Baffinland Iron Mines Incorporated (BIM), Ballast Water Study Plan

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BIM Ballast Water Study Plan Version Control Table

Version	Author	Date	Changes
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DISCLAIMER
This DRAFT study plan has been prepared for discussion purposes and is subject to modification as details are agreed upon.

As some scientific terms or jargon may be unfamiliar to readers, a glossary of terms is provided at the end of this document.

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Background

Shipping has been the primary vector responsible for movement and introduction of aquatic non-indigenous species (NIS) around the globe (Bailey et al. 2020), largely through ballast water discharge and biofouling, and is of particular concern in a warming and increasingly accessible Arctic (Chan et al. 2019; Goldsmit et al. 2020). Furthermore, future invasion risk in the Northern Hemisphere through Arctic globalization was one of the top ranked issues in a recent horizon scan on invasion science (Ricciardi et al. 2017) and has been recognized by the Arctic Council who have recommended strategies for limiting risks (CAFF and PAME 2017). Preventative measures, such as ballast water exchange and treatment and reduction of ship biofouling, are key components in the management of species introductions. While exchange has been the required mechanism for management of ballast water in Canada since 2006, with the 2017 entry-into-force of the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004*, many ships are beginning to install Ballast Water Management (Treatment) Systems (BWMS) (IMO 2018). Over the past decade, Fisheries and Oceans Canada (DFO) has been conducting research on the effectiveness of ballast exchange practices and associated risks of species introductions (e.g., Chan et al. 2012; DiBacco et al. 2012; Casas-Monroy et al. 2014; Goldsmit et al. 2019). More recently (2017-2019), as part of the Experience-Building Phase of the Convention, DFO has been conducting research on the biological composition (and risk) of treated ballast water and new methods for ballast water sampling and analysis. However, this research has been primarily conducted with ships arriving to Vancouver, BC, and ports within the Ontario Great Lakes. This study plan describes proposed research to be conducted with ships arriving to Milne Inlet Port, NU, to broaden understanding of BWMS efficacy and the biological risks posed by Baffinland Iron Mines Incorporated (BIM) Project shipping. This research will support development of a program for ongoing monitoring of risk/compliance of ballast water discharges from Mary River Project ships arriving at Milne Inlet Port. The research will align with DFO priorities for the protection of Canada's oceans and other aquatic ecosystems (and species) from human impact and invasive species. Concurrently, it will fulfill obligations under commitments made by Baffinland to the Nunavut Impact Review Board (NIRB) as part of the environmental impact review for the Phase 2 Proposal. DFO acknowledges the importance of community involvement in developing plans for this research. The steps outlined below represent a starting point and suggested approach for stimulating discussion. The intent is to adapt and further co-develop plans with affected communities using mechanisms they feel will allow for comprehensive and meaningful involvement in the process of developing and participating in the project.

Objectives

1. To exchange knowledge, co-develop research plans via community involvement, and provide training for indigenous individuals (especially 'youth'[1]) in affected communities (e.g., Pond Inlet) to participate in ballast water biological sampling, and build new/draw on existing local capacity for risk assessment and future ballast water monitoring at BIM;
2. To develop standard protocols for biological monitoring of risk/compliance with ballast water management standards for ongoing use by BIM:
    a. To verify and adapt existing ballast water biological sampling methods, as needed, for ships arriving to the BIM facility.

[1] For the purposes of this plan, 'youth' are defined as individuals aged 18-35 to meet safety and site access requirements

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b. To verify the accuracy and feasibility of potential new rapid indicative analysis tool(s) for assessing ballast water compliance (with respect to viable organism densities) for future use by BIM/community monitors.

3. To identify the most important factors related to the risk of introducing aquatic NIS in ballast water discharged by ore carriers at Milne Inlet Port by collecting samples across a stratified sample of ships using different ballast water management strategies (60-75 samples over two shipping seasons, from ships using ballast water exchange or ballast water exchange plus treatment);
4. To develop a risk assessment tool (specific to Milne Inlet) that will facilitate future targeting of higher risk ships for monitoring risk/compliance and support development of species-specific rapid response plans based on risk factors identified through results of biological sampling.

General Plan

The work will be conducted in multiple stages:

Year 1 (pilot program focussed on Mittimatalik (Pond Inlet) participation)

Stage	Timeframe*
1) literature review, sampling design, workshop preparation, share proposal summary and initiate contact with community representatives (step 1 would also include affected communities listed below in expanded Year 2 program **)	Jan-May 2021
2) project planning community workshop (workshop #1)	June 2021
3) sample collection/analyses training workshop (workshop #2)	July 2021
4) pilot ballast water biological sampling/on site analyses sample collection	July 2021
5) operative ballast water biological sampling/on site analyses	Aug-Oct 2021
6) follow-up debrief/community outreach	Nov 2021
7) lab analyses of preserved biological samples	Aug – Dec 2021
8) preliminary analysis/risk assessment and reporting with community participants (workshop #3)	Dec 2021 +

*Timing for steps 2-7 contingent on COVID-related public health and travel restrictions; virtual/remote participation options will be utilized as needed and if possible until restrictions are lifted

Year 2 (expanded program with inclusion of additional affected communities that have an interest**):

Stage	Timeframe
9) project planning community workshop (workshop #4)	Jan-Feb 2022
10) sample collection/analyses training workshop (workshop #5)	July 2022
11) operative ballast water biological sampling/on site analyses	Aug-Oct 2022
12) follow-up debrief/community outreach	Nov 2022
13) lab analyses of Y2 preserved biological samples	Aug-Dec. 2022
14) analysis/risk assessment and reporting with community participants (workshop #6)	Dec 2022 +
15) development of RA framework and analysis	Ongoing with target completion Oct 2022
16) input on final risk assessment (workshop #7 - all communities)	Nov 2022 – Feb 2023

**e.g., Igloolik, Sanirajak (Hall Beach), Kangitugaapik (Clyde River), Ikpiarjuk (Arctic Bay)

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In Stage 1, a review of scientific literature and relevant data on ballast risk assessment will be conducted to identify factors known to affect NIS risk under different ballast management scenarios, design a stratified sampling plan and estimate appropriate sample strata/sizes, and evaluate risk assessment approaches that have been successfully used elsewhere to target ships for biological sampling/ compliance testing. Concurrently, we will initiate development of a risk assessment framework to be refined as samples are obtained and preliminary findings emerge (stage 15). Standard operating procedures will also be developed or adapted specifically for biological sampling of ships at BIM, and required equipment and supplies procured, prepared, and shipped to the BIM Mary River Mine site on BIM chartered flights. BIM will transport all equipment to the Milne Port facility by road, where it will be held until training and sampling are initiated. A plain language proposal summary as well as copies of the full draft proposal (for reference) will be shared with the Hunters and Trappers Organizations/Associations (HTO/As), hamlets, and other representatives of affected communities to initiate contact, introduce proposed plans and timelines, and identify potential participants for follow-on workshops/training. An emphasis will be placed on recruiting individuals (particularly youth) with past environmental experience (such as completing environmental/scientific courses) and/or interest in environmental science/stewardship.

During stages 2 & 9, initial project planning workshops will be held with 6-8 recruited youth in each community. Workshop participants will be encouraged to help facilitate follow-up community outreach activities to build on established trust with local northern communities, exchange knowledge/concerns about NIS and ballast water activities at BIM, local logistics, and set priorities for ballast water biological sampling and analysis activities in each season. Interested individuals from these initial workshops would be encouraged to maintain their involvement and asked to participate in sample collection/analyses training workshops (stages 4 & 10, below) to further their experience.

Sample collection/analyses training workshops (Stages 3 & 10) will be held with 6-8 community participants to familiarize them with the analysis methods prior to starting the operative biological sampling program (stages 5 & 11). A DFO team will provide ‘classroom’ training, at first demonstrating procedures and then facilitating hands-on skill development. These workshops will help prepare individuals for participation in ballast water biological sampling activities at Milne Port, and help them determine if they wish to continue participating in the ballast water study, depending on individual interest and ability. We have confidence that this method works and have published with northern community members as coauthors (Sevellec et al. 2020) who led similar field sampling without direct supervision (i.e., southern researchers were not present).

During pilot ballast water biological sampling (Y1, Stage 4), DFO researchers will work collaboratively with BIM to determine if sampling and analysis procedures already in use at southern ports are transferable/feasible for Milne Inlet environmental/operational conditions. A DFO team (maximum 3 people) will be deployed to the BIM facility, with all necessary equipment (owned and retained by DFO), for approximately 1 week to conduct ballast water biological sampling and analyses based on existing Standard Operating Procedures. The pilot sampling stage will give the DFO team the chance to become familiar with site safety, security and operational procedures (e.g., cargo loading operations, de-ballasting) at the BIM dock/anchorages and adapt existing procedures for biological sampling and analysis of ballast water as required prior to conducting any on-ship training with community participants.

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For the operative ballast water biological sampling program (stages 5 & 11), a 3-person DFO team will be deployed to BIM to conduct daily ballast water biological sampling (see Table 1), depending on ship schedules and other factors (e.g. weather, safety). New DFO personnel will rotate in every 2-3 weeks, ideally having some overlap between outgoing and incoming personnel for smooth transition (depending on availability of DFO personnel; rotational schedules to be coordinated with BIM taking into account availability of accommodations and community flights). Interested community participants who have completed the sample collection/analyses training workshop will also rotate at BIM during this time, two persons at a time, to accompany the DFO team and to participate in ballast water biological sample collection and analysis, learning all steps of the process. BIM will provide and supervise all safety training on site to DFO and community participants (maximum 5 persons total at any one time). The DFO team will provide additional safety and technical training (specific to hands-on sample collection and analysis methods) to community participants and BIM staff (if relevant), with a view to develop/build on a local skilled workforce that can conduct future ballast water sampling/ monitoring and analysis at BIM with limited support from DFO. Community participants will receive close guidance on all sample collection and analysis methods until they are able to conduct the work unassisted. Community participants and DFO researchers will be on site at BIM facility for 2-3 weeks at a time (maximum 3 weeks/rotation), allowing participants sufficient time to gradually develop comfort and proficiency with sampling and data recording methods.

After the close of each shipping season, a follow-up debriefing session will be held with participants (ideally in their own community) to discuss their experiences and troubleshoot ways to improve future sampling and training approaches. Community participants will be encouraged to participate in provision of post-field season updates to key community organizations and representatives (stages 6 & 12).

Following completion of lab analyses and data entry in a given project year (stages 7 & 13), analysis/risk assessment and reporting workshops (stages 8 & 14) will be held with previous (and interested) participants, to discuss/develop data analysis methods, the risk framework and generate preliminary findings. Ideally, community participants will actively participate in data analysis/risk assessment development and sharing this information with community organizations and representatives through various methods of outreach determined through group discussion.

DFO will build on these preliminary analyses by conducting/overseeing statistical modelling of collected data and writing up of risk assessment results which will then be brought back to affected communities for review (stage 15). DFO will also consult with and seek feedback and input from BIM and Transport Canada during the preliminary analysis and review stages.

A draft of the final risk assessment will be shared with previous workshop/sampling participants and ultimately the broader community through a concluding set of workshops and outreach activities (stage 16) as detailed below.

Workshops/Training Plan (each workshop expected to be 3-5 days)

Project planning (Workshops #1 & #4; 6-8 participants with interest/experience in environmental science - youth-focused): will begin with DFO researchers and participants sharing their backgrounds and exploring the general ways in which we can work together in a manner consistent with the principles of *Inuit Qaujimajatuqangit.* DFO will follow by sharing background about the motivations for the study, general information on ship-mediated transport of aquatic species, summarizing related ship

operations and findings from global research on key vectors, such as ballast water. There will then be an open discussion with time for all participants to ask questions. DFO researchers will share knowledge gained from prior research conducted on ships arriving to ports in southern Canada and proposed sample design/plans for Milne Port ballast water research and community participation, followed by open discussion with time for all participants to ask questions and identify gaps/suggest modifications to the proposed plan, including the stratified sampling design and logistics. Finally, the workshop participants will review/identify which community organizations/individuals should ideally be engaged, other potential participants for future workshops/sampling, and 'brainstorm' on the best ways to conduct outreach/communicate information to the broader community. This will include identifying the main messages to be communicated and discussing how to formulate these in a way that they can be translated effectively in Inuktitut. Following development of outreach materials, community participants will ideally lead outreach activities with support from DFO researchers.

Sample collection/analyses training (Workshops #2 & #5; interested participants from previous workshop): will provide technical and safety training related to analysis of ballast water samples. Participants will review and discuss written Standard Operating Procedures (SOPs) while the DFO team demonstrates sampling and analysis procedures. After demonstration of the procedures, safe work procedures will be discussed (e.g., safe handling of chemicals used). Participants will then conduct active hands-on learning, following SOPs on 'mock' samples, using microscopes (for detailed analysis) and other scientific equipment (for indicative analysis), and walking through the steps of recording data. Interested participants from workshops #2 & #5 will be given the opportunity to participate in the ballast water biological sampling program at BIM with the DFO team. Community participants who participate in biological sampling will ideally take on leadership roles (with DFO researchers acting in a supporting role) to provide updates to key organizations/representatives in the broader community on the work accomplished during the ballast sampling stage in relation to the stratified sampling plan and the training plan. Furthermore, Y1 participants could be involved in training Y2 participants (if they want to). For example, a Y2 participant could be paired with a Y1 participant in the field and they could help DFO to deliver Y2 workshops (#4 & #5). It is anticipated that 1-2 BIM staff will also participate in workshops, to facilitate knowledge-sharing and coordination of on-site logistics with the DFO team (hereafter, referred to as BIM workshop staff).

Analysis/risk assessment and reporting (Workshops #3 & #6; interested participants from previous workshops): Raw tabulated data will be shared with participants to allow for input and discussion on patterns in the data and ways to organize and summarize the results to explore potential factors that could influence risk, based on data collected to date (acknowledging that preserved samples may not have been fully assessed at this time). Where possible, analyses (e.g., graphing or mapping of preliminary results) will be conducted jointly following these discussions, so participants have the chance to learn the process of exploratory data analysis. DFO will share potential options for risk assessment (i.e., the risk assessment framework), and seek feedback from workshop participants on what approaches they think would work best given their experiences and observations of the data. Ideally, direct participation in data exploration and deeper understanding of project results will empower participants to work together (with DFO support) to develop ways to share findings with, and seek input from, the broader community through outreach.

Review/input on final risk assessment (Workshop #7 - all communities). The final risk analysis/assessment developed with consideration of input from community and BIM received during the analysis/risk assessment reporting workshops (#3 & #6), associated outreach, and Transport Canada feedback, will be shared with previous workshop participants prior to workshop #7 to allow for their

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review. This will be followed by workshops with participants in each community to allow for discussion and development of presentation materials. This would be conducted in a similar manner to earlier planning workshops, where participants help to highlight the main messages they feel should be communicated to the broader community and discuss how to formulate these in a way that they can be translated effectively in Inuktitut. Following development of outreach materials, participants will ideally lead outreach activities with support from DFO researchers to seek feedback on results, identify any gaps and clarify roles/responsibilities in next steps for ongoing monitoring of ballast water at BIM.

All materials to be shared with the broader community will be translated to Inuktitut to facilitate communication, learning and discussion in whichever language individuals are most comfortable with. As discussed above, wherever possible time will be taken to work cooperatively with workshop participants in ensuring English phrases or text are developed in a way that allow for proper translation to Inuktitut.

Detailed Ballast Water Biological Sampling Plan

A stratified sampling plan (such as 1/3 ships using solely ballast water exchange (BWE), 1/3 ships using UV-based BWMS (plus BWE) and 1/3 ships using chemical-based BWMS (plus BWE)) will be developed during stage 1 based on an array of factors (e.g., ballast water management methods, last port of call, etc.), and finalized after Workshop #1. The sampling plan will guide selection of ships to target sufficient sample representation across factors, bearing in mind limitations/opportunities presented by the daily schedule of available ships and BIM cargo operations. BIM will support DFO by contacting ships in advance of their arriving to Milne Inlet to coordinate access and ballast water sample collection. Ideally, one ship per day will be sampled when the DFO team is on site. Based on current knowledge of ship operations at BIM, it is anticipated that ballast water sampling will be conducted while ships are at anchor in Milne Port, prior to cargo loading activities, in conjunction with ballast salinity testing already conducted by BIM environmental monitors.

Preparation for Sampling

BIM will assist DFO with the selection of ships for sampling by providing shipping schedules and contact details. Ships will be contacted in advance of their arrival in port to obtain information about the ships' ballast water management plan (e.g., if ballast water treatment and/or exchange will be used). A plan for sampling will be discussed with crew on each ship, and ships with a BWMS will be asked to provide information about ballast water pumping rates and sample port configuration (i.e., engineering drawings, photos). DFO will acquire a copy of the Canadian Ballast Water Reporting Form for each ship prior to boarding. Ships will be targeted for sampling based on the stratified sampling design, although safety and dock schedule will be a primary determinant of which ships will be boarded (ships will typically be boarded and sampled between 6 am and 6 pm).

Boarding Ships

DFO will plan timing of ship visits with ship crew through BIM and the Port Captain. BIM will arrange for safe transport of the biological sampling team by vehicle across the mine site to the dock, and by tugboat to/from the ships at anchorage. The biological sampling team will consist of up to 5 DFO personnel and community participants (plus any personnel BIM may assign to oversee the team), depending on availability and safe capacity of transportation methods. Equipment needed for biological sampling will be transferred from the tugboat to the ship using the ships' lifting basket or heaving/haul line (typically 2 or 3 40-L back packs and a 75-L plastic bin filled with sample hose; less equipment is required for ships using BWE only). The biological sampling team will transfer from the tugboat to the

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ship using the ships' gangway and sign in with the ships' crew. BIM will provide the biological sampling team with a means of contact to communicate with the tugboat for the return trip to shore when biological sampling has been completed (i.e., to facilitate safe transfer between vessels and summons the tugboat if it has left for other duties). Upon boarding, and prior to sampling, a member of the biological sampling team will meet with the ship crew (typically the Chief Officer and Chief Engineer) to confirm the provenance of the ballast water (ballast water source, age, management applied, etc.) to verify ship-specific details necessary to ensure safety and minimal impact to ship operations, and to obtain authorization to proceed with biological sampling.

Collection of Treated Ballast Water Samples – From Ships' Engine Room

For ships using a BWMS (i.e., treatment), the biological sampling team will conduct sampling using the sample port and probe already installed in the ships' engine room (typically located close to the overboard discharge). Sampling will be conducted under the supervision of the Chief Officer and Chief Engineer (or delegate). DFO sampling equipment will be connected to the ships' sampling port, to enable in-line isokinetic continuous sampling methods consistent with the IMO G2 sampling guidelines (IMO 2008; ICES 2017). Support may be required from ships' engineering staff to make the connection and will be required to run the ballast pump(s) and BWMS (if operated on discharge) during sampling. To shorten time on ship, the ship crew will be asked to have the BWMS ready for operation (i.e., ensure that any warm-up of the system or preparation of neutralization chemicals are completed prior to arrival of the biological sampling team on ship).

Sampling must be conducted **during** standard de-ballast operations, for a duration of 30-60 minutes (approximately 500 cubic meters ballast water sent overboard). The Chief Officer will determine which ballast tank(s) can be safely de-ballasted to facilitate biological sampling. At least 1000-L (ideally 3000-L) of ballast water will be taken from the ships' discharge line via the sample port and passed through a plankton net to collect large organisms (≥ 50 µm size) inside the net. At the same time, 20-L of unfiltered water will be collected in a large container to collect small organisms. Ballast water samples which have passed through the plankton net will be directed into the 75-L plastic bin with drain hose for disposal under the direction of the Chief Engineer (typically redirected to the bilge or clean/grey water holding tanks; 1000 to 3000-L). Once biological sampling is completed, the ship crew will be notified (de-ballasting can be stopped, if desired). The collected biological samples will be split into containers for transport off the ship. Depending on time available, some initial processing of samples can be conducted in the engine room; time on ship can be shortened with less sample processing on board, but the trade-off will be larger volumes of water having to be carried off ship. The biological sampling team will disconnect and collect all its sampling equipment and disembark from the ship. Total time on ship can range from 2-3 hours, depending on the level of support provided by the ship crew, and the size and experience of the research team.

Collection of Exchanged Ballast Water Samples – From Ships' Deck

For ships without a sample port installed in the engine room (typically ships without a BWMS, i.e., those that conduct BWE only), the biological sampling team will conduct sampling by lowering sampling equipment (e.g., plankton net and Van Dorn water sampler) into ballast tanks from the ships' deck through an opened manhole cover. To shorten time on ships, ship crews will be asked to have the ballast tank manhole cover opened in advance of arrival of the biological sampling team on ship. Sampling must be collected **prior to** de-ballast operations. The sampling equipment will be deployed to the lowest accessible depth in the ballast tank. Both plankton nets and water samplers will need to be lowered and retrieved several times to collect sufficient ballast water sample volume to achieve representative samples for both size classes of organisms. The collected biological samples will be split

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into containers for transport off the ship. Depending on time available, some initial processing of samples can be conducted in the engine room; time on ship can be shortened with less sample processing on board, but the trade-off will be larger volumes of water having to be carried off ship. The biological sampling team will collect all its sampling equipment and disembark from the ship. Total time on ship is typically 1 hour, depending on the ballast tank accessible depth (less depth will require deploying the plankton net and water sampler more times and thus take longer).

If a single ship contains ballast water from different source locations, it would be of interest to sample one tank from each ballast water source, if time allows (sampling a second tank would mean longer time on ship).

Sample Analysis – Fresh/Unpreserved Samples

Analysis of unpreserved samples will be completed for all treated ballast water samples to estimate the number of live organisms in relation to regulation D-2 of the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004.* Although this regulation does not apply for ships using ballast water exchange, analysis of unpreserved samples may be completed for exchanged ballast water samples as part of testing indicative analysis methods and verifying analysis methods (Objective 2) and to inform the analysis of different ballast histories (Objective 3). Both detailed and indicative analysis methods will be used, allowing an assessment of the reliability of the indicative tool(s) being used, to determine if indicative analysis methods alone can be sufficient for use at BIM in the future. Detailed analysis consists of sample assessment under a microscope by a trained analyst to obtain direct counts of living organisms (two size classes: ≥50 µm and 10-50 µm); DFO will not conduct detailed analysis of the indicator microbes specified in regulation D-2 as this would entail specialized laboratory certification and containment procedures. Indicative analysis consists of sample assessment using a technology that may be operated with limited training to obtain an estimate of the number of viable organisms. Based on the results of previous research on indicative tools, DFO has selected the Satake Viable Organism Analyser (MOL Techno-Trade, Ltd.) for conducting indicative analysis of living organisms on BIM Project vessels because it can assess both organism size classes (≥50 µm and 10-50 µm) and is relatively easy to use. Analysis of unpreserved samples typically takes 3 personnel 3-5 hours and should be completed within six hours of sample collection in a suitable 'laboratory' location off the ship.

Sample Analysis – Preserved Samples

A portion of all ballast water samples collected will be preserved for later taxonomic analysis by DFO or delegated contractors (species-level identifications (or lowest feasible level) using morphological and/or molecular methods).

Data Analysis and Risk Assessment

DFO will conduct exploratory data analysis during the ballast sampling phase and at the end of Y1 sampling to track progress against the stratified sample design, making modifications to targeting priorities, as deemed necessary. Data will be anonymized and aggregated, and ship identity will not be released when results are shared more broadly with the scientific community or any other stakeholders. Following the close of the 2022 shipping season and receiving input from community analysis/risk assessment and reporting workshops, data will be fully analysed to identify trends/risk factors specific to ships sampled at BIM. Ideally, community participants, BIM, and TC will provide input/assist with the development of a risk assessment that can be used in future years to develop a targeted sampling design for monitoring ballast water. This could involve evaluation of, and decisions on what factors and

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thresholds should be used in future risk-based targeted sampling and what methods are most effective for indicative testing as detailed above for the concluding workshops. Data will also be used to conduct comparisons of the detailed (live count) analysis method vs. indicative analysis methods, as well as preserved sample analysis methods to assess the feasibility of, and information value provided by the two latter approaches.

Safety and Security

All BIM safety policies, procedures and site-specific training will be followed while on the BIM site, and relevant International Safety Management and security procedures followed while on ships. In addition, DFO will follow all field and lab safety procedures established under their departmental Occupational Health and Safety Hazard Protection Program. BIM and DFO will ensure that all biological sampling team participants involved in field sampling and lab analysis are provided with necessary Personal Protective Equipment (such as safety boots, hard hat, personal flotation device, cold-water survival suit, etc.). At the same time, there is an active global pandemic, and information and public health advisories are constantly changing. DFO and BIM will continually assess the safety and security of all participants/activities and will modify procedures and policies as required to reflect new information and advisories. These may include virtual training/consultation, minimizing the number of participants undertaking certain activities to meet physical distancing requirements or postponement of planned activities. All relevant public health advisories will be monitored and followed. In the case of any differences between the multiple safety and security procedures, the more stringent (precautionary) procedures will be followed.

Table 1: Summary of proposed sampling/data collection for BWMS and BWE ships.

	Ship Type:	**BWMS**	**BWE**
Sample/Data Collected:	**Method:**	Inline - sample port	In tank - access hatch
≥ 50 µm Size Class (Zooplankton)	Live/Detailed Analysis	Y	N / optional
	Preserved (taxonomy)	Y	Y
	Indicative Analysis	Y	N / optional
≥10 - <50 µm Size Class (Phytoplankton)	Live Counts	Y	N / optional
	Preserved (taxonomy)	Y	Y
	Indicative Analysis	Y	N / optional
Physical Water Parameters (temperature, conductivity, pH, etc.)	Multiparameter Sonde	Y	Y
	Refractometer (salinity)	Y	Y
Total Residual Oxidants: TRO (chlorine)	Chlorine Colorimeter	Y	N

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Glossary

Ballast water: water, with its suspended matter, taken on board a ship to increase draft, to change trim, to regulate stability, or to maintain stress loads within acceptable limits

Ballast water management system (BWMS): any system which uses mechanical, physical chemical and biological processes, either singularly or in combination, to remove, render harmless or avoid the uptake or discharge of harmful aquatic organisms and pathogens within ballast water and sediments

Ballast water exchange (BWE): a process which involves the replacement of ballast water at sea with the aim to remove or reduce the number of coastal organisms transported in ballast water

Biofouling: the fouling or attachment of organisms on underwater surfaces such as the hull of a ship

Compliance testing: taking a sample and using an analysis method to indicate or confirm that a sample of ballast water meets a regulatory requirement

Indicative analysis tool: a device which provides a measurement of a parameter that is not a direct determination of the number of viable organisms, but which serves as an informative estimate of the number of viable organisms (e.g., adenosine triphosphate (ATP), chlorophyll a, variable fluorescence, etc.)

Isokinetic: refers to something moving at a constant speed. In the context of ballast sampling this refers to the speed of water moving through the in- line ballast sample port at the same speed as the water in the main ballast pipe of the ship.

Morphological characteristic: refers to the outward appearance of an organism or internal structure of various body parts, usually visible to the naked eye or under magnification

Molecular genetic assessment: refers to the study of characteristics in the genetic codes of organisms which are often be used to differentiate populations or species

Non-indigenous species (NIS): species introduced outside their natural past or present range

Vector: the physical mechanism by which a species is transported to a new location

Viable organisms: organisms that are alive and/or have the ability to generate new individuals in order to reproduce the species

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