# Using BIIGLE as a collaborative identification tool for fisheries captures: an example from the benthic epifauna trawl surveys of the Canadian Beaufort Sea Marine Ecosystem Assessment (2021 to 2024)

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# ABSTRACT

This report details the improvement of at-sea identification of epibenthic invertebrates collected during annual surveys of the Canadian Beaufort Sea Marine Ecosystem Assessment (CBS-MEA) through a collaborative and remote-based interregional workflow. The collaboration between DFO-Arctic and DFO-Quebec regional teams started in 2021 and, during that first year, a high rate (67 %) of at-sea identification errors was documented in the dataset. This highlighted the need to improve the approach for validating taxonomic identifications while optimizing knowledge sharing. During each survey, photos of whole trawl catches as well as each taxon collected were taken. Starting in 2022, the collaborative image annotation software BIIGLE was used in post-field work to share photos of specimens with digital labels (annotations) representing a scientific name. A taxonomic expert (DFO-Quebec) reviewed the epifauna biodiversity dataset and, if necessary, annotated the corrections directly through the photos in BIIGLE. The field team (DFO-Arctic) was then able to visually review taxonomic corrections and naming of unidentified taxa in the photos, enabling a better learning opportunity than reviewing revised taxonomic names in a spreadsheet dataset. From 2021 to 2024, the identification correction rate dropped from 67 % to 16 %. This underscores that an iterative collaboration, facilitated by usage of BIIGLE, greatly improved at-sea identification. This approach holds potential for broader application across other collaborative programs and projects related to fisheries captures within or outside DFO, demonstrating the value of taxonomic validation and use of digital tools in remote collaboration.

# RÉSUMÉ

Ce rapport porte sur l'amélioration de l'identification en mer des invertébrés épibenthiques collectés lors des relevés de l'évaluation environnementale marine de la mer de Beaufort canadienne (CBS-MEA) grâce à une collaboration interrégionale à distance. La collaboration entre les équipes des régions MPO-Arctique et MPO-Québec a commencé en 2021 et, au cours de cette première année, un taux élevé (67 %) d'erreurs d'identification en mer a été noté dans les données. Ceci a soulevé le besoin d'améliorer l'approche de validation des identifications taxonomiques tout en optimisant le partage des connaissances. Lors de chaque relevé, des photos des captures totales au chalut ainsi que de chaque taxon collecté ont été prises. Ainsi, à partir de 2022, le logiciel collaboratif d'annotation d'images BIIGLE a été utilisé après chaque relevé pour partager des photos de spécimens avec des étiquettes numériques associées (annotations) représentant un nom scientifique. Une experte en taxonomie (MPO-Québec) a examiné le jeu de données sur la biodiversité de l'épifaune et, si nécessaire, a annoté les corrections directement sur les photos dans BIIGLE. L'équipe de terrain (MPO-Arctique) a ensuite pu visualiser les taxons corrigés et non identifiés sur les photos, offrant ainsi une meilleure opportunité d'apprentissage que la simple consultation des données corrigées dans un fichier. De 2021 à 2024, le taux de correction a chuté de 67 % à 16 %. Cela souligne qu'une collaboration itérative, facilitée par l'usage de BIIGLE, améliore grandement l'identification en mer. Cette approche a un potentiel d'application plus large dans d'autres programmes et projets collaboratifs liés aux captures halieutiques au sein ou en dehors du MPO, démontrant la valeur de la validation taxonomique et de l'utilisation des outils numériques dans une collaboration à distance.

# 1. INTRODUCTION

The Canadian Beaufort Sea Marine Ecosystem Assessment (CBS-MEA) conducted by the Department of Fisheries and Oceans (DFO) is a scientific program that focuses on the integration of oceanography, food web linkages, physical-biological couplings, and spatial and interannual variabilities. The program also aims to expand the baseline coverage of species diversity, abundances, and habitat associations in previously unstudied areas of the Beaufort Sea and Western Canadian Archipelago (Niemi et al. 2020; Galley et al. 2023). As part of this program, epibenthic invertebrates are collected, identified, counted and weighed. An inter-regional collaboration began in 2021 between the DFO-Arctic Region CBS-MEA team (Freshwater Institute, researcher Andrea Niemi) and a benthos research team in DFO-Quebec (Maurice Lamontagne Institute, MLI, researcher Virginie Roy). The aim of the collaboration was to build a remote-based interregional workflow to validate and improve at-sea identification of the epibenthic invertebrates collected during annual CBS-MEA surveys.

During the first year of the collaboration, in 2021, the workflow required the DFO-Arctic field team to identify each species/taxa from the survey catch and take photos. The taxonomic dataset and the photos were then transferred, along with some frozen voucher specimens to the DFO-Quebec benthic lab at MLI (Mont-Joli, QC). As with many at-sea programs, field technicians may have general knowledge of benthic taxonomy, but few are Arctic taxonomic experts, and field processing may be time-limited to accurately and consistently discriminate between morphologically similar taxa.

Comparisons of the 2021 photos and voucher samples to the field taxonomic dataset indicated a high rate of at-sea identification errors, and demonstrated that certain species were systematically misidentified. As many taxa were often reoccurring across stations, learning how to identify them correctly was crucial to improve at-sea identification in subsequent years. The challenge was to provide remote feedback on the identification review process to the field technician after the specimens were a posteriori expertly reviewed. Hence, there was a noticeable need to improve the approach to validating taxonomic identifications while optimizing knowledge sharing about corrections or updates made to the taxonomic datasets without having to send an expert in the field. Here, the objective was the development of a remote-based collaborative workflow to improve the accuracy and efficiency of benthic catch processing. To accomplish that goal, the approach of sharing annotated images via an online platform (through DFO intranet) was assessed.

# 2. METHODS

The first step to develop our approach was the choice of an online platform. The web application Bio-Image Indexing and Graphical Labelling Environment (BIIGLE) was deemed the best platform to serve our objectives because it is an open-source and web-based software that only requires a web browser on a device with a network connection, and an account to use, which makes it very accessible, without requiring software installation or a powerful computer. It is an online tool that allows users to catalogue and annotate photos and videos (https://biigle.de) (Langenkämper et al. 2017; Zurowietz and Nattkemper 2021).

Our collaborative workflow could be described using the image data pathway from the acquisition step to its publication (Figure 1). The at-sea acquisition of specimen photographs was done using an Olympus camera (2021-2022) or an iPhone 14 Pro camera (2023-2024). The iPhone 14 Pro was selected in the most recent years of the project because it offers better performance in a low-light environment, while still being able to take macro (close-up) images. The photographs are then renamed and organized using a photo organization software (in this case, Adobe Lightroom). We chose the following file naming scheme that provides a unique file name:

<PROJECT>-<YEAR>_<DEPLOYEMENT EVENT NUMBER> _<BASE FILE NAME>.jpg

Example: CBSMEA-2023_BBT-245_1436.jpg

The photos are then transferred to a DFO-Quebec Region network storage location supported by a Linux server. This assures the images are available for authorized users that can access the internal (intranet) DFO network.

The collaborative image annotation software BIIGLE available on the DFO network was used by DFO users to annotate the photos without them being accessible to the public at this step of the process. After species identifications are vetted by DFO experts, a DarwinCore archive is produced and published to the DFO data catalogue (currently Enterprise Data Hub (EDH)) before being made publicly available on OBIS (https://obis.org).
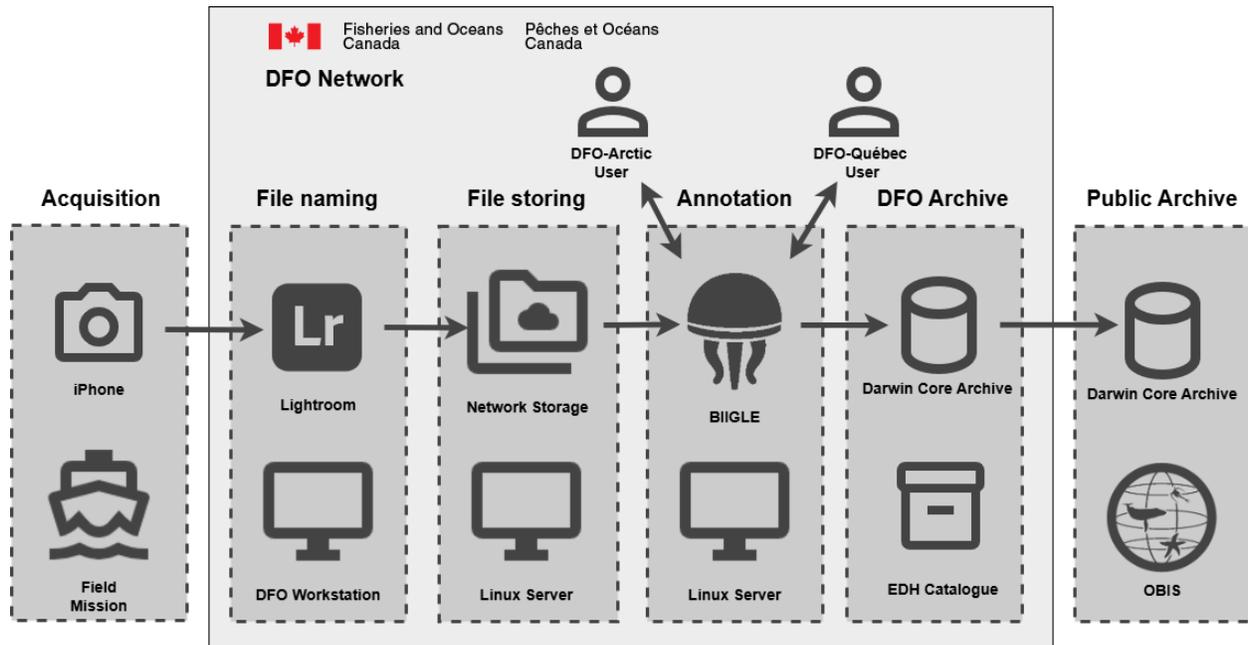


Figure 1. Image workflow pathway: field acquisition; file naming; photo storage on a network drive; collaborative annotation with BIIGLE and the creation of an archive for species data publication.

## 2.1. DFO INFRASTRUCTURE: BIIGLE INSTANCE AND NETWORK STORAGE

The web application BIIGLE relies on third party image hosting services. Users typically have to first upload their images on a public image hosting platform (e.g., Google storage, Azure Blob Storage or AWS S3) for BIIGLE to access.

Most users place images on a public hosting service and use the public BIIGLE instance. To have all activity confined within the DFO network, we opted to store the images internally and use an on-premise BIIGLE instance. This was partly motivated by less expensive storage options offered by internal storage compared to DFO-cloud offerings on MS Azure, while still adhering to the DFO directive on data management (DFO 2024). Two independent infrastructure components are required on the DFO network: (1) a server for network file storage, and (2) a server for the BIIGLE web application.

The images are stored on a DFO Linux server running the CDOS Managed Linux Distribution (CMLD). The image server is configured to act like a Network Attached Storage (NAS) and the image files are easily managed through a mapped network drive on Windows workstations. Although we chose to use a Linux server to accomplish these tasks, this could have been accomplished using a NAS device. A CMLD resource gateway can be used to bridge most commercially available NAS devices to the DFO network, thus making the files available to use with our internal BIIGLE instance.

A different Linux server, also running the CMLD, is used to host the BIIGLE instance. It is worth noting that we used two servers to independently satisfy the two infrastructural components (file hosting + web application), but they could both have been configured in a single server.

The on-premises infrastructure strikes a balance, allowing us to be flexible within the safeguarded setting of the DFO network. The BIIGLE instance and the images are accessible to any user that can access the DFO network, either at the office or using the virtual private network (VPN).

## 2.2. BIIGLE CBS-MEA PROJECT ARCHITECTURE

Each year since 2021, the CBS-MEA survey takes place during August in the Western Canadian Arctic, mainly in the Beaufort Sea and Amundsen Gulf. A total of 32 stations were sampled for epifauna in 2021, 22 in 2022, 23 in 2023, and 22 in 2024, with a 3 m-long benthic beam trawl (6.3 mm mesh net) and an Atlantic Western IIA otter trawl (12.7 mm mesh net), both deployed at each station. The catch is sorted, and all invertebrates are identified to the lowest taxonomic level possible. The catch is always photographed. An overview photo of the entire catch and individual photos of each taxon are taken.

The at-sea photos were organized in BIIGLE in a *project* named *Arctic-West-CBSMEA*, with each survey year separated in its own file (called *volume* in BIIGLE). The photo upload and annotation steps were completed following the field program by the Quebec Region technician, given limited network accessibility while at sea. A total of 546 images were uploaded in 2021, 1 650 in 2022, 1 171 in 2023 and 1 198 in 2024.

Details on how annotations were conducted are given in section 2.4. The BIIGLE *project* was set to private settings and can only be consulted upon invitation. A polygon tool was used to ensure that the entire specimen is surrounded by the annotation. The annotations were taken from a *label tree*, i.e., a collection of labels that can be attached to an image or part of an image. Our *label tree* was constructed specifically for the *Arctic-West-CBSMEA* project and contains a list of taxa found in the Western Canadian Arctic region. The scientific names are imported from the World Register of Marine Species (WoRMS). The WoRMS database is fully embedded within BIIGLE, avoiding the risk of typographical errors. The *label tree* was first built in 2022 using taxa that were collected and recorded during the 2021 survey. In the years that followed, the tree was updated to include any new taxa records or terms. The users of the BIIGLE *Arctic-West-CBSMEA project* have editor permissions on the *label tree*, allowing them to modify it during an annotation process. The *label tree* is currently private, but could be opened to be used by other BIIGLE projects studying the same region.

In addition to the BIIGLE image annotations, *image labels* have also been used to classify the photos in four categories: *Capture*, *Sample*, *Specimen*, *Information* (Table 1). Only the photos categorized as *Specimen* are annotated to avoid duplicates. For further details on the terminology used in BIIGLE, see the application manual (https://biigle.de/manual).

Table 1. Definition of the four image labels used to characterize the photos in the BIIGLE CBS-MEA project.

| Image Label Category | Definition | Example |
|---|---|---|
| Capture | A photo showing the entire mixed catch. | Specimens of a trawl catch transferred into a bin. |
| Sample | A photo of the sorted capture. | The taxa sorted on one or many trays. |
| Specimen | A photo showing only one taxon (with one or many individuals of the same taxon). | One taxon with an attached label. |
| Information | A photo without organisms but with relevant information. | A photo of a label showing station/trawl information. |

## 2.3. TESTING ANNOTATION SESSION (2021)

In early 2022, before implementing BIIGLE as a collaborative validation tool, a pilot project was conducted to test its efficiency. A set of 50 photos were selected from the 2021 CBS-MEA epifaunal dataset that showed either a single specimen or taxon (Figure 2), or a mix of taxa (Figure 3). The goal was to practice annotating and identifying using the different kinds of photos taken at sea for both the field (DFO-Arctic Region, here Caitlin Allison) and lab technician (DFO-Quebec Region, here Valérie de Carufel). This pilot project helped raise awareness of the quality of the photos taken during fieldwork for future identification purposes. We recommend that anyone new to using BIIGLE begin with a testing annotation session.

Figure 2. Example of an image labelled as *Specimen* showing only one individual of a species (here the decapod *Argis dentata*). The photo is from the 2021 survey, station MTI-045, deployment event W2A-050.



Figure 3. Example of an image labelled as *Sample* showing a mix of taxa and individuals on a tray. The photo is from the 2021 survey, station MTI-04, deployment event BBT-037.

## 2.4.      FULL ANNOTATION SESSIONS (2022 TO 2024)

Starting in 2022, BIIGLE was fully implemented in the validation process of taxonomic names. The annotation sessions were conducted differently in 2022 than in 2023-2024. Since 2022 was the first year of BIIGLE use, the process was improved in the successive years. In 2022, the annotation session was conducted in two steps. First, the field technician (DFO-Arctic Region) would annotate all of the specimen photos. Secondly, the lab technician (DFO-Quebec Region) validated the identification and identified the unknown species, with the help of photos and some frozen voucher specimens. The lab identifications were made using a variety of sources, including guides and photo catalogs (Pohle 1988; Squires 1990; Vassilenko and Petryashov 2009; Zakharov et al. 2018; Nozères et al. 2019; Lacasse et al. 2020). If a correction was needed, a second annotation with the corrected taxa would be attached by the lab technician (Figure 4). The aim of that process was to facilitate tracking and learning while correcting misidentifications. Specimens that have received two annotations indicate that a correction was necessary. This not only highlights which taxa were frequently misidentified but also shows the correct identification. However, this method was time consuming.
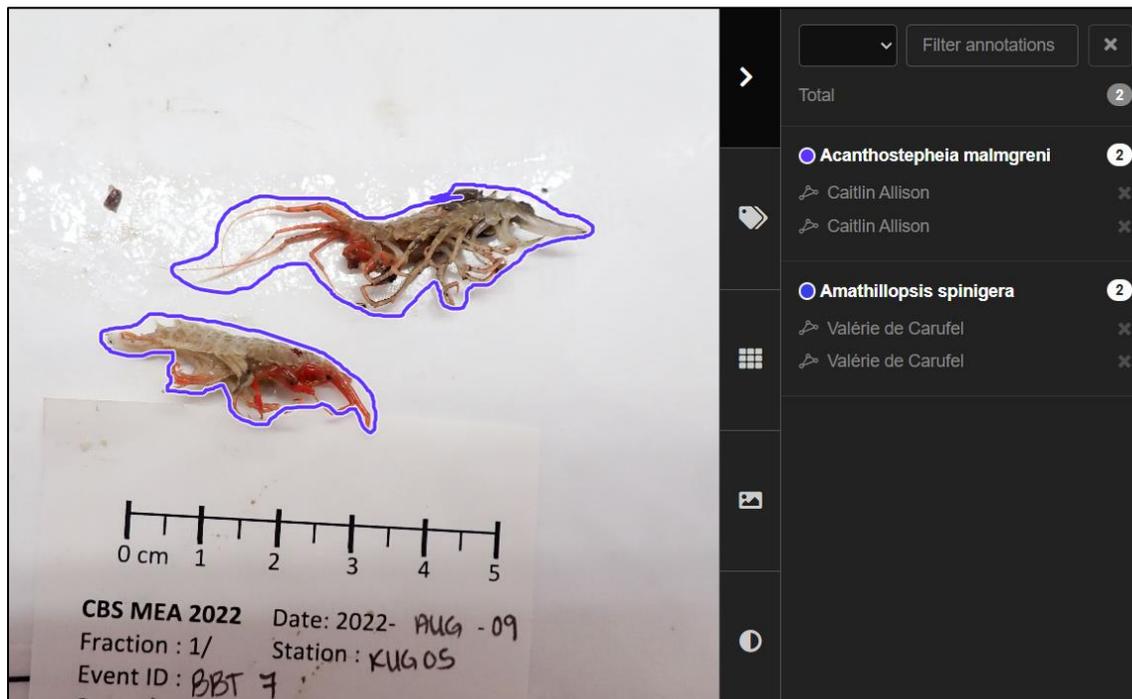


Figure 4. Example of an annotated photo in 2022 in BIIGLE software. Each individual (same species) had two annotations attached to it (see the right panel): a first annotation with the amphipod name *Acanthostepheia malmgreni* by Caitlin Allison (DFO-Arctic region) and then a second annotation/correction with the name *Amathillopsis spinigera* by Valérie de Carufel (DFO-Quebec region). The photo is from the 2022 survey, station KUG-005, deployment event BBT-007.

In 2023 and 2024, the annotation sessions were more effective. First, with frozen specimens and field images, the lab technician reviewed all identifications. BIIGLE annotations were added by the lab technician only to the misidentified or unknown taxa. These serve as markers for the field technician highlighting taxa that need special attention. Secondly, the field technician reviewed all BIIGLE images and attached labels to specimens that were correctly identified at sea, using the field data. During this process, all images were systematically examined, allowing

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observation of instances where taxonomic identifications errors were corrected (Figure 5). This approach not only saved time but also served as a better learning tool, as the field technician learned from the corrections made on the photos during the annotation process.



Figure 5. Example of an annotated photo in 2023 in BIIGLE software. Only one annotation is attached per polygon. First the blue polygon on the left shows an annotation of the shrimp *Sabinea septemcarinata* correctly identified at sea by Caitlin Allison (DFO-Arctic Region). Secondly, the blue polygon on the right shows an annotation of several amphipods labelled at sea as *Acanthotozoma cristatum* that was later corrected to *Lepidepecreum umbo* by Valérie de Carufel (DFO-Quebec Region). The photo is from the 2023 survey, station AXL-002, deployment event BBT-171.

# 3. RESULTS

## 3.1. MODIFICATIONS OF TAXONOMIC NAMES

Each year (2021 to 2024), more than 1 000 occurrences of epibenthic invertebrates were recorded at sea (Table 2; de Carufel et al. 2025). The percentage of modifications in records to valid taxonomic names declined every year, going from 67 % in 2021 down to 16 % in 2024 (Table 2). A taxonomic name was modified for different reasons: taxonomic correction, taxonomic rank adjustment (higher or lower, depending on the taxon), or spelling correction.

Table 2. Yearly total of taxa occurrences, total number of corrections and modification rate.

| Year | Total number of occurrences | Total number of modifications | Percent modified (%) |
|---|---|---|---|
| 2021 | 1356 | 904 | 67 |
| 2022 | 1113 | 631 | 57 |
| 2023 | 1442 | 501 | 35 |
| 2024 | 1313 | 212 | 16 |

## 3.2. FREQUENTLY CORRECTED TAXA

At the beginning of the collaboration, some taxa were systematically misidentified. These challenging taxa were listed and discussed with the field technician to provide specific advice on how to identify them while at sea. Through the use of the BIIGLE online platform, communication was facilitated by giving access to many annotated images of these taxa.

Some of the challenging taxa are presented in Table 3. They are shown here for one of two reasons: (1) they have been modified at least 10 times in at least one year of CBS-MEA, or (2) they were systematically misidentified because they were not often found in the catches. A complete version of the corrected dataset is available online (de Carufel et al. 2025). For the majority of challenging taxa listed, except the amphipod *Tmetonyx* sp., the number of modifications has decreased over the years, reaching no modifications for some taxa in 2024. In the following section, the modifications are specifically due to changes in the taxonomic identifications and not in rank or spelling.

Table 3. Number of modified taxonomic name records for challenging taxa in each survey year of CBS-MEA (see text for details).

| Group | Number of name modifications | | | |
| Revised taxon | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|
| Crustacea – Decapoda | | | | |
| *Eualus belcheri\** | 40 | 38 | 1 | 0 |
| *Lebbeus polaris\** | 18 | 0 | 0 | 0 |
| *Hyas alutaceus* | 36 | 15 | 0 | 0 |
| Crustacea – Amphipoda | | | | |
| *Caeconyx caeculus* | 12 | 20 | 0 | 0 |
| *Ampelisca* sp.* | 19 | 5 | 0 | 0 |
| *Tmetonyx* sp. | 0 | 1 | 18 | 20 |
| *Rhachotropis* sp. | 15 | 10 | 1 | 2 |
| *Lepidepecreum umbo\** | 0 | 1 | 8 | 4 |
| Crustacea – Isopoda | | | | |
| *Caecognathia stygia* | 0 | 5 | 9 | 0 |
| Mollusca – Bivalvia | | | | |
| *Portlandia arctica\** | 23 | 14 | 5 | 1 |
| Mollusca – Gastropoda | | | | |
| *Colus* sp.* | 29 | 18 | 17 | 0 |
| Echinodermata – Asteroidea | | | | |
| *Pontaster tenuispinus\** | 24 | 2 | 0 | 0 |
| Other | | | | |
| Nemertea | 14 | 16 | 28 | 0 |

*These taxa are presented in Appendix A along with the taxonomic identification advice that was communicated to the field technician.

# 4. DISCUSSION

The use of the BIIGLE online platform was a key asset for our remote-based collaborative workflow for epibenthic record validation. Several strengths of BIIGLE made it particularly valuable: (1) it provides a cataloguing system for several *volumes* of images in projects, (2) its annotation tools enables the correction to taxonomic names based on periodically imported names from the WoRMS database, (3) it is freely accessible with an internet-enabled screen device (tablet or computer), and (4) may be installed as a local instance on an internal network.

For some taxa like sponges or soft corals, macroscopic images of a specimen are often insufficient for taxonomic identification, especially if image quality is inadequate (in focus, resolution, or lighting), as may arise – especially when attempting to photograph while at-sea. The collection of frozen voucher specimens remains a valuable means for validation, if not essential for difficult taxa like sponges, and is not replaced entirely by the use of BIIGLE. The ability to review and compare large numbers of annotated images, from at-sea or of frozen vouchers examined in the lab, makes validating identification faster and thus more feasible. Reviewing large numbers of photos is a burden, and an annotation tool like BIIGLE makes it easy to manage, organize and share labelled files once the initial manual annotation is completed. Systematically photographing all catches and selected samples of specimens in the field then becomes a valuable resource for validating identifications after a sampling survey has been completed (Nozères et al. 2022).

Through its annotation tools, BIIGLE enables the efficient correction of annotations for taxonomic identifications through images, as well as tracing the initial and corrected identifications by user (Langenkämper et al. 2017). This is a very powerful tool for learning. Between 2021 and 2024, the rate of name modifications (e.g., corrections, new identifications) declined from 67 % to 16 % per year. Some taxa were systematically misidentified during the first years (e.g., shrimp of *Eualus* spp.), but the feedback provided remotely through an internet-based collaborative workflow permitted the improvement of at-sea identification of these taxa in the subsequent years. This work also showed that an important factor in improving at-sea identification lies in applying a consistent routine or workflow, which is greatly assisted by having the same personnel annotating images in repeated years. The remote collaboration seen here also greatly facilitated an iterative learning process supporting DFO personnel working to provide reliable records for fisheries and biodiversity science. We suggest that this workflow could also support student training, if multiple years of field work are expected.

It is important to note that we do not consider the high percentage of modifications in the project's first year to be alarming. While some modifications were indeed identification corrections, others reflected changes in taxonomic rank or spelling mistakes. This is an expected outcome of field programs, and not a critique of past work, but rather highlights the value of both collaborative image validation and the application of consistent naming for database records, enabled here by the taxonomic-based label lists imported from WoRMS. Photo-validation of taxonomic identifications was adopted by DFO Quebec Region for fisheries surveys in the 2000s, leading to improvement in the identifications over the years, until reaching a plateau where 5 to 15 % of at-sea identifications are still corrected every year through photos (Nozères et al. 2022). The need for expert validation should be considered normal, as it is not feasible to identify all kinds of taxa during fishing operations at sea, when limited in time, space,

and resources, compared to post-survey reviews using images. If image validation was to be conducted on other DFO surveys, similar patterns of misidentification and inconsistent record names would likely be observed. This project demonstrated the value of a collaborative validation review across DFO Regions that was made possible through the sharing of images and voucher specimens that were named in records using a standardized global taxonomy (i.e., WoRMS). Our use of BIIGLE to review survey catches through images enhanced the reliability of epibenthic survey records, even though it was not a replacement for the traditional taxonomic workflow of the extensive laboratory review of specimens. While the use of local taxonomic guides and photo catalogs during fieldwork remains important, the validation through images when using BIIGLE increased the efficiency and accuracy of database validation while building identification skills within DFO for taxonomy, and ultimately improves assessments of Arctic marine epibenthic biodiversity.

# 5. PERSPECTIVES

Our approach for identification validation holds potential for application across other species diversity-based collaborative DFO projects. Since 2023, BIIGLE has been used for some stock assessment surveys in the DFO-Quebec Region, both inshore and offshore, as a platform to catalogue images and for identification validation, but has not yet been used collaboratively. The BIIGLE annotation tool has been widely adopted for annotation in underwater visual surveys by other DFO Regions (Nozères et al. 2024; Command et al. 2024; Kozakewich et al. 2024), and internationally (Schoening et al. 2020; Lelièvre et al. 2025). However, the use of BIIGLE to collaboratively review capture images, as compared to underwater imagery, is unique and has not been done before to the best of our knowledge. Since 2001, capture images from Quebec Region surveys have been reviewed using single user commercial images cataloguing software like Adobe Lightroom (Nozères et al. 2011). This project study is a testament to the usability and the flexibility of BIIGLE, as an open-source tool that could be adapted for a specific purpose and make collaborative group work feasible.

Recently, work was undertaken to facilitate the integration of capture images acquired using an at-sea input software, ANDES, into BIIGLE. ANDES is a field input tool developed by DFO and used across multiple regions in Eastern Canada (Ricard et al. 2024). Capture images can be directly acquired to accompany catch records in ANDES. The images and data are then readily transferred as a BIIGLE *volume* following cruise with matching metadata. ANDES is planned to be integrated with CBS-MEA, providing another opportunity to leverage the benefits of BIIGLE for efficient  image and data validation following Arctic surveys.

BIIGLE also offers an API which enables users to script (for example using the R programming language) interactions without using the graphical interface. BIIGLE can export annotated images using the COCO format (Lin et al. 2014), a widely used annotation format for training AI models. The manually annotated images in BIIGLE could eventually serve as a valuable data asset for AI training, including the use of AI or machine learning within BIIGLE, such as its MAIA module (Zurowietz et al. 2018).

BIIGLE can be a very powerful tool for training personnel. At-sea identification remains challenging, especially under time pressure and variable sea conditions. However, it is essential that personnel performing identifications receive proper and ongoing training. This software can serve as a continuous learning platform for biodiversity personnel, allowing them to familiarize

themselves with images of commonly sampled species in their study region, as well as those that are newly encountered during a survey, as may occur with either rare, poorly captured, or newly arrived taxa that may arise with climate changes or ecosystem shifts. BIIGLE provides the opportunity to showcase a wide array of examples of commonly caught taxa and facilitates the search for photos presenting specific taxa thanks to its image annotations. It can therefore be used as a cataloging tool to easily view photos of specific taxa. This ability to visually illustrate biodiversity information is especially important for knowledge sharing with communities within the Inuvialuit Settlement Region or with local communities elsewhere in Canada. Producing a photo catalogue specific to the region would further support this effort, offering a practical reference relevant to the biodiversity found in that area.

Beyond the use of BIIGLE, there are additional benefits of having images accessible across the Department. Given that the images are stored on the DFO network, they could be integrated with Government of Canada Enterprise Data Hub (EDH) data products that include imaging data. However, at the time of this report, EDH archives could only contain taxonomic information alongside field survey metadata, as there is insufficient storage to host images. As a workaround, we can include a link to the image location, such as a networked drive in Quebec Region within the EDH archive thus making the images and their metadata discoverable and available to all with access to the internal DFO network. Such access within DFO further supports opportunities for remote knowledge transfer, skill development, and collaborative research.

# 6. ACKNOWLEDGEMENTS

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# APPENDIX A

In the following sections, advice for taxonomic identification of frequently misidentified taxa is provided. Although the taxa described are based on catches from the Western Canadian Arctic, the taxonomic information is useful for other Canadian Arctic and subarctic locations as several of the taxa are broadly distributed. In some cases where the correct taxon was confused with one or more taxa morphologically similar, images of the latter are provided as examples.

## Crustacea – Decapoda

*Eualus belcheri* (AphiaID urn:lsid:marinespecies.org:taxname:107502):

*Eualus belcheri* was often misnamed in 2021 and 2022 for *Eualus gaimardii* (AphiaID urn:lsid:marinespecies.org:taxname:107504). These two morphologically similar species, previously considered to be two subspecies, were confused many times in the dataset. They both have spines on their rostrum, but *E. belcheri* can be recognized by a well-defined red stripe pattern on their abdomen (Squires 1990) (Figure A-1). Also, *E. belcheri* always have a strong black tipped hook on their third somite. Although adults of *E. gaimardi* (Figure A-2) can sometimes exhibit a hook on their third somite, it would be less prominent and lack the black tip (Squires 1990). The black coloration is not always visible on photos, hence the importance of considering all characters to identify a taxon.



Figure A-1. Photo of *Eualus belcheri* taken at sea by Caitlin Allison. The photo is from the 2022 survey, station KUG-003, deployment event BBT-018. Arrows point to distinctive morphological characteristics of the species: 1) black tipped hook on the third somite, 2) well-defined red stripe pattern on abdominal somites.

Figure A-2. Photo of *Eualus gaimardii* taken at sea by Caitlin Allison. The photo is from the 2024 survey, station BNK-04, deployment event BBT-065. Note the lack of well-defined stripes on the abdomen and a less prominent hook on third somite.

<u>*Lebbeus polaris*</u> (AphiaID urn:lsid:marinespecies.org:taxname:107521):

*Lebbeus polaris* was often misidentified in 2021 for other shrimp species (*Eualus gaimardii, Pandalus borealis, Bythocaris* sp.). This species can be variable in the shape of the rostrum (i.e., presence or absence of dorsal spines). The presence of one supraorbital spine can confirm the genus identification (Squires 1990) (Figure A-3). To see examples of the diversity of shapes, see Lacasse et al. (2020). It should be noted that *L. polaris* belongs to a species complex, since genetically different groupings have been found (e.g., Marcil et al. 2025).



Figure A-3. Photo of *Lebbeus polaris* taken at sea by Caitlin Allison. The photo is from the 2022 survey, station CPB-06, deployment event BBT-125. Arrow points to a distinctive morphological characteristic of the species, 1) one supraorbital spine

## Crustacea – Amphipoda

*Ampelisca* (AphiaID urn:lsid:marinespecies.org:taxname:101445):

*Ampelisca* is an amphipod genus (Ampeliscidae family) that have four small red eyes (Figure A-4). It was misidentified in 2021 and 2022 as family Eurytheneidae (AphiaID urn:lsid:marinespecies.org:taxname:177050).
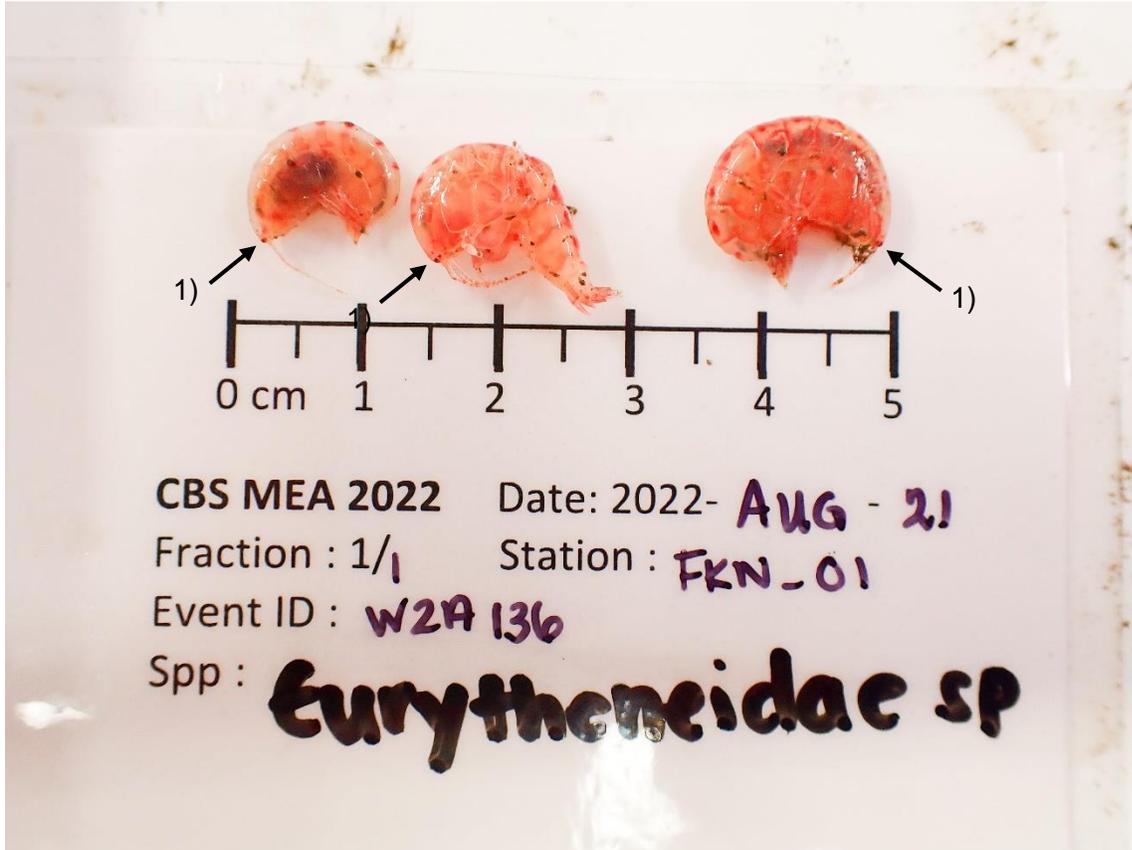


Figure A-4. Photo of *Ampelisca* sp. taken at sea by Caitlin Allison. The photo is from the 2022 survey, station FKN-01, deployment event W2A-136. The erroneous label shows that the specimens were misidentified at sea as Eurytheneidae sp. Arrows point to a distinctive morphological characteristic of the species: 1) four small red eyes.

<u>*Lepidepecreum umbo*</u> (AphiaID urn:lsid:marinespecies.org:taxname:102603):

*Lepidepecreum umbo* is an amphipod that was recorded in 2022 as "unknown amphipod" (Figure A-5). It was then found again in 2023 and 2024 (Figure A-6), but misidentified as *Acanthonotozoma cristatum* (AphiaID urn:lsid:marinespecies.org:taxname:101872) (Figure A-7). Note on A-5 the short rostrum and the distinctive shape of the coaxal plate.



Figure A-5. Photo of a frozen specimen of *Lepidepecreum umbo* taken in the lab by Claude Nozères/Valérie de Carufel. Specimen is from 2022 survey, station MTI-183, deployment event BBT-183. Arrows point to distinctive morphological characteristics of the species: 1) short rostrum, 2) distinctive shape of the coaxal plate.



Figure A-6. Photo of fresh colour specimens of *Lepidepecreum umbo* taken at sea by Caitlin Allison. Photo is from 2023 survey, station CPY-03, deployment BBT-139.
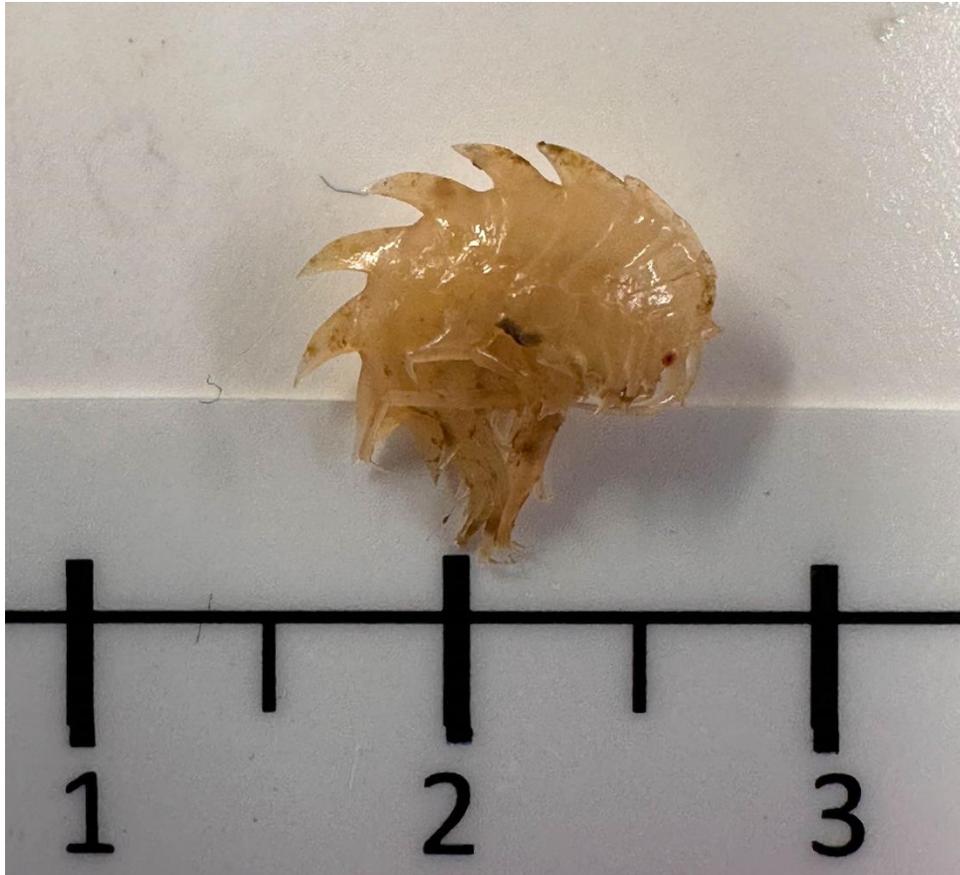
Figure A-7. Photo of *Acanthonotozoma cristatum* taken at sea by Caitlin Allison. The photo is from the 2023 survey, station PWS_02, deployment event W2A-196. It has a longer rostrum and elevated dorsal teeth.

## Mollusca – Bivalvia

*Portlandia arctica* (AphiaID urn:lsid:marinespecies.org:taxname:141987):

Small specimens of *Portlandia arctica* (Figure A-8) were misidentified in 2021, 2022, 2023 and 2024 as *Nuculana* (AphiaID urn:lsid:marinespecies.org:taxname:138259) (Figure A-9) or *Yoldia* (AphiaID urn:lsid:marinespecies.org:taxname:138672) (Figure A-10). *Portlandia arctica* has a less pronounced asymmetry than these two other taxa.
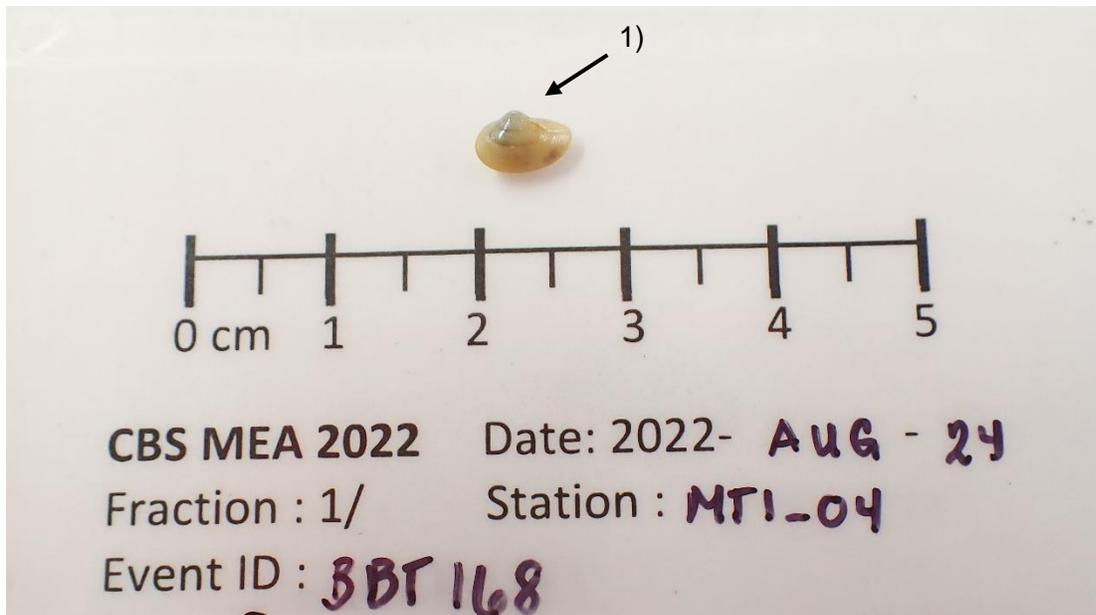


Figure A-8. Photo of *Portlandia arctica* taken at sea by Caitlin Allison. Photo is from the 2022 survey, station MTI-04, deployment event BBT-168. Arrow points to a distinctive morphological characteristic of the species: 1) less pronounced asymmetry.
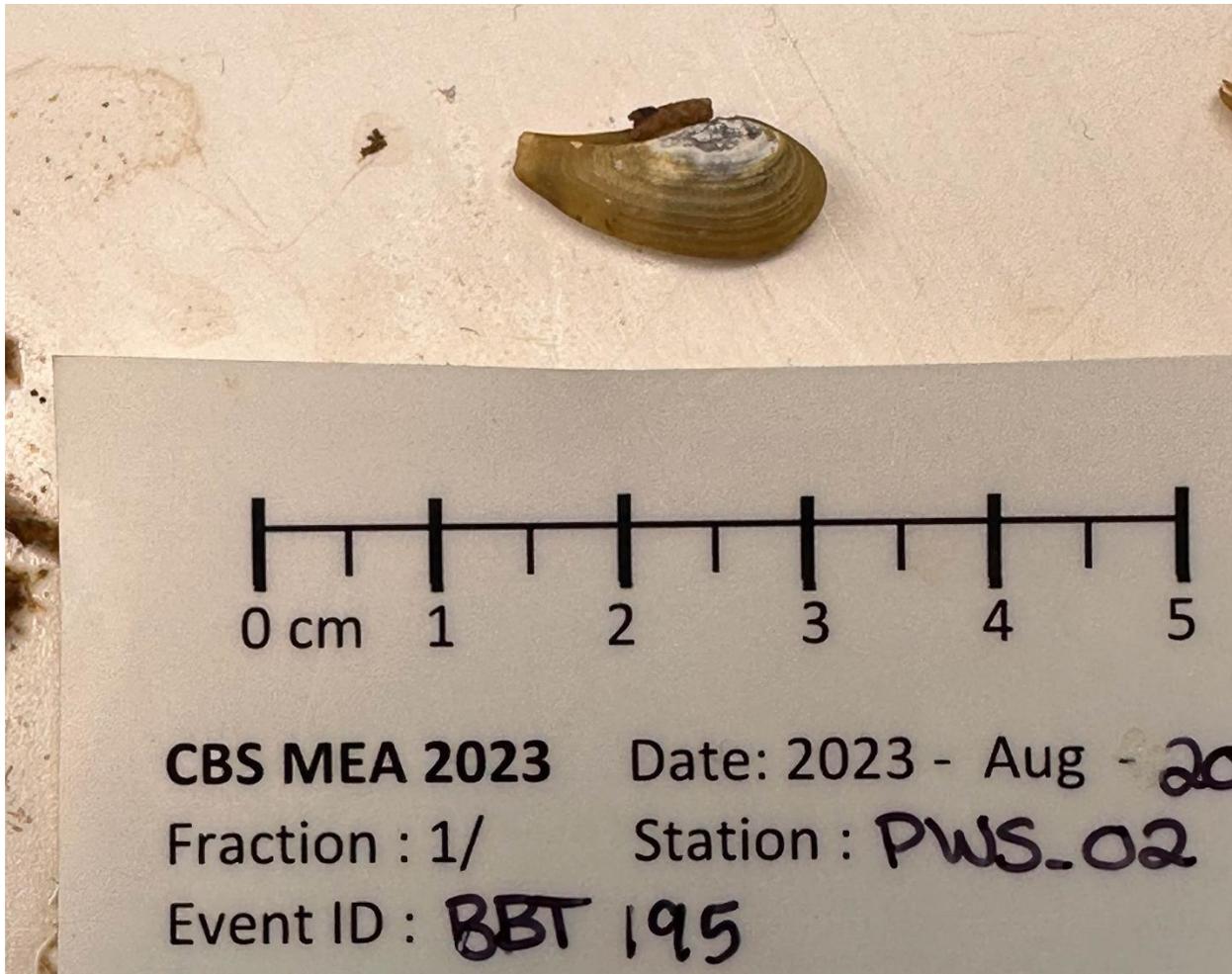
Figure A-9. Photo of *Nuculana pernula* taken at sea by Caitlin Allison. Photo is from the 2023 survey, station PWS_02, deployment event BBT_195.
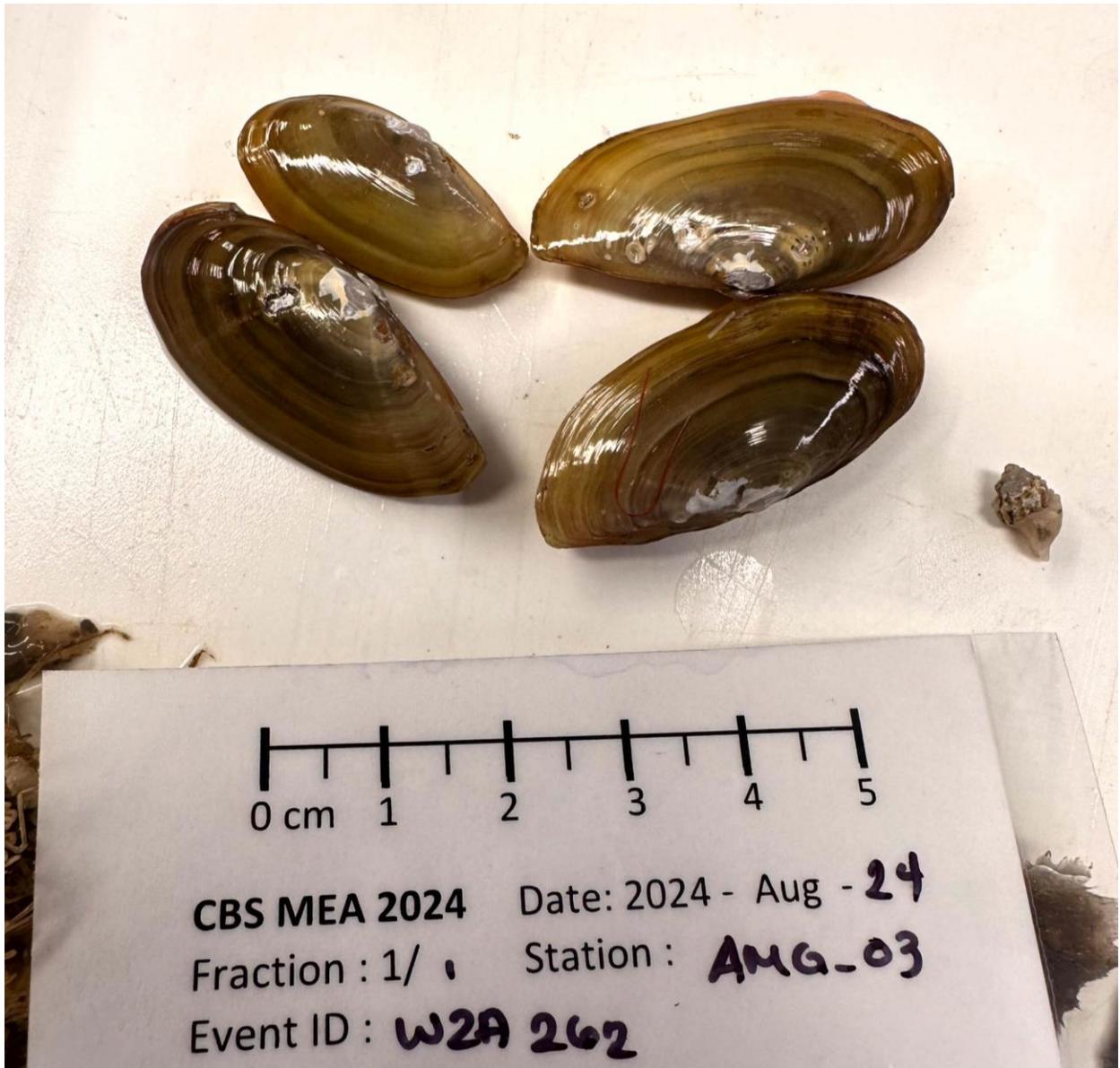
Figure A-10. Photo of *Yoldia hyperborea* taken at sea by Caitlin Allison. Photo is from the 2024 survey, station AMG_03, deployment event W2A-262.

## Mollusca – Gastropoda

_Colus_ (AphiaID urn:lsid:marinespecies.org:taxname:137704):

_Colus_ is a gastropod genus (Figure A-11) that was misidentified in 2021, 2022 and 2023 as _Neptunea_ (AphiaID urn:lsid:marinespecies.org:taxname:137710) (Figure A-12) or _Buccinum_ (AphiaID urn:lsid:marinespecies.org:taxname:137701) (Figure A-13). These gastropod genera are often confused during at-sea identification. _Colus_ has a long siphonal canal, unlike _Buccinum_ and _Neptunea_, and an oval operculum with a terminal nucleus, unlike _Buccinum_.



Figure A-11. Photo of _Colus_ sp. taken at sea by Caitlin Allison. Photo is from the 2023 survey, station KUG-005, deployment event BBT-022. Arrow points to a distinctive morphological characteristic of the species: 1) long siphonal canal. Operculum not shown on the photo.

Figure A-12. Photo of *Neptunea heros* taken in the lab by Valérie de Carufel. Photo is from the 2023 survey, station CPB-02, deployment event W2A-108.

Figure A-13. Photo of *Buccinum hydrophanum* taken at sea by Caitlin Allison. Photo is from the 2024 survey, station CPB-03, deployment event BBT-131.

## Echinodermata – Asteroidea

*Pontaster tenuispinus* (AphiaID urn:lsid:marinespecies.org:taxname:123851):

Small specimens of *Pontaster tenuispinus* (Figure A-14) were recorded in 2021 as "unknown sea star", and misidentified in 2022 as *Henricia* that is common in boreal waters of the Atlantic and the Pacific (AphiaID urn:lsid:marinespecies.org:taxname:123276). *Pontaster tenuispinus* has spines along the margin between the dorsal and ventral surfaces
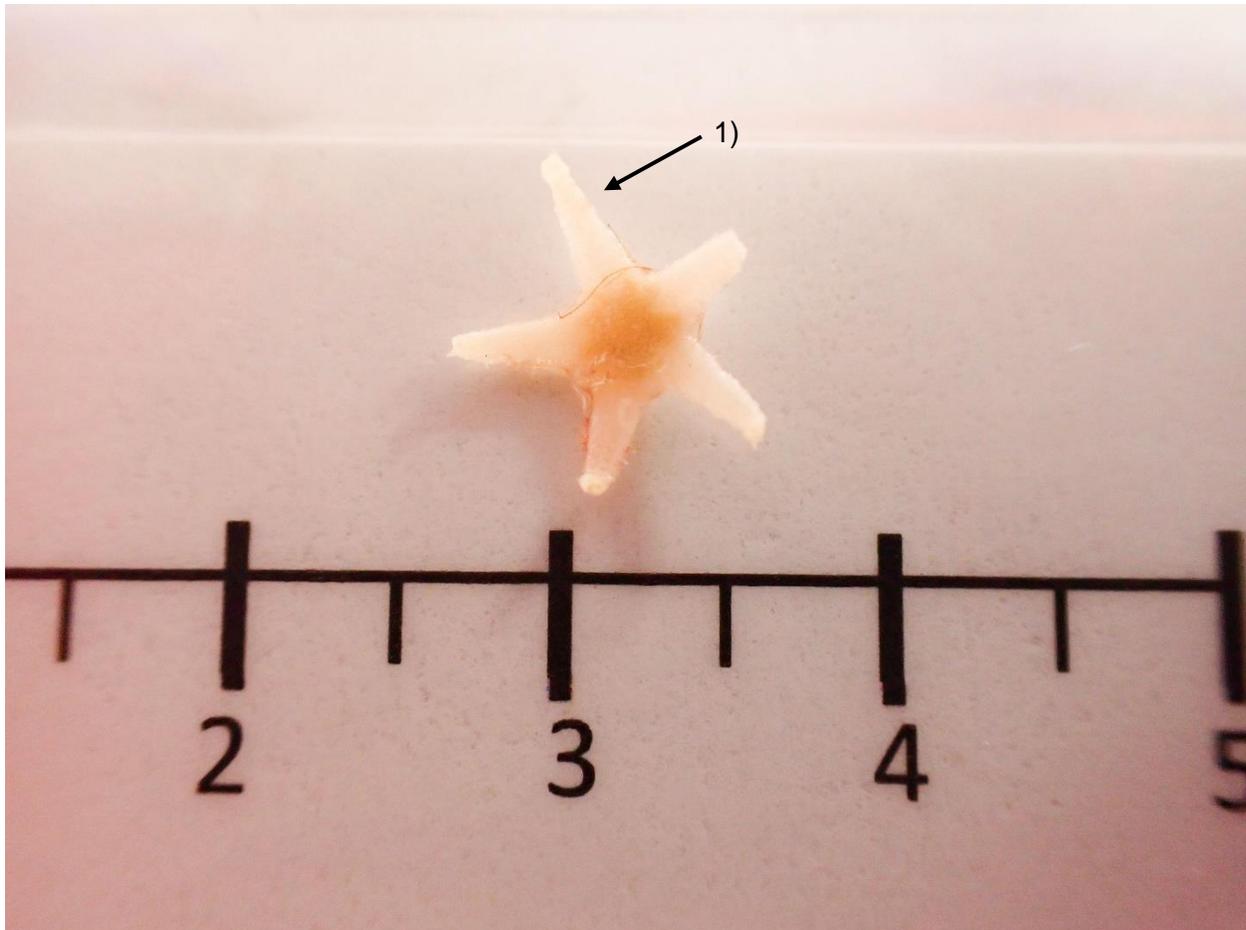


Figure A-14. Photo of *Pontaster tenuispinus* taken at sea by Caitlin Allison. Photo is from the 2022 survey, station DUS-007, deployment event BBT-191. Arrow points to a distinctive morphological characteristic of the species: 1) spines along the margin.