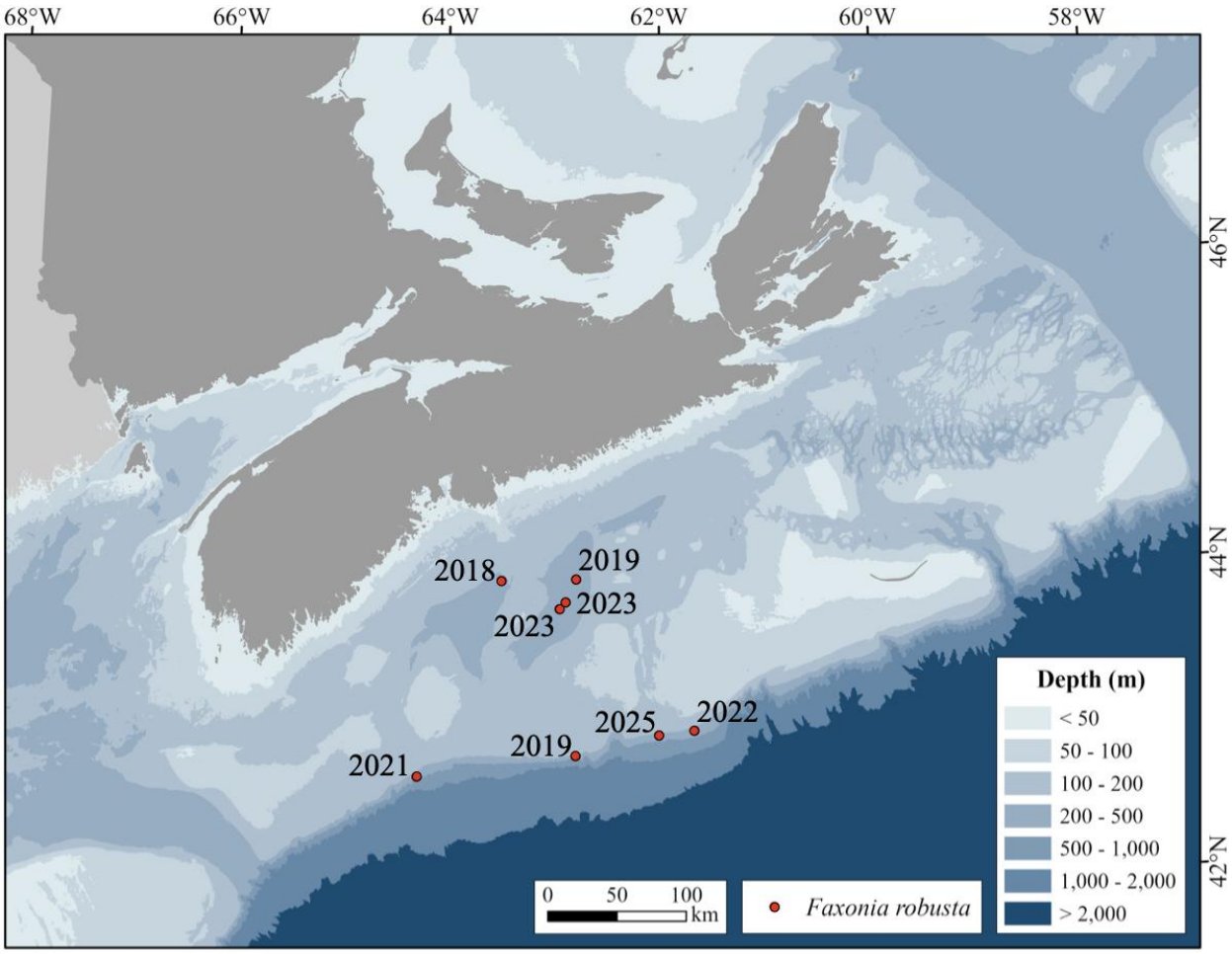

Figure 15. Map of confirmed occurrences by year of *Faxonia robusta* sampled from the Maritimes RV surveys between 2017-2025.

TEL2018023 set 006

NED2019030 set 119

NED2019030 set 132

CAR2021240 set 068

TEL2022010 set 161

CAR2023011 set 132

CAR2023011 set 217

CAR2025010 set 122

Figure 16. Examples of photos from eight confirmed sets with *Faxonia robusta*.

Hadropenaeus modestus (Smith, 1885)

Infraorder Penaeoidea, Family Solenoceridae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=377445

Diagnosis: A small shrimp bearing a short rostrum with six dorsal teeth (Alves-Júnior *et al.* 2017).

Examined specimens: NED2017020 sets 124 (Figure 17), 253, and 261; NED2020025 set 122, TEL2022010 sets 41 and 160; CAR2023002 set 137; TEL2023010 sets 98 and 99. Photos confirmed nine sets (Figures 18 and 19) from the shelf margin originally recorded as *Dichelopandalus leptocerus*, *Sergia robusta*, Shrimp (Decapoda), or Unidentified. Captures were from 161-234 m depth.

Distribution: Gulf of Mexico and Caribbean Sea with outliers from Brazil to Delaware (Alves-Júnior *et al.* 2017, Pérez Farfante 1977).

No specific published genetic information, but there are two groups in the Indian Ocean, for *Hadropenaeus lucasi* in BOLD:ADX3855 and the genus in BOLD:AAY2502.

Figure 17. *Hadropenaeus modestus* as seen on NED2017020 set 124, carapace length: 13 mm.

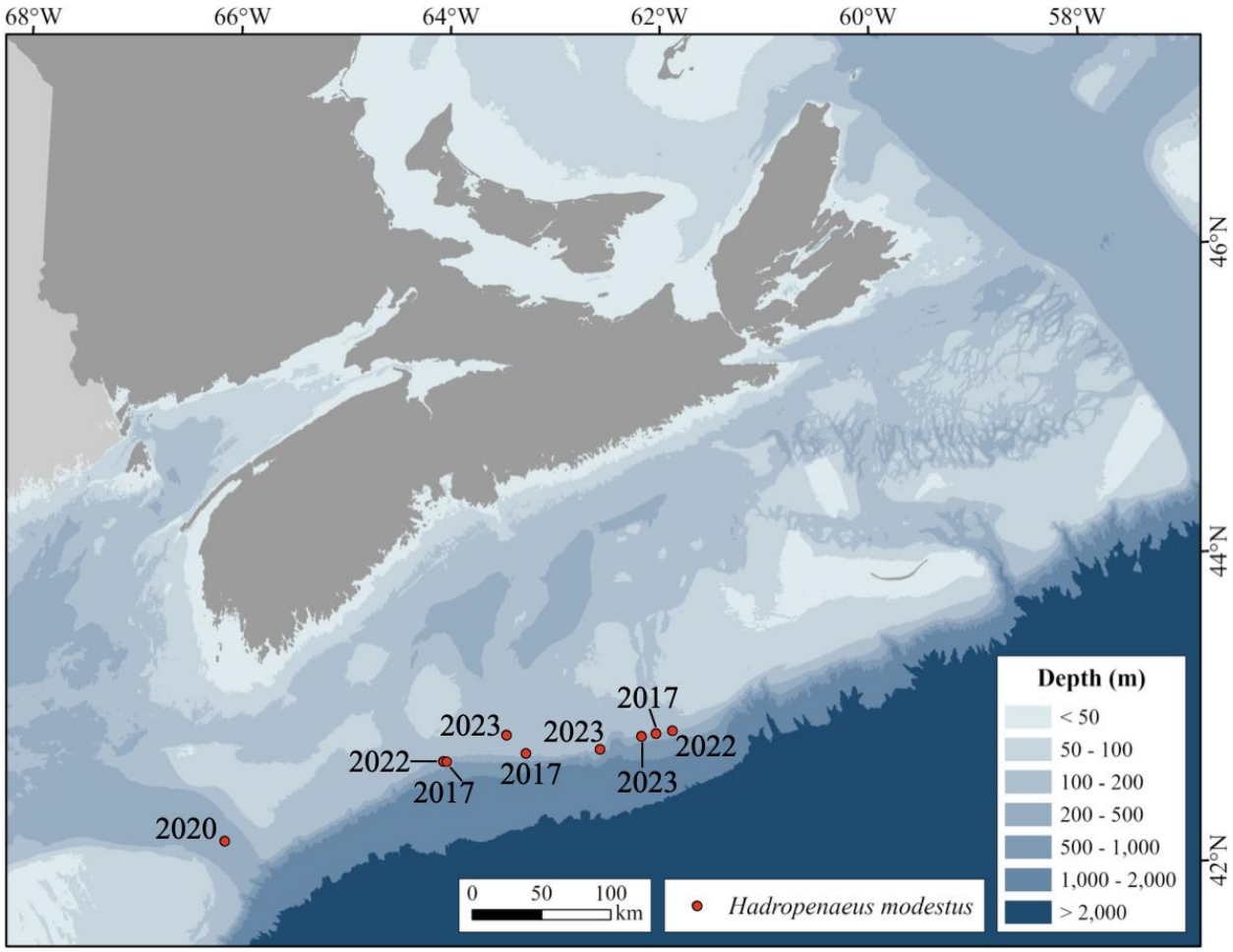

Figure 18. Map of confirmed occurrences by year of *Hadropenaeus modestus* sampled from the Maritimes RV surveys between 2017-2025.

Figure 19. Examples of photos from nine confirmed sets with *Hadropenaeus modestus*.

***Hymenopenaeus debilis* Smith, 1882**

Infraorder Penaeoidea, Family Solenoceridae
https://www.marinespecies.org/aphia.php?p=taxdetails&id=107117

Diagnosis: Distinguished by a short rostrum, though reaching past the eyes, and with 1 to 3 ventral teeth (Crosnier 1973).

Examined specimens: NED2017020 set 130 (Figure 20), 259 and 260. Photos confirmed three sets off the shelf (Figures 21 and 22) originally recorded as Shrimp (Decapoda). Captures were from 426-1295 m depth.

Distribution: Gulf of Mexico to New Jersey (Pérez Farfante 1977) and the Laurentian Channel in the Gulf of St. Lawrence (Savard and Nozères 2012).

Currently published in four genetic groupings on BOLD, one having nine specimens from Portugal with one from Laurentian Channel in Canada (BOLD:AAD7684) and three others in GenBank: https://bench.boldsystems.org/index.php/Taxbrowser_Taxonpage?taxid=181787.

Figure 20. *Hymenopenaeus debilis* sampled from NED2017020 set 130, carapace length: 12 mm.

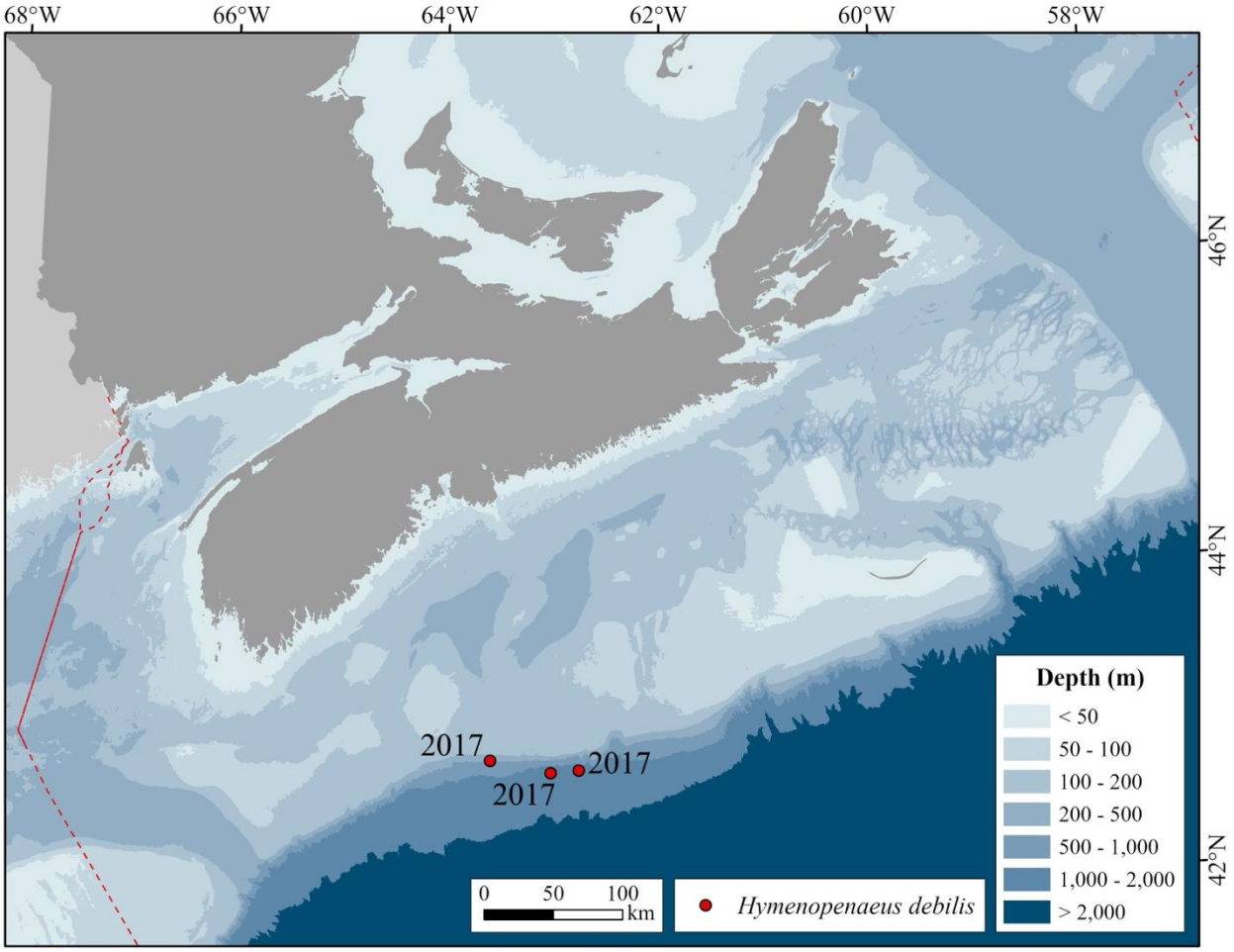

Figure 21. Map of confirmed occurrences by year of *Hymenopenaeus debilis* sampled from the Maritimes RV surveys between 2017-2025.

NED2017020 set 130

NED2017020 set 130

NED2017020 set 259

NED2017020 set 260

Figure 22. Examples of photos from three confirmed sets with *Hymenopenaeus debilis*.

***Plesionika acanthonotus* (Smith, 1882)**

Infraorder Caridea, Family Pandalidae, ***Plesionika acanthonotus*** (Smith, 1882)
https://www.marinespecies.org/aphia.php?p=taxdetails&id=107654

Diagnosis: Upcurved rostrum, usually shorter than the antennal scale (Pequegnat 1970, Crosnier and Forest 1973, Poupin and Corbari 2016, Cardoso 2010). Also distinguished from *P. holthuisi* by longer maxillipeds, smaller eye, and three pairs of lateral spines on telson.

Examined specimens: NED2017020 set 246 (Figure 23); CAR2021240 set 68; CAR2025002 set 90. Photos indicated three sets on the shelf margin (Figures 24 and 25) with individuals having a short rostrum; however, two captures (CAR2021240 set 68 and CAR2025002 set 90) had a mixture of individuals with a variety of rostrum shapes and lengths, presumably like *Plesionika holthuisi*. Sets were originally recorded as Shrimp (Decapoda) or *Plesionika* sp. Captures were from 355-386 m depth.

Distribution: Brazil to Gulf of Mexico and South Carolina (Cardoso *et al.* 2019). Reported to occur at shallower depth (about 325 m) than *P. holthuisi* (Crosnier and Forest 1968).

DNA barcoding had two BINS: BOLD:AAE2134 in Portugal and BOLD:AED3888 in Brazil. Cardoso *et al.* (2019) analysed COI and 16S genetic markers and concluded there were two distinct populations of *P. acanthonotus*, in western and eastern Atlantic.

Figure 23. *Plesionika acanthonotus*, sampled from NED2017020 set 246, carapace length: 12.2 mm.

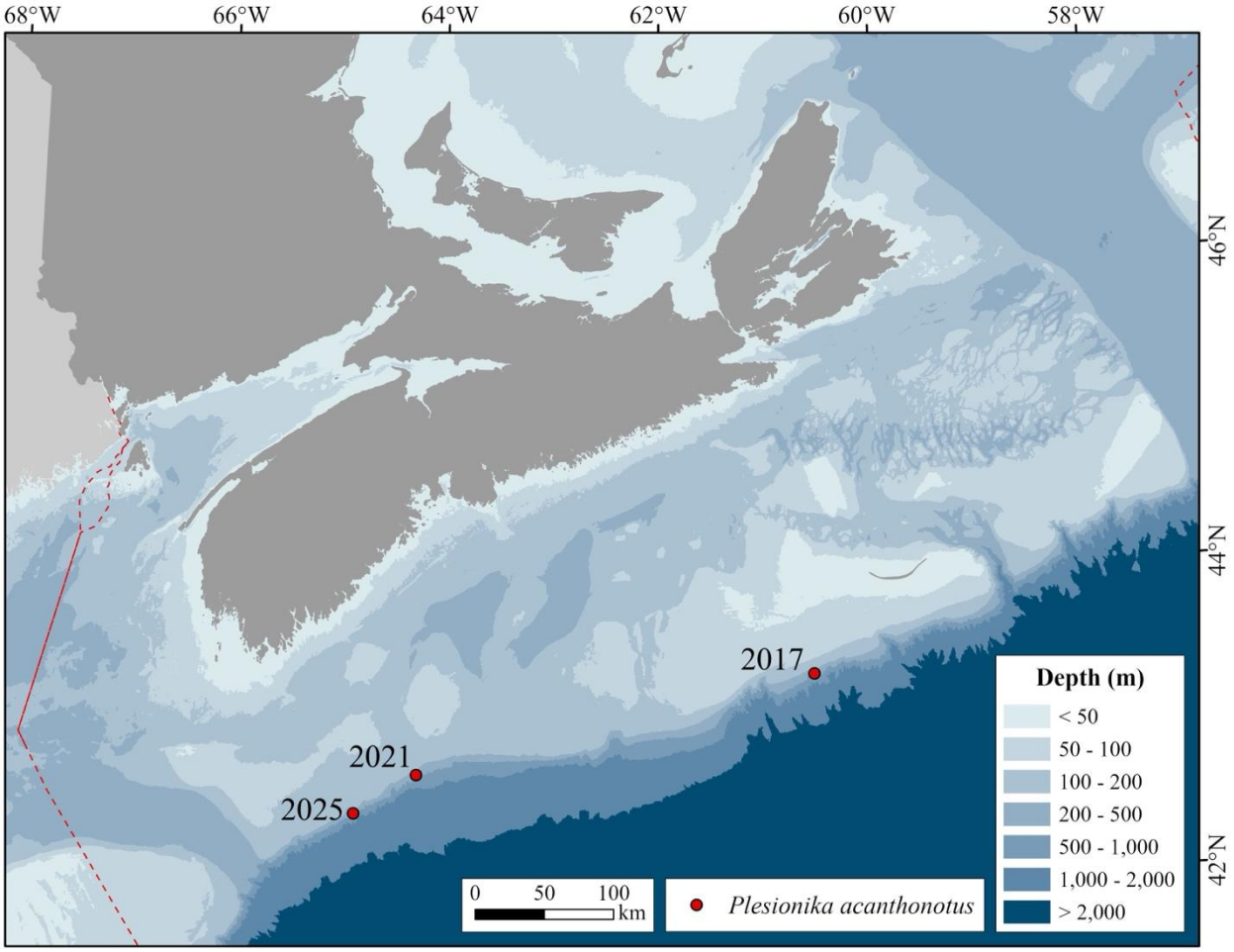

Figure 24. Map of confirmed occurrences by year of *Plesionika acanthonotus* sampled from the Maritimes RV surveys between 2017-2025.

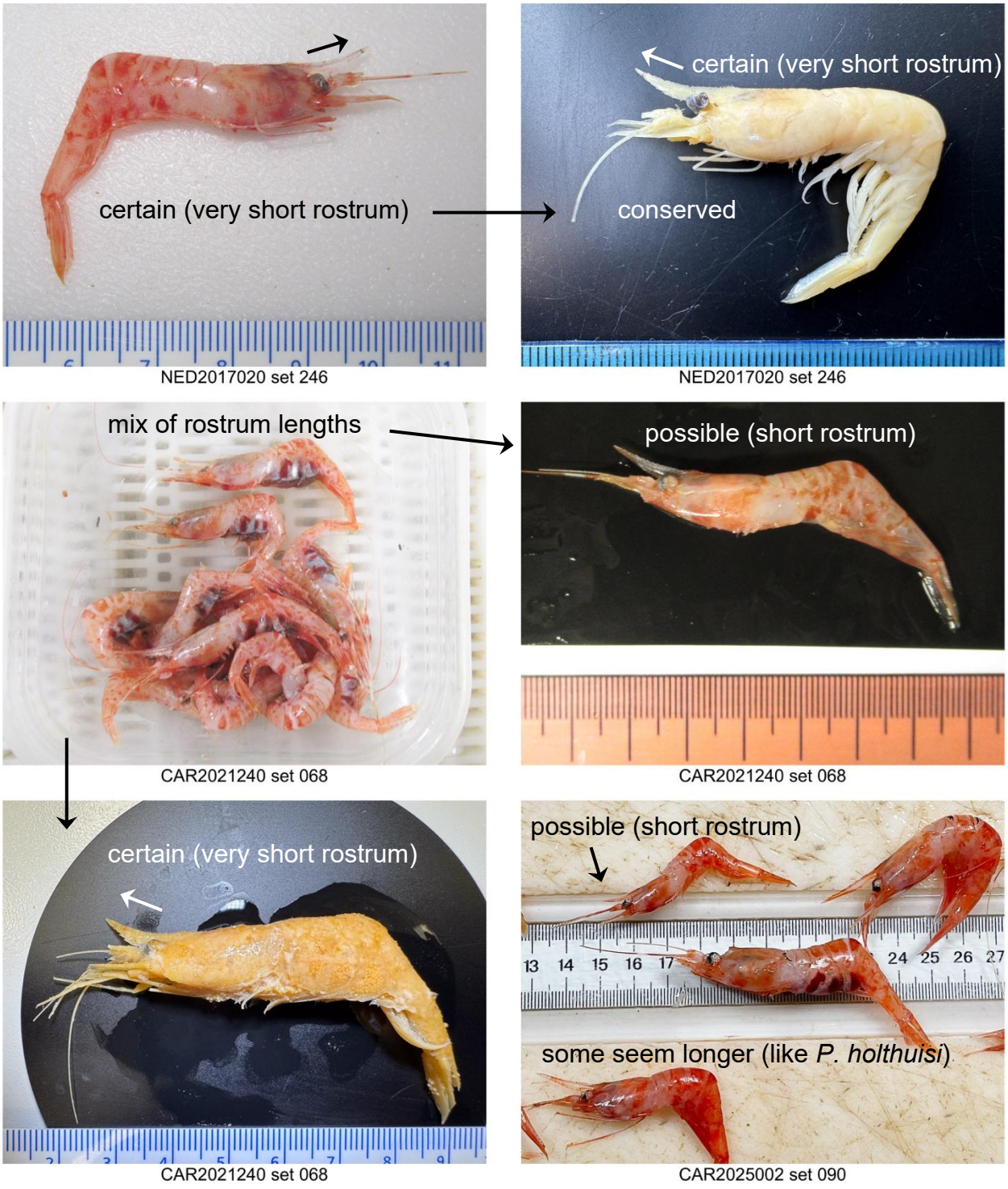

Figure 25. Examples of photos from three confirmed sets with *Plesionika acanthonotus*.

***Plesionika holthuisi* Crosnier & Forest, 1968**

Infraorder Caridea, Family Pandalidae**, *Plesionika holthuisi*** Crosnier & Forest, 1968
https://www.marinespecies.org/aphia.php?p=taxdetails&id=240887

Diagnosis: Rostrum exceeding the antennal scale, unlike *Plesionika acanthonotus,* and longer than the carapace, with 13-17 dorsal teeth, 5-7 of which are movable spines behind the eye, and not separated from the other teeth, unlike *Plesionika tenuipes*. (Pequegnat 1970). Telson with four pairs of lateral spines and presence of a small posterior tooth on the 3rd abdominal segment (Cardoso 2010).

Examined specimens: NED2017020 set 121 (Figure 26); NED2017020 set 130; CAR2021240 set 68; CAR2025010 set 97; CAR2025010 set 128 (CAR2025002 set 90 only had an at-sea photo), seen from off the shelf margin (Figures 27 and 28). Four sets had a single shrimp and two sets had multiple individuals mixed with short-rostrum *Plesionika acanthonotus* and intermediate variations (Figure 28). Originally recorded as Shrimp (Decapoda), *Plesionika martia*, or *Plesionika* sp. Captures were from 293-549 m depth.

Distribution: Gulf of Mexico, with outliers reported to Virginia and Delaware (https://obis.org/taxon/240887). Smithsonian NMNH collected specimens from a canyon east of the Gulf of Maine in 2019: https://www.gbif.org/occurrence/2549488348. Reported to occur deeper (>500 m) than *P. acanthonotus* (Crosnier and Forest 1968, Pequegnat 1970).

DNA analysis has been published on a single specimen from the Gulf of Mexico (voucher ULLZ 7953, GenBank EU868703; Bracken *et al.* 2009). Examination of morphology and genetics suggest that *P. holthuisi* is a distinct species from *P. acanthonotus* (Cardoso *et al.* 2019).

Figure 26. *Plesionika holthuisi*, sampled from NED2017020 set 121, carapace length: 13.7 mm.

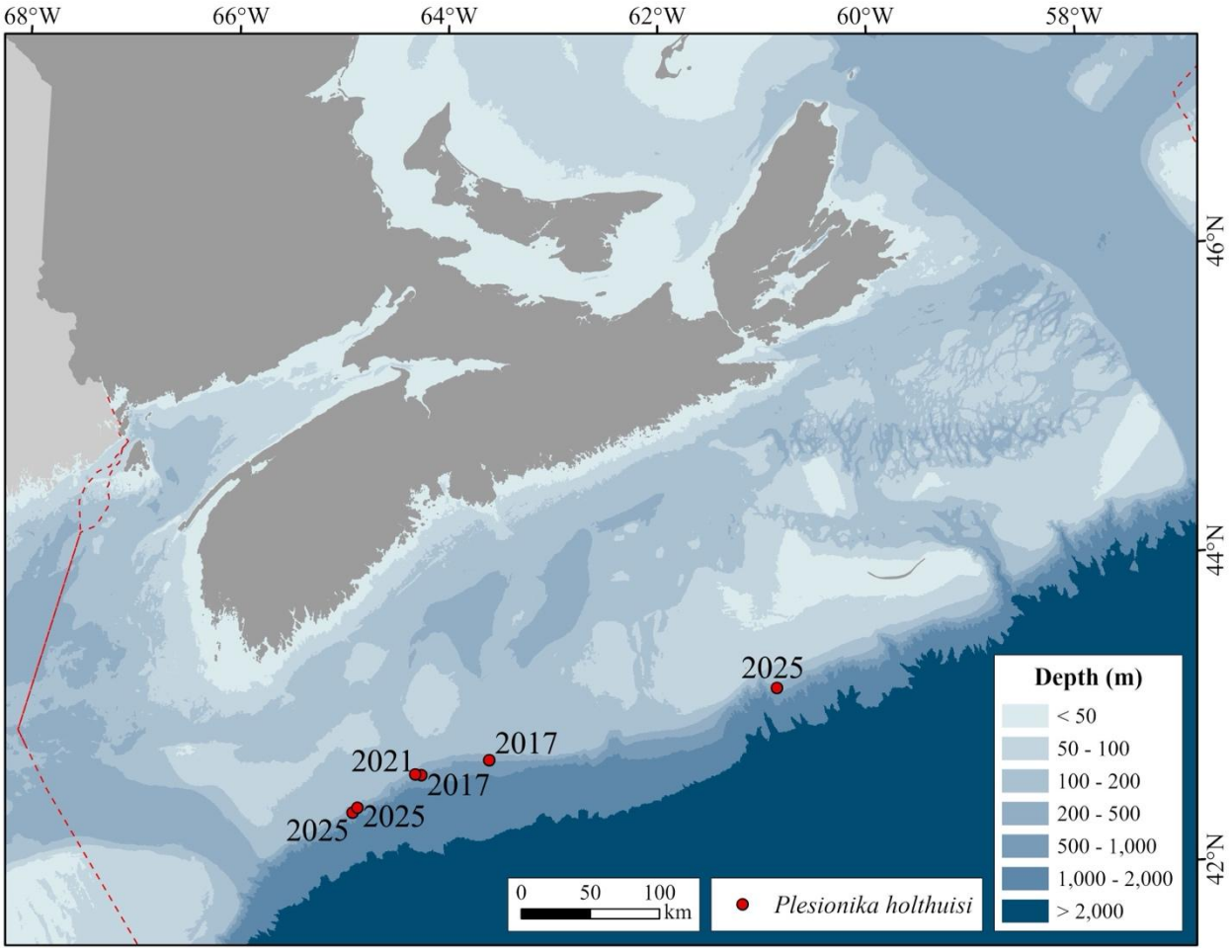

Figure 27. Map of confirmed occurrences by year of *Plesionika holthuisi* sampled from the Maritimes RV surveys between 2017-2025.

Figure 28. Examples of photos from six confirmed sets with *Plesionika holthuisi*.

***Plesionika longipes* (A. Milne-Edwards, 1881)**

Infraorder Caridea, Family Pandalidae, ***Plesionika longipes*** (A. Milne-Edwards, 1881)
https://www.marinespecies.org/aphia.php?p=taxdetails&id=421803

Diagnosis: Rostrum usually about twice as long as carapace, body with red lateral striping (Pequegnat 1970, Poupin and Cobari 2016).

Examined specimens: TEL2022010 set 161 as First Unidentified; CAR2023002 set 137 (Figure 29) as Shrimp; CAR2023011 set 210 as First Unidentified—damaged specimens, not measured, but published by ROM as *Plesionika narval*: https://www.gbif.org/occurrence/5070775404. Photos confirmed the three sets from all the shelf margin (Figures 30 and 31). Captures were from 161-287 m depth.

Distribution: Gulf of Mexico to Carolinas and Massachusetts (Pequegnat 1970, Poupin and Carbari 2016). Has been misreported for other striped shrimp, such as this observation for 2008 in the Gulf of Maine, https://www.inaturalist.org/observations/18080200, initially confused with *Plesionika edwardsii* that has a more recurved rostrum with widely spaced and larger dorsal teeth by the orbit (see comparisons in Fig. 6, Poupin and Carbari 2016).

DNA barcoding had one record for *P. longipes*, in the BIN group BOLD:ACG7954, sampled from the eastern Gulf of Mexico (https://portal.boldsystems.org/record/FLBAR1214-19).

Figure 29. *Plesionika longipes*, sampled from CAR2023002 set 137, carapace length: 12 mm.

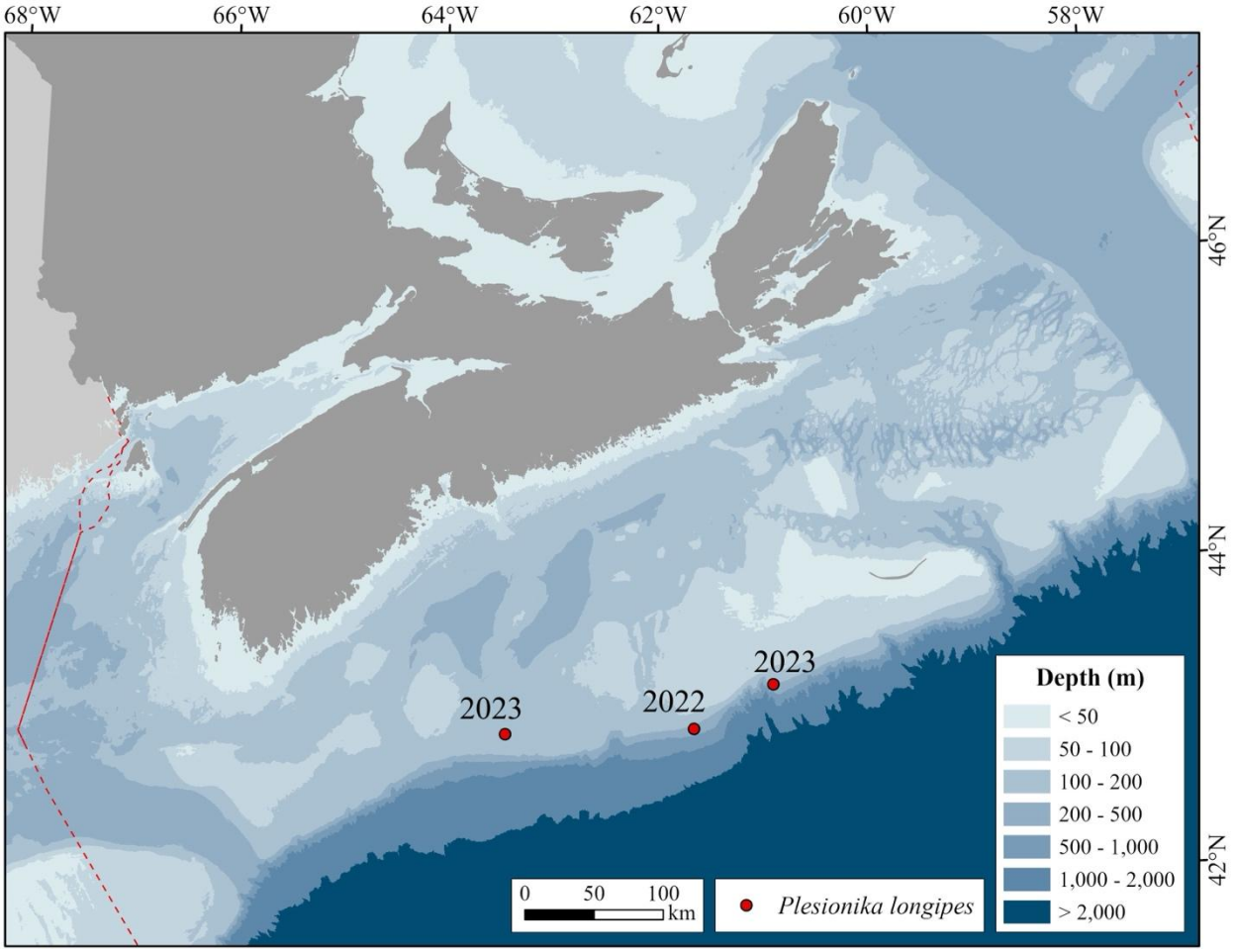

Figure 30. Map of confirmed occurrences by year of *Plesionika longipes* sampled from the Maritimes RV surveys between 2017-2025.

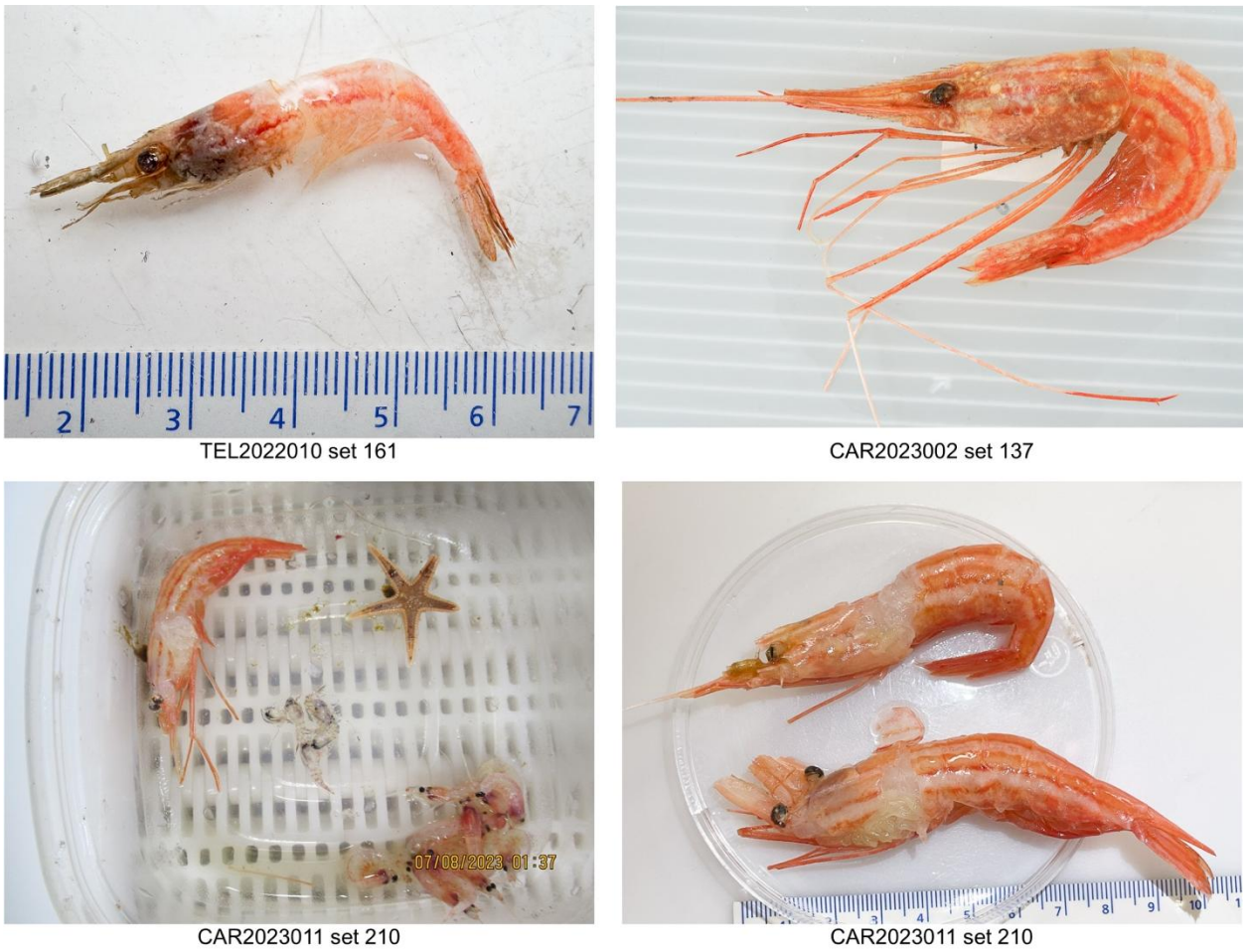

Figure 31. Examples of photos from three confirmed sets with *Plesionika longipes*.

***Plesionika tenuipes* (Smith, 1881)**

Infraorder Caridea, Family Pandalidae***, Plesionika tenuipes*** (Smith, 1881)
https://www.marinespecies.org/aphia.php?p=taxdetails&id=421805

Diagnosis: Rostrum about equal in length to carapace, with 8-10 dorsal teeth, 2-4 of which are movable spines behind the eye with a distinct separation from the others on the rostrum (Pequegnat 1970). Superficially similar in appearance to *Pandalus borealis* and *Plesionika holthuisi*.

Examined specimens: NED2020025 set 140, CAR2023011 sets 64 (Figure 32) and 217; CAR2024010 set 173; TEL202310 sets 79, 80, 81, and 84. Records previously published by ROM for CAR2023011 sets 64 (https://www.gbif.org/occurrence/5070818266) and 217 (https://www.gbif.org/occurrence/5070771372). Photos confirmed 16 sets from inner shelf basins (Figure 33 and 34), originally recorded as *Plesionika* sp., *Atlantopandalus propinqvus*, *Dichelopandalus leptocerus*, *Pandalus borealis*, Shrimp (Decapoda), or Unidentified. Captures were from 141-265 m.

Distribution: Columbia to Gulf of Mexico and on to Virginia. While this species was first described off Long Island (Smith 1881), Wigley (1960) and Williams (1984) considered it extralimital on the northeastern coast of the USA, with only outliers reported off New York (https://obis.org/taxon/421805).

No published genetic information was obtained for this species on BOLD.

Figure 32. *Plesionika tenuipes* sampled from CAR2023011 set 64, carapace length: 11 mm.

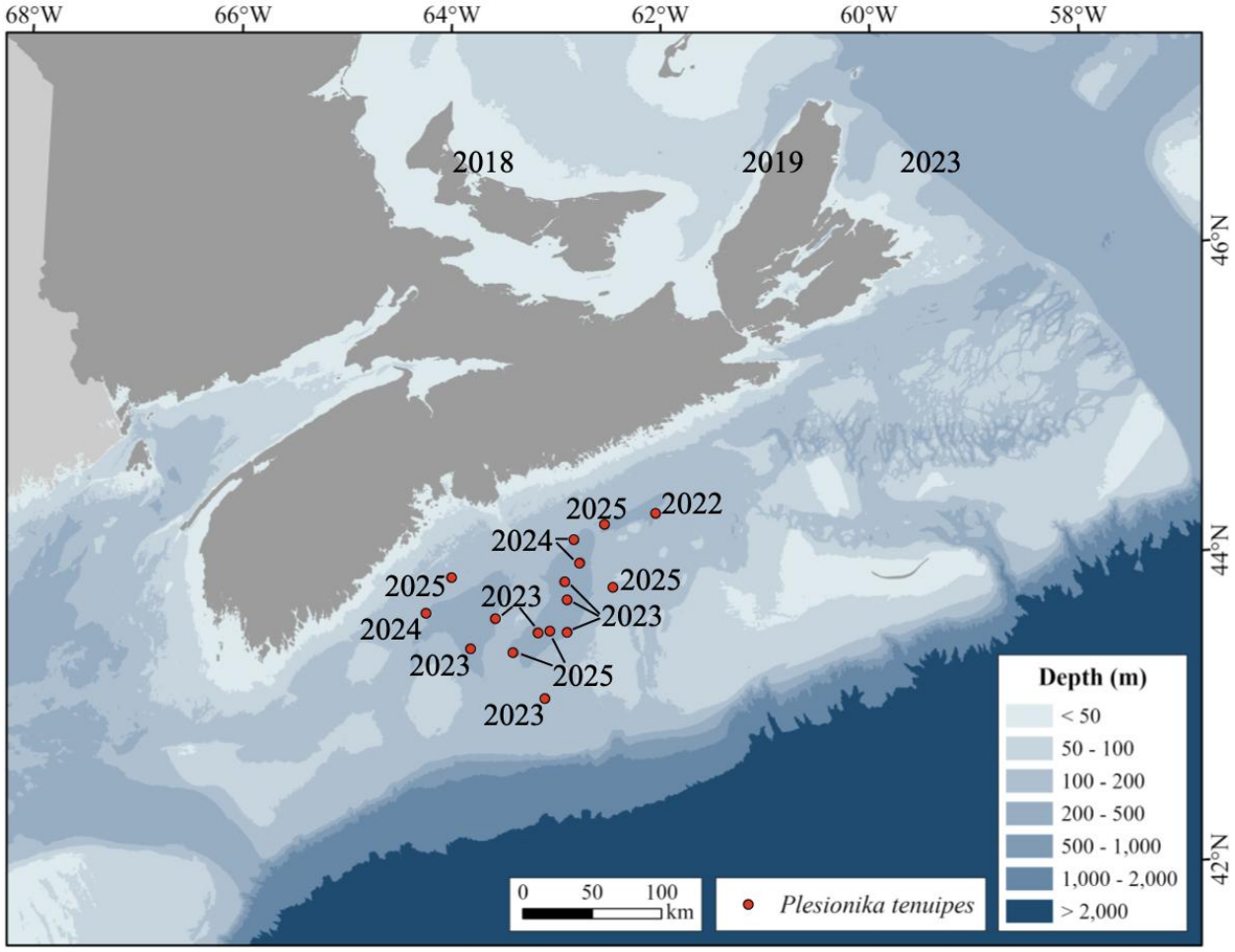

Figure 33. Map of confirmed occurrences by year of *Plesionika tenuipes* sampled from the Maritimes RV surveys between 2017-2025.

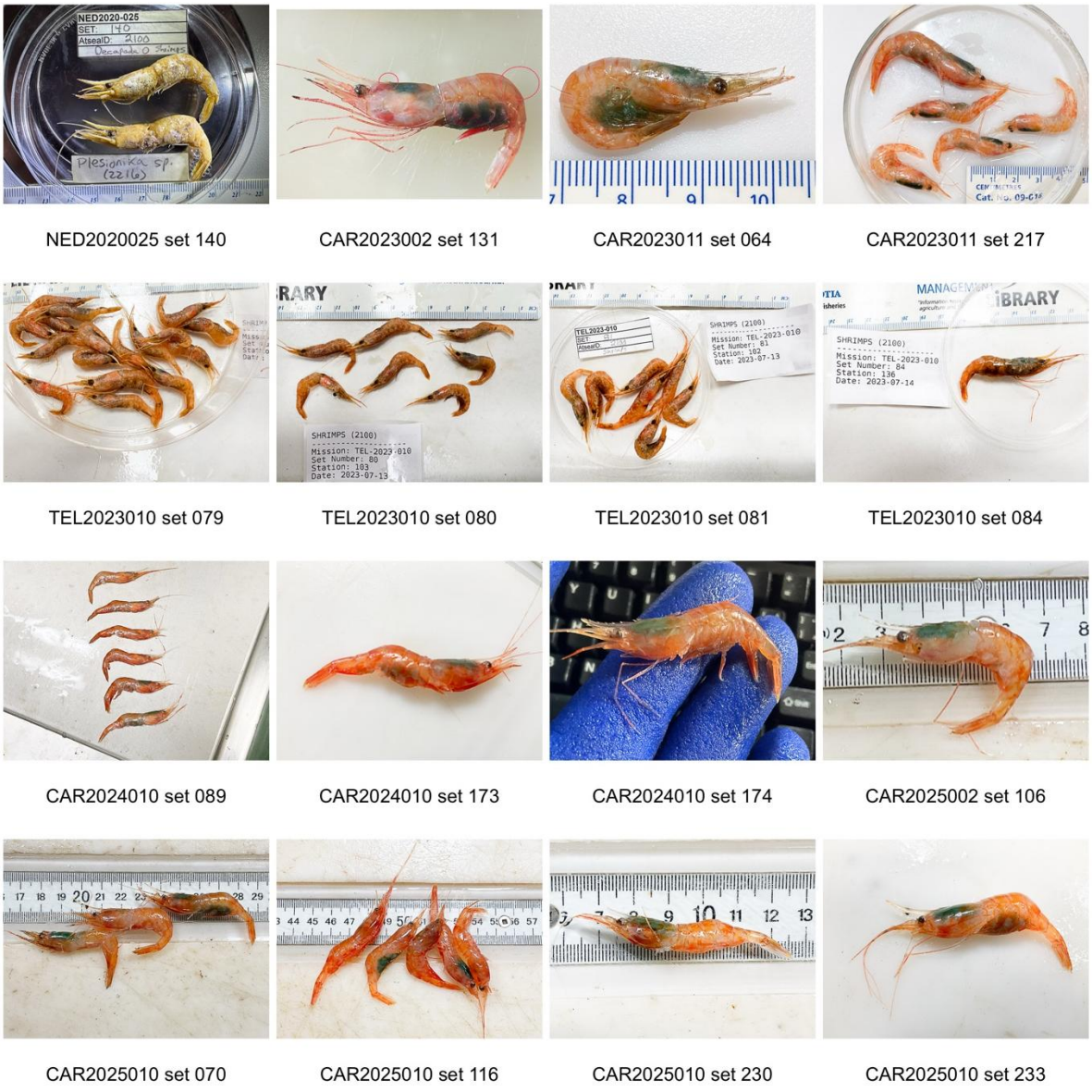

Figure 34. Examples of photos from 16 confirmed sets with *Plesionika tenuipes*.

***Plesionika martia* (A. Milne-Edwards 1883)**

Infraorder Caridea, Family Pandalidae**, *Plesionika martia*** (A. Milne-Edwards 1883)
https://www.marinespecies.org/aphia.php?p=taxdetails&id=107661

Diagnosis: Slender rostrum, up to 2x length of carapace, with 6-9 teeth basally and 3-5 behind the eye, then smooth beyond the antennular peduncle (Pequegnat 1970). Reddish, generally uniform coloration.

Examined specimens: NED2017020 set 246 (mixed with *Atlantopandalus propinqvus*); NED2019102 set 013; CAR2021240 set 068; CAR2024010 set 105; CAR2025002 set 090; CAR2025002 set 122; CAR2025010 set 097 (mixed with *P. holthuisi*). Photos confirmed 15 sets, from Gulf of Maine to Laurentian Channel (Figures 36 and 37), recorded as *A. propinqvus, Plesionika* sp, Shrimp (Decapoda), or Unidentified. Captures were from 258-532 m depth.

Distribution: Brazil to Gulf of Mexico, considered extralimital near Massachusetts (Williams 1984).

DNA barcoding had several in a group from NE Atlantic (BOLD:AAC9742), and three other groups with a few from Africa and India, the latter including a grouping with *Plesionika alcocki*.

Figure 35. *Plesionika martia* sampled from CAR2025002 set 94, carapace length: 26 mm.

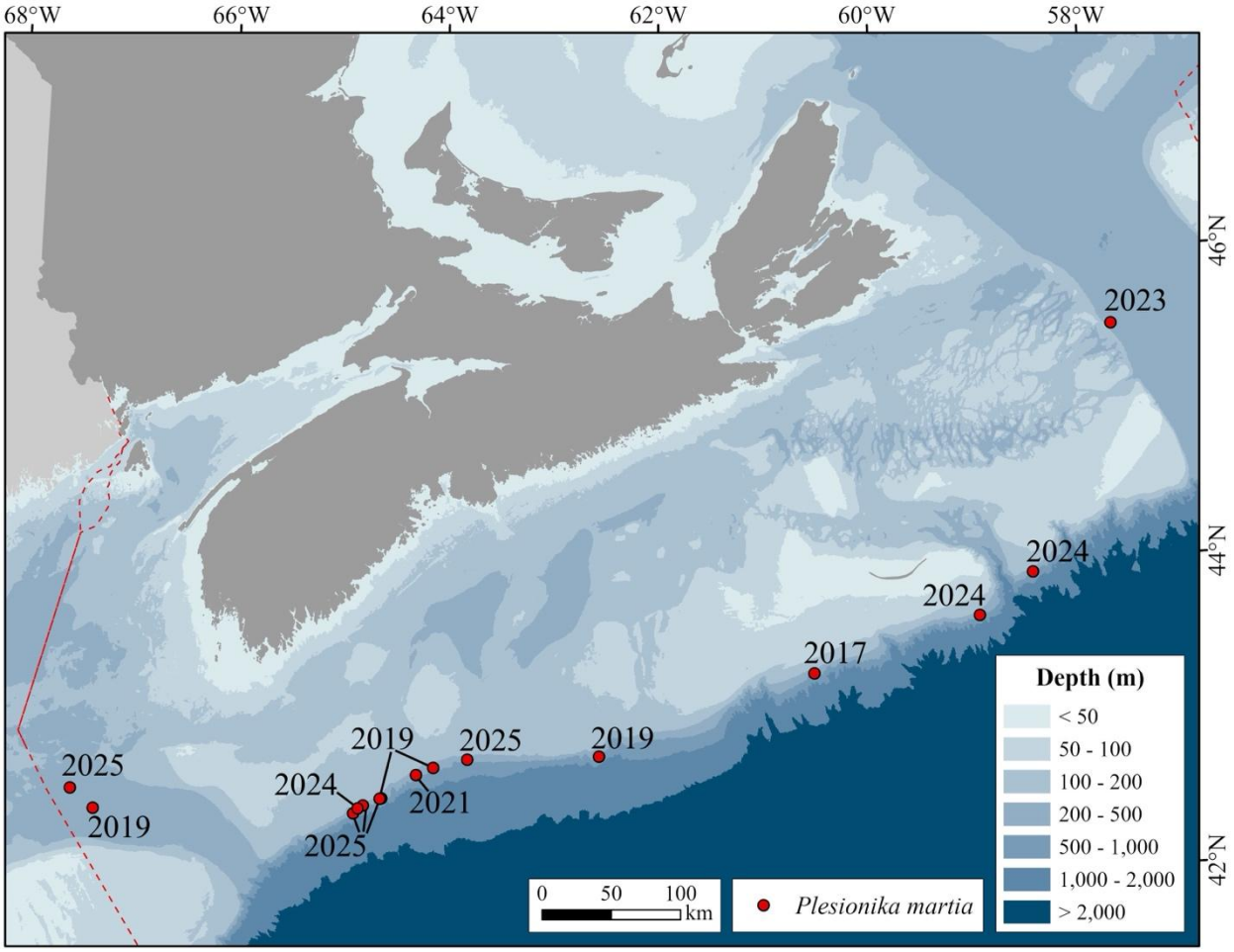

Figure 36. Map of confirmed occurrences by year of *Plesionika martia* sampled from the Maritimes RV surveys between 2017-2025.

Figure 37. Examples of photos from 15 confirmed sets with *Plesionika martia*.

DISCUSSION

Reviewing the records, images, specimens, and online resources revealed information that may help to explain the new RV survey species records, and how they had been misidentified or reported generally such as 'Shrimp'. The patterns are first examined here separately for each of the families of Aristeidae, Solenoceridae, and Pandalidae, followed by discussion on potential factors for their discovery through surveys.

Aristeidae

In Atlantic Canada, the giant red shrimp of Aristeidae have historically been reported as *Aristaeopsis edwardsiana* (Squires 1990). Reviewing records since 2017 from the Maritimes Region RV surveys confirmed only four sets for *A. edwardsiana:* three south of Emerald Basin, between 624 and 1348 m depth, and one in the Laurentian Channel from 2024 at 474 m depth. Other records were validated as the new species of *Aristaeomorpha foliacea* (6 sets) and *Aristeus antillensis* (1 set). All three species occurrences overlapped along the southwest margin of the Scotian Shelf but differed in their distributions to the north. On other surveys, *A. edwardsiana* have been observed from the Grand Banks up to Davis Strait in the Arctic (https://www.inaturalist.org/observations?subview=map&taxon_id=260237). Surveys have also reported *A. antillensis* from off southern Newfoundland, on the margins of the Grand Banks and into the Laurentian Channel, but not further north. Confusion of *A. antillensis* for *A. edwardsiana* was recently revealed when examining photos and specimens from surveys, such as a specimen sampled in the Laurentian Channel in 2004 that was corrected for *A. antillensis* in 2025 (https://www.inaturalist.org/observations/263442954).

In contrast to the established presence of the other two aristeid species, the review for *Aristaeomorpha foliacea* revealed no prior record for Canadian waters before being sampled in 2017. The nearest specimen of *A. foliacea* is at the Yale Museum, collected from off Cape Cod at the Bear Seamount in 2002: https://www.gbif.org/occurrence/350568600. So far, this species has only been confirmed from the Maritimes and has not been observed on the more northern RV surveys. Further south, two similar species are reported that may yet appear in Canadian waters: *Cerataspis monstrosus* and *Hepomadus tener* (examples shown in Farrelly and Ahyong 2019). The species *C. montrosus* was previously known as *Plesiopenaeus armata* as the juvenile form was so distinctive it was thought to be another species (Bracken-Grissom *et al.* 2012). A larval specimen was recorded in the Gully canyon in 2009 and confirmed in the laboratory in 2024, but no adults have been recorded in Canada, with the nearest one at the Yale Museum, sampled in 2006 from off New Jersey: https://www.gbif.org/occurrence/350605945. Vigilance may be warranted to confirm all future aristeids, for the three known species as well as for these two additional species.

While captures of aristeids were infrequent, the three confirmed species were sampled in 2017, 2019, and 2023-2025, making it unclear if they were established species or errant specimens. Several in the catch data were reported as either Aristeidae or *A. edwardsiana* between 2019-2023 but could not be confirmed, with four records from 2021 and 2023 having no photos (records not shown). The three species may be suspected in captures that averaged 10-65 g per shrimp per set, making them heavier than all other shrimp except the solenocerid *Faxonia robusta*. Apart from average weights, distributions might be an indicator for Aristeidae as captures were wide ranging

along the Scotian Shelf margin, unlike *Faxonia robusta* that appeared limited to the central Shelf and inner basin. In this review, the most northern and eastern occurrences of aristeid shrimp on the Maritimes survey was of *A. edwardsiana* from the Laurentian Channel in 2024. Another was also recorded in that area in 2015 (https://www.gbif.org/occurrence/3081852630), In contrast, Newfoundland and Quebec surveys had 17 captures of *A. antillensis* and *A. edwardsiana* in the Laurentian Channel in the 2000s: https://www.gbif.org/species/8021. Given the infrequent captures and non-uniform catch distributions along with potential capturability differences between RV surveys, it may be difficult to evaluate trends of aristeid shrimp in Canadian waters. In addition, as commercial species and with widespread occurrences in oceans, genetic analyses have already been conducted on several aristeids in certain areas but is not clear how similar or different are the ones encountered in the NW Atlantic region. Molecular analyses of local specimens should be performed to clarify their distributions.

Solenoceridae

Among the new species was a second group of penaeids within the family Solenoceridae: the large shrimp *Faxonius robusta* and the two smaller species of *Hadropenaeus modestus* and *Hymenopenaeus debilis*. The species *F. robusta,* known historically as *Pleoticus robustus,* was previously documented for Atlantic Canada as an occasional stray to the Scotian Shelf (Pohle 1988, Squires 1990). As noted above, it is possible that some captures may have been of *F. robusta* but were misnamed for the large shrimp of family Aristeidae, though their distributions differed in some ways. The occurrences of solenocerids generally overlapped with the deepwater species on the Scotian Shelf margin. Unlike the aristeids, the species *F. robusta* was also sampled from inner basins along with the small pandalid *Plesionika tenuipes*, and none were confirmed east of Sable Island. The other surveys have also not yet confirmed any *F. robusta* to the east, such as in the Laurentian Channel or along the margin of the Grand Banks, but surveys in the US have reported it in the Gulf of Maine, as was noted on iNaturalist.

As a small red shrimp, the new species *Hadropenaeus modestus* may be mistaken for resident species like *Robustosergia robusta* unless examined closely for details like the rostrum. Although pelagic, sergestids are occasionally sampled in bottom trawls and may be the default name for uncertain red shrimp, including *Gennadas*-like kinds (family Benthesicymidae) sampled on other DFO RV surveys (https://doi.org/10.6084/m9.figshare.26125543). Like with *F. robusta*, catches of *H. modestus* were not reported east of Sable Island and was not noticed in more northerly RV surveys by Newfoundland and Labrador or Quebec Regions.

Confusion for small red shrimp as sergestids might also be involved for the prior absence of *Hymenopenaeus debilis* records on the Maritimes surveys. This species was among the rarest in this review, with only three captures, all in 2017 and from the same area on the margin of the eastern Scotian Shelf. The 2017 summer survey was special in having conducted more deepwater sets off the Scotian Shelf which may account for these records. Unlike the other solenocerids, it has also been sampled from other surveys in the Laurentian Channel: nine times in summers between 2011-2024, then three times during a special winter survey in 2024, with some records published here: https://www.gbif.org/species/2223312. An additional challenge is with the related species, *Hymenopenaeus laevis*, that has been reported in museum collections from the off the Scotian Shelf (https://www.gbif.org/species/2223294) and the Gully canyon in the middle of the

shelf (MacIsaac 2011, MacIsaac *et al.* 2013). The regional species of *Hymenopenaeus* may need taxonomic review, as evidenced by the four genetic groupings of specimens posted as *H. debilis* on BOLD. A Laurentian Channel specimen, https://portal.boldsystems.org/record/PIMI007-23, matched to others in the Atlantic, while a Gully specimen, initially mislabelled as Aristeidae, https://portal.boldsystems.org/record/EKDFO017-07, was nearest genetically to a group with *Hymenopenaeus doris* from the Pacific Ocean. Another difference between the species may be distributional, as *H. laevis* occurs in deeper water. As with most of the new species, the scarcity of occurrences in trawl captures may make this species and the other solenocerids difficult to evaluate for trends in biodiversity.

Pandalidae

Compared to penaeoid shrimp that are abundant in warmer waters, including aristeids in the Gulf of Mexico (Antonio *et al.* 2024), caridean shrimp are better known in the NW Atlantic, such as the family Pandalidae that includes commercial coldwater species like *Pandalus borealis*. It seems surprising then that pandalids comprised five of the 10 new survey species, and four were also new to Canadian waters. Most local pandalids are common and abundant species, apart from the rare pelagic species, *Plesionika richardi* (Pohle 1988, Squires 1990. Records of *P. richardi* were of museum specimens from 1964-1986, from off the Scotian Shelf to the edge of the Grand Banks (https://obis.org/taxon/183350), until mesopelagic surveys were done in the Gully in 2010 (Lirette and Kenchington 2026). No record of this distinctive species, bearing a very long rostrum with many ventral teeth, was noticed in this review.

The RV Survey typically samples three species: *Pandalus borealis, Pandalus montagui, Atlantopandalus propinqvus*—and now four, with the re-discovery of *Dichelopandalus leptocerus,* as mentioned in the Introduction. As also noted earlier, the cosmopolitan species *Plesionika martia* was not listed for Canada in 1990, but the 2017 summer survey revealed it could be mistaken for another deepwater pandalid, *Atlantopandalus propinqvus* (Figure 38).

Figure 38. At-sea examples of a) *Atlantopandalus propinqvus*, displaying the characteristic upcurved rostrum, sampled in a capture with b) *Plesionika martia* (NED2017020 set 246)

Historically, Nizinski (2003) has cited Williams (1984) in considering *P. martia* as extralimital in the Atlantic US, although with 14 captures confirmed for most years since 2017, the species may have become more than an occasional stray. There is some confidence *P. martia* was not in the Laurentian Channel prior to 2011 as photos on the Quebec Region survey have been taken of captures since 2001 (Nozères *et al.* 2022). Without photos or specimens, it is uncertain to know when in the 2000s this species might have arrived in the Maritimes Region.

This example with *P. martia* is mentioned because misidentifications for another common pandalid, *Pandalus borealis,* may account for the presence of *Plesionika tenuipes* first being recorded in 2023. As it was not noticed in 2017, it may have also arrived in the interval. This shrimp also differed from the other reviewed species by only occurring in basins on the Scotian Shelf, unlike most of the new species that were usually sampled near the shelf margin. Perhaps this difference in habitat makes it more likely to be a recent resident compared to the more offshore pelagic species brought in as strays by the Gulf Stream, as encountered on the shelf margin.

As with species like *A. foliaceus* and *F. robusta*, some of the new pandalids have recently been recorded nearby, such as *Plesionika holthuisi,* that was collected at Bear Seamount in 2019 by NMNH: https://www.gbif.org/occurrence/2549488348, and *Plesionika longipes* by a US survey in the Gulf of Maine in 2008: https://www.gbif.org/occurrence/1935596368. Another small species, *Plesionika acanthonotus*, like the solenocerid *H. modestus,* had records reported further south, off Delaware, for example. This species is similar in appearance to *Plesionika holthuisi*, differing by the longer rostrum in the latter, and their distributions seemed similar, with captures of both species in a set. Some report *P. holthuisi* as occurring at about 500 m and deeper while *P. acanthonotus* can occur at shallower depths (Crosnier and Forest 1968, Pequegnat 1970), and thus the two species may not be expected to overlap. A 2017 record here at over 500 m seemed likely to confirm this pattern for *P. holthuisi*, but others were sampled in shallower and mixed with *P. acanthonotus*. Morphological identifications of complete specimens are possible though may be difficult (Cruz and Fransen 2004, Cardoso 2010). Specimens of *Plesionika* sp. (sometimes annotated as *holthuisi*) were recently sampled in US waters (*e.g.,* Nizinski and Shea 2025). As genetic sequences have already been published for this pair, publishing molecular analyses of future specimens may help to confirm their identity and distributions across the Atlantic.

Worldwide, *Plesionika* and other pandalids can be remarkably diverse in both morphology and genetics. Listed on BOLD as of 2026, there were 62 genetic groupings (BINs) for 49 names in specimens, suggesting that misidentifications (incorrect name) and cryptic species (undefined taxa) may be likely: https://portal.boldsystems.org/result?query=Plesionika[tax]. A particularly difficult clade was comprised of the 'striped' types variously reported as *Plesionika edwardsii, Plesionika longipes*, and *Plesionika narval*, with further study needed to confirm the distribution of extant species and perhaps define new ones. The non-reviewed species of *Dichelopandalus leptocerus* and *Plesionika martia* may also have some particularities in their genetics; the former may be closer taxonomically to the local *Atlantopandalus propinqvus* than it is to the NE Atlantic *Dichelopandalus bonnieri*, while the cosmopolitan *P. martia* currently has three BIN groups for the species on BOLD, that may also suggest cryptic kinds are present across the oceans. The new species *P. tenuipes* had no public nucleotide information on either BOLD or NCBI GenBank (https://www.ncbi.nlm.nih.gov/), and thus it is not yet known if it holds any taxonomic surprises.

Identification Challenges

While no DNA sequences have yet been published on the specimens of the new survey species, the current public data from BOLDsystems may be valuable for interpreting species and distributions. A feature available in BOLD is the grouping of specimens with related DNA sequences (separated by a certain level of differences). The groups form uniquely named clusters (BINs), regardless of the taxonomic identifications provided by the source (Ratnasingham and Hebert 2013). Misidentifications may become revealed when a species name differs from the name of a majority of specimens in a BIN. A recent example was seen with nudibranchs: several BINs are currently identified with the name *Dendronotus frondosus*, suggesting either errors or cryptic species. The largest group, BOLD:AAC7990, with 94 specimens, has 91 as *D. frondosus* with 10 from Canada in 2023, including one as *D.* cf. *robustus* (from Maritimes in 2011), and two as *D. venustus*, suggesting that the majority name *frondosus* may be correct for this group. In contrast, the group of BOLD:AAC7991 had 17 records named as *D. frondosus* from Atlantic Canada and 57 specimens as *Dendronotus lacteus,* mostly from NE Atlantic, but now including 10 records from Canada, along with updated records after this was grouping was first noticed earlier this year. https://portal.boldsystems.org/record/PIMI089-23. In this scenario, a species without prior historical distribution in NW Atlantic may be common, either overlooked or as a new arrival, when revealed by published sequences of correctly identified specimens from different locations. However, the use of genetics may also present challenges beyond misidentifications and cryptic or as-yet undescribed species if adequate reference DNA sequences are not available (Bourret *et al.* 2023). In the above example of nudibranchs, another lesser-known species, *Dendronotus velifer* (Lundin *et al.* 2017), was also revealed by its BIN membership in BOLD:ADJ9042 (https://portal.boldsystems.org/record/PIMI075-23), while others were uncertain and await a reference sequence of validated specimens (https://portal.boldsystems.org/record/PIMI074-23).

The difficulty with establishing species presences may also arise with conserved museum records if species were named but not directly examined, as was the case for this report. Some museums had collections of rare species that may need taxonomic validation. At the Atlantic Reference Centre, in St Andrews, NB, Canada, one such unusual species was the solenocerid shrimp, *Solenocera membranacea*. The portals OBIS (https://obis.org/taxon/107120) and GBIF (https://www.gbif.org/species/2223409) shows it as a common NE Atlantic and Mediterranean species. The images on GBIF, mostly from iNaturalist, show a red-banded shrimp that may confused with other kinds. A second North American source, on GBIF, is for a museum specimen in 1885: https://www.gbif.org/occurrence/699127390. No reference was uncovered for the species in the NW Atlantic and an examination of the specimen should be conducted.

Regular RV surveys are an important source for museum collections, but research programs may also sample different species and reveal the distributions and abundance of species that may appear rare or absent in bottom trawls. Shrimp-like pasiphaeids, sergistids, and acanthephyrids are frequent examples of being rare or occasional in bottom trawls while being very abundant when sampled by nets in the water column (Savard and Nozères 2012, MacIsaac *et al.* 2014). In MacIsaac (2011), the review of pelagic crustacean samples in the Gully canyon from 2007-2010 also revealed several new shrimp species for Canadian waters, yet these did not overlap with the new species from the benthic trawl. The pelagic samples of *H. laevis* were mostly sampled from over 1000 m depth while the RV surveys sampled *H. debilis* were from about 300-600 m

depth, in both Maritimes Region and the Laurentian Channel (e.g., https://www.inaturalist.org/observations?taxon_id=295528). It is uncertain if the lack of overlap arose from different gear types or depth ranges. Reviewing underwater images taken in 2022-2023 from benthic landers positioned at about 300 m depth in the Gully Canyon had shrimp like *Atlantopandalus propinqvus* (https://www.inaturalist.ca/observations/336088273) (Nozères *et al.* 2024), or perhaps of *Plesionika* cf. *holthuisi*. However, based on the confirmed distributions seen here of shrimp sampled by the RV survey, these seem unlikely to be of *P. holthuisi* as none have been confirmed east of Sable Island (Figure 27).

The RV surveys by DFO are a platform of opportunity for the sampling of a wide range of mostly bottom-dwelling species. The surveys are oriented toward gathering data for the stock assessment of commercially fished species, and while considerable efforts are made to document the total biodiversity of the catch in the trawls, not all kinds are reliably sampled or suitable for the same kinds of analysis as the targeted species (Nozères *et al.* 2015, Nozères *et al.* 2022). In this review, the identification of new shrimp species may represent new arrivals, fortunate sampling of rare species, or corrections for previously unnoticed kinds. The first challenge in determining if a species may be new in the region is the catchability of deepwater pelagic species when sampling using a bottom trawl. Some pelagic shrimp species such as *Pasiphaea multidentata* may be regularly recorded in trawl captures, while some like *Eusergestes arcticus* are only occasional, and others are very rare in captures, perhaps not even sampled each year like *Hymenopenaeus debilis* (Savard and Nozères 2012). These rare captures in bottom trawls might be related to behaviour, such as resting near the bottom for adult *Pasiphaea multidentata* (Aguzzi *et al.* 2007), as has been observed regionally from underwater imagery in the Laurentian Channel (*e.g.*, https://inaturalist.ca/observations/144314725), which may also explain a low proportion of juveniles the catch, as these remain in the water column. While a few adults of *P. multidentata* are captured in bottom trawls, this species is more abundant in pelagic trawls, as documented on research surveys in the Gully off the Scotian Shelf (MacIsaac *et al.* 2014). Similarly, the bottom trawl sampled the new shrimp species as adults, several even bearing eggs, but smaller specimens were usually absent. The above cited Gully pelagic surveys, conducted between 2007-2009, did not identify any of the new shrimp species listed in this report, and only one juvenile aristeid of *Cerataspis monstrosa*, which suggests these species were not locally present at that period, at least when sampling from the water column. Several of the new species may be benthic-oriented but still not easily sampled, as has been noticed in underwater images or some surveys, for example when Poupin and Corbari (2016) remarked that *P. holthuisi* was sampled in trawls, but not found in traps and dredges.

Biodiversity Trends

Despite the challenges of reviewing historical records, the exercise can provide clues to changes in biodiversity (*e.g.,* Tingley and Beissinger 2009). Determining the arrival date of new shrimp in the Maritimes Region is of special interest, at least for these species, because they are commonly associated with warmer waters to the south of Canada (Williams 1984). Documenting their presences in recent years could be an indication of warming water masses carrying these species northwards to the Scotian Shelf off Nova Scotia. From occurrence records, such as on iNaturalist and GBIF, some of the species appeared to have their northern limits near the Gulf of Maine and thus it may not be surprising if they strayed into Canadian waters, and with increasing

frequency in recent years due to warming water masses in the region (Hebert *et al.* 2024). Several of the new records were found south of the Emerald Basin, at the entrance of the Warm Slope Water on the western Scotian Shelf. This water mass originates from the Gulf Stream and moves onshore to fill the inter basins of the Scotian Shelf and the Gulf of Maine in the west (Smith *et al.*, 1978). This is also the characteristic area of the glass sponge *Vazella pourtalesii* (Beazley *et al.* 2018), which was originally described from the Florida Keys (Schmidt, 1870). Habitats with fixed sponges, as with corals, might not be expected to have changed distributions in recent years, thus the appearance of new shrimp, if indeed recent arrivals, may signal recent environmental changes in temperature and circulation. Shrimp presences may then serve as indicators of changes that could impact local coral areas, of interest for research into marine conservation and monitoring.

In addition to confirming species presences by location and date, it would be of interest to distinguish between extralimital individuals and new residents. As was previously mentioned, sampled specimens were of adult-like sizes and several had eggs, suggesting they are completing their life cycle in the region. Evidence may be obtained from images of different life stages in local observations, such as the recent sightings in Nova Scotia of larval stomatopods, or mantis shrimp (https://www.inaturalist.org/observations/242260732), a kind of littoral crustacean that was sampled as an adult on the RV survey for the first time in 2025 (J. Murillo). Complementary evidence may come from environmental DNA analyses of water to detect taxa not caught in nets, using genetic information from adults, but also eggs, larvae, or juveniles in the local area, depending on location and season (Maslakova *et al.* 2022, Sevellec *et al.* 2025).

Another consideration for changes in distributions with new species is the potential for seasonal effects. For the planktonic communities, warming waters may be associated with blooms of increased abundance earlier in the year (Casault *et al.* 2025), which can affect recruitment success of larvae and subsequently adults of fishes and decapods (Brosset *et al.* 2019). As the RV surveys occur at the same months each year, they cannot compensate for changes in seasonality. For Maritimes Region, that has two seasonal surveys that overlap in the east, the winter survey captures may come to resemble those from the summer survey if warmer water is preferred. The differences between seasons were not evaluated here, nor the changes over years, because there were very few total captures. Nonetheless, a few trends may be in evidence. For example, *F. robusta* was only sampled in summer, suggesting that conditions or capturability differed in winter. Meanwhile, *P. acanthonotus* and *P. holthuisi* were sampled in summer until 2025 when they were also seen on the winter survey for the first time.

CONCLUSIONS

This report summarizes 10 new and one lesser-known shrimp species sampled on the annual Maritimes Ecosystem Research Vessel Surveys of the Scotian Shelf, between 2017 and 2025. Several species may be wholly new, while others were already reported in Canadian waters but had not yet been noticed on the surveys prior to this review. The species were commonly associated with warmer waters in lower latitudes, and some may represent northern range extensions in recent years. As not all catches nor all surveys in the review period had at-sea photos or conserved specimens for validation, there is uncertainty for when the new species may have first appeared in the survey region. The information and photo of confirmed species presented by

this review will complement historical and future identification guides, checklists, and occurrence records for Atlantic Canada, to help with identifying future captures. Several species may require taxonomic review, and undertaking molecular analyses is recommended for future specimens. The report also serves as a reference example on how to document and verify when new taxa may appear in future sampling, as may be expected due to warming waters with climate change.

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APPENDIX. SHRIMP RECORDS FROM SURVEYS

Table A1. Set details of new and lesser-known shrimp sampled on Maritimes RV surveys between 2017 and 2025. Note: counts were the minimal seen in two mixed captures of *Plesionika acanthonotus/holthuisi* for CAR2021240 set 68 and CAR2025002 set 90. Value for latitude, longitude, and depth (m) are from the start of each set.

Species	Cruise	Set	Date	Latitude	Longitude	Depth (m)	Count
Aristaeopsis edwardsiana	NED2017020	263	2017-08-13	42.5477	-63.8792	1348	1
Aristaeopsis edwardsiana	CAR2023002	166	2023-03-29	42.6857	-64.0742	624	4
Aristaeopsis edwardsiana	CAR2023002	167	2023-03-29	42.7545	-63.7017	677	1
Aristaeopsis edwardsiana	CAR2024010	211	2024-07-29	47.2283	-59.6912	474	1
Aristaeomorpha foliacea	NED2017020	130	2017-07-17	42.7837	-63.5655	426	1
Aristaeomorpha foliacea	NED2019030	105	2019-07-14	42.5315	-64.5218	390	2
Aristaeomorpha foliacea	NED2019030	256	2019-08-08	44.2268	-58.0245	488	2
Aristaeomorpha foliacea	CAR2023002	138	2023-03-23	42.7998	-63.3975	302	1
Aristaeomorpha foliacea	CAR2024010	105	2024-07-14	42.4833	-64.6797	347	4
Aristaeomorpha foliacea	CAR2024010	106	2024-07-14	42.5527	-64.4537	410	17
Aristaeomorpha foliacea	CAR2024010	267	2024-08-04	43.9345	-58.6910	373	8
Aristaeomorpha foliacea	CAR2024010	268	2024-08-04	43.6695	-59.1840	384	4
Aristaeomorpha foliacea	CAR2025010	98	2025-07-18	42.5300	-64.5352	329	10
Aristeus antillensis	NED2017020	121	2017-07-16	42.6825	-64.1652	549	3
Aristeus antillensis	NED2019030	133	2019-07-20	42.8103	-62.6025	532	4
Aristeus antillensis	CAR2023002	166	2023-03-29	42.6857	-64.0742	624	1
Aristeus antillensis	CAR2024010	250	2024-08-02	44.2098	-58.0783	490	2
Aristeus antillensis	CAR2025002	90	2025-03-15	42.4318	-64.7662	386	4
Faxonia robusta	TEL2018023	6	2018-07-14	43.9638	-63.4745	199	1
Faxonia robusta	NED2019030	119	2019-07-19	43.9733	-62.805	247	2
Faxonia robusta	NED2019030	132	2019-07-20	42.8278	-62.8158	349	1
Faxonia robusta	CAR2021240	68	2021-08-06	42.6867	-64.2173	355	4
Faxonia robusta	TEL2022010	161	2022-08-04	42.9853	-61.7617	287	1
Faxonia robusta	CAR2023011	132	2023-07-25	43.781	-62.9568	269	1
Faxonia robusta	CAR2023011	217	2023-08-09	43.8242	-62.9010	265	5
Faxonia robusta	CAR2025010	122	2025-07-21	42.9570	-62.0760	278	1
Hadropenaeus modestus	NED2017020	124	2017-07-17	42.7803	-63.9853	229	1
Hadropenaeus modestus	NED2017020	253	2017-08-12	42.9650	-62.1100	229	5
Hadropenaeus modestus	NED2017020	261	2017-08-13	42.8362	-63.2613	183	1
Hadropenaeus modestus	NED2020025	122	2020-07-26	42.2318	-65.895	234	1
Hadropenaeus modestus	TEL2022010	41	2022-07-17	42.7800	-63.9918	227	1
Hadropenaeus modestus	TEL2022010	160	2022-08-04	42.9802	-61.9668	196	1
Hadropenaeus modestus	CAR2023002	137	2023-03-23	42.9570	-63.4335	161	2
Hadropenaeus modestus	TEL2023010	98	2023-07-15	42.8625	-62.6077	232	2
Hadropenaeus modestus	TEL2023010	99	2023-07-16	42.9493	-62.2383	232	1
Hymenopenaeus debilis	NED2017020	130	2017-07-17	42.7837	-63.5655	426	1
Hymenopenaeus debilis	NED2017020	259	2017-08-12	42.7230	-62.7815	1158	1
Hymenopenaeus debilis	NED2017020	260	2017-08-12	42.7058	-63.0308	1295	1

Species	Cruise	Set	Date	Latitude	Longitude	Depth (m)	Count
Plesionika acanthonotus	NED2017020	246	2017-08-11	43.3298	-60.6813	379	1
Plesionika acanthonotus	CAR2021240	68	2021-08-06	42.6867	-64.2173	355	1
Plesionika acanthonotus	CAR2025002	90	2025-03-15	42.4318	-64.7662	386	1
Plesionika holthuisi	NED2017020	121	2017-07-16	42.6825	-64.1652	549	1
Plesionika holthuisi	NED2017020	130	2017-07-17	42.7837	-63.5655	426	1
Plesionika holthuisi	CAR2021240	68	2021-08-06	42.6867	-64.2173	355	1
Plesionika holthuisi	CAR2025002	90	2025-03-15	42.4318	-64.7662	386	3
Plesionika holthuisi	CAR2025010	97	2025-07-18	42.4638	-64.7218	293	1
Plesionika holthuisi	CAR2025010	128	2025-07-21	43.2380	-61.0048	298	1
Plesionika longipes	TEL2022010	161	2022-08-04	42.9853	-61.7617	287	1
Plesionika longipes	CAR2023002	137	2023-03-23	42.9570	-63.4335	161	2
Plesionika longipes	CAR2023011	210	2023-08-07	43.2648	-61.0483	210	2
Plesionika tenuipes	NED2020025	140	2020-07-29	44.3842	-62.0988	208	2
Plesionika tenuipes	CAR2023002	131	2023-03-23	43.5093	-63.7658	223	3
Plesionika tenuipes	CAR2023011	64	2023-07-16	43.1880	-63.0982	141	1
Plesionika tenuipes	CAR2023011	217	2023-08-09	43.8242	-62.9010	265	5
Plesionika tenuipes	CAR2024010	89	2024-07-12	43.7355	-64.168	198	6
Plesionika tenuipes	CAR2024010	173	2024-07-21	44.0675	-62.7860	245	1
Plesionika tenuipes	CAR2024010	174	2024-07-22	44.2167	-62.8365	208	1
Plesionika tenuipes	CAR2025002	106	2025-03-17	43.9677	-63.9437	170	1
Plesionika tenuipes	CAR2025010	70	2025-07-15	43.4827	-63.3822	188	3
Plesionika tenuipes	CAR2025010	116	2025-07-20	43.623	-63.0588	245	6
Plesionika tenuipes	CAR2025010	230	2025-08-05	43.9073	-62.4888	146	1
Plesionika tenuipes	CAR2025010	233	2025-08-05	44.3158	-62.5623	214	1
Plesionika tenuipes	TEL2023010	79	2023-07-13	43.9442	-62.9247	256	57
Plesionika tenuipes	TEL2023010	80	2023-07-13	43.6177	-62.8988	219	29
Plesionika tenuipes	TEL2023010	81	2023-07-13	43.6155	-63.1647	236	31
Plesionika tenuipes	TEL2023010	84	2023-07-14	43.7012	-63.5458	203	24
Plesionika martia	NED2017020	246	2017-08-11	43.3298	-60.6813	379	13
Plesionika martia	NED2019102	13	2019-03-08	42.7343	-64.0665	402	1
Plesionika martia	NED2019030	40	2019-07-07	42.4097	-67.0508	258	1
Plesionika martia	NED2019030	105	2019-07-14	42.5315	-64.52183	390	4
Plesionika martia	NED2019030	133	2019-07-20	42.8103	-62.6025	532	1
Plesionika martia	CAR2021240	68	2021-08-06	42.6867	-64.2173	355	1
Plesionika martia	TEL2023010	215	2023-08-03	45.5142	-57.8553	304	1
Plesionika martia	CAR2024010	105	2024-07-14	42.4833	-64.6797	347	18
Plesionika martia	CAR2024010	267	2024-08-04	43.9345	-58.691	373	2
Plesionika martia	CAR2024010	268	2024-08-04	43.6695	-59.184	384	3
Plesionika martia	CAR2025002	90	2025-03-15	42.4318	-64.7662	386	1
Plesionika martia	CAR2025002	94	2025-03-16	42.789	-63.7678	421	18
Plesionika martia	CAR2025002	122	2025-03-27	42.534	-67.2602	313	1
Plesionika martia	CAR2025010	97	2025-07-18	42.4638	-64.7218	293	6
Plesionika martia	CAR2025010	98	2025-07-18	42.53	-64.5352	329	6