ANNEX 17

RESOLUTION MEPC.378(80)
(adopted on 7 July 2023)

2023 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38 of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee relating to any matter within the scope of the Organization concerned with the prevention and control of marine pollution from ships,

RECALLING ALSO that Member States of the International Maritime Organization made a clear commitment to minimizing the transfer of invasive aquatic species by shipping in adopting the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004,

RECALLING FURTHER that studies have shown biofouling on ships to be an important means of transferring invasive aquatic species which, if established in new ecosystems, may pose threats to the environment, human health, property and resources,

NOTING the objectives of the Convention on Biological Diversity, 1992, and that the Kunming-Montreal Global Biodiversity Framework includes a target to eliminate, minimize, reduce and/or mitigate the impacts of invasive alien species on biodiversity and ecosystem services by identifying and managing pathways of the introduction of alien species,

NOTING ALSO that the transfer and introduction of invasive aquatic species through ships' biofouling threatens the conservation and sustainable use of biological diversity, and implementing practices to control and manage ships' biofouling can greatly assist in reducing the risk of the transfer of invasive aquatic species,

NOTING FURTHER that this issue, being of worldwide concern, demands a globally consistent approach to the management of biofouling,

RECALLING that, at its sixty-second session, it had adopted, by resolution MEPC.207(62), the *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (Biofouling Guidelines), developed by the Sub-Committee on Bulk Liquids and Gases,

RECALLING ALSO that, at its seventy-second session, it had agreed to review the Biofouling Guidelines, with a view to amending the Guidelines, if required,

HAVING CONSIDERED, at its eightieth session, the draft revised *Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species*, developed by the Sub-Committee on Pollution Prevention and Response,

1 ADOPTS the *2023 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species*, as set out in the annex to the present resolution;

2 REQUESTS Member States to take urgent action in applying these Guidelines, including the dissemination thereof to the shipping industry and other interested parties, taking these Guidelines into account when adopting measures to minimize the risk of introducing invasive aquatic species via biofouling, and reporting to MEPC on any experience gained in their implementation;

3 AGREES to keep these Guidelines under review in light of the experience gained;

4 REVOKES resolution MEPC.207(62).

2023 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES

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1 INTRODUCTION

1.1 MEPC 62 adopted the 2011 *Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (the Guidelines) through resolution MEPC.207(62). The aim of the Guidelines was to provide a globally consistent approach to managing biofouling by providing useful recommendations of general measures to reduce the risk associated with biofouling for all types of ships.

1.2 Member States of the International Maritime Organization (IMO) decided at MEPC 72 to review the Guidelines in order to assess the uptake and effectiveness of the Guidelines and identify any required action.

1.3 Studies have shown that biofouling can be a significant vector for the transfer of invasive aquatic species. Biofouling on ships entering the waters of States may result in the establishment of invasive aquatic species, which may pose threats to human, animal and plant life, economic and cultural activities, and the aquatic environment.

1.4 Invasive aquatic species have been recognized as one of the major threats for the well-being of the oceans by, inter alia, the Convention on Biological Diversity, several UNEP Regional Seas Conventions, the Asia Pacific Economic Cooperation forum and the Secretariat of the Pacific Region Environmental Programme.

1.5 Prediction of risk of introducing invasive species is complex, hence these Guidelines have the intention to minimize the accumulation of biofouling on ships. Biofouling may include invasive species while a clean hull and niche areas significantly reduce this risk. Studies have shown that the biofouling process begins within the first few hours of a ship's immersion in water. The biofouling pressure on a specific ship is influenced by a range of factors, starting with design and construction of the ship hull and niche areas, followed by operating profile of the ship and maintenance history.

1.6 These Guidelines describe recommended biofouling management practices, as illustrated in figure 1. Attention during initial ship design and construction may provide effective and sustainable means to reduce ship biofouling risks, supplemented by anti-fouling systems (AFS) for all types of ships' submerged or otherwise wetted surface areas, including hull and niche areas. Although these Guidelines focus on ships using AFS, these biofouling management practices are equally recommended for ships using coatings or surfaces that are not used to control or prevent attachment of organisms, as may be applicable.

1.7 The need for inspection and biofouling management may depend on the use of AFS, cleaning regime, and the overall risk of biofouling on the hull and in niche areas. By conducting ship-specific monitoring of risk parameters, identifying potential higher risk for biofouling, an optimized regime for biofouling management can be determined. Cleaning is an important measure to remove biofouling from the hull and niche areas but, when conducted in-water, it poses a risk of releasing invasive aquatic species into the water. Waste substances which are dislodged from the ship during the cleaning operation should therefore be collected. The Guidelines provide guidance for cleaning actions based on a fouling rating number with an overall aim to minimize the risk of transfer of invasive aquatic species. Maintenance and ship recycling should also be conducted with sufficient preventative measures to avoid release of any invasive aquatic species into the water. When conducting biofouling management, potential release of harmful waste substances should also be considered.

1.8 In addition to the Biofouling Guidelines, the following frameworks are relevant for minimizing the transfer of invasive aquatic species:

.1 the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (BWM Convention), which aims to minimize the transfer of invasive aquatic species through ships' ballast water and sediments; and

.2 the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention), which addresses anti-fouling systems on ships and focuses on the prevention of adverse impacts from the use of anti-fouling systems and the biocides they may contain.

1.9 Biofouling management practices may also improve a ship's hydrodynamic performance and can be effective at enhancing energy efficiency and reducing air emissions from ships. This concept has been identified by IMO in the 2022 *Guidelines for the development of a ship energy efficiency management* plan *(SEEMP)* (resolution MEPC.346(78)). These Guidelines further support the *2023 IMO Strategy for the reduction of green house gases from ships* (resolution MEPC.377(80)).

1.10 A GEF-UNDP-IMO GloFouling Partnerships Project was conducted as part of wider efforts by IMO, in collaboration with the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), to protect marine ecosystems from the negative effects of invasive aquatic species. The aim of the GloFouling Partnerships Project was to build capacity in developing countries for implementing the IMO Biofouling Guidelines and other relevant guidelines to minimize the transboundary introduction of invasive aquatic species, with additional benefits in the reduction of greenhouse gas emissions from global shipping.

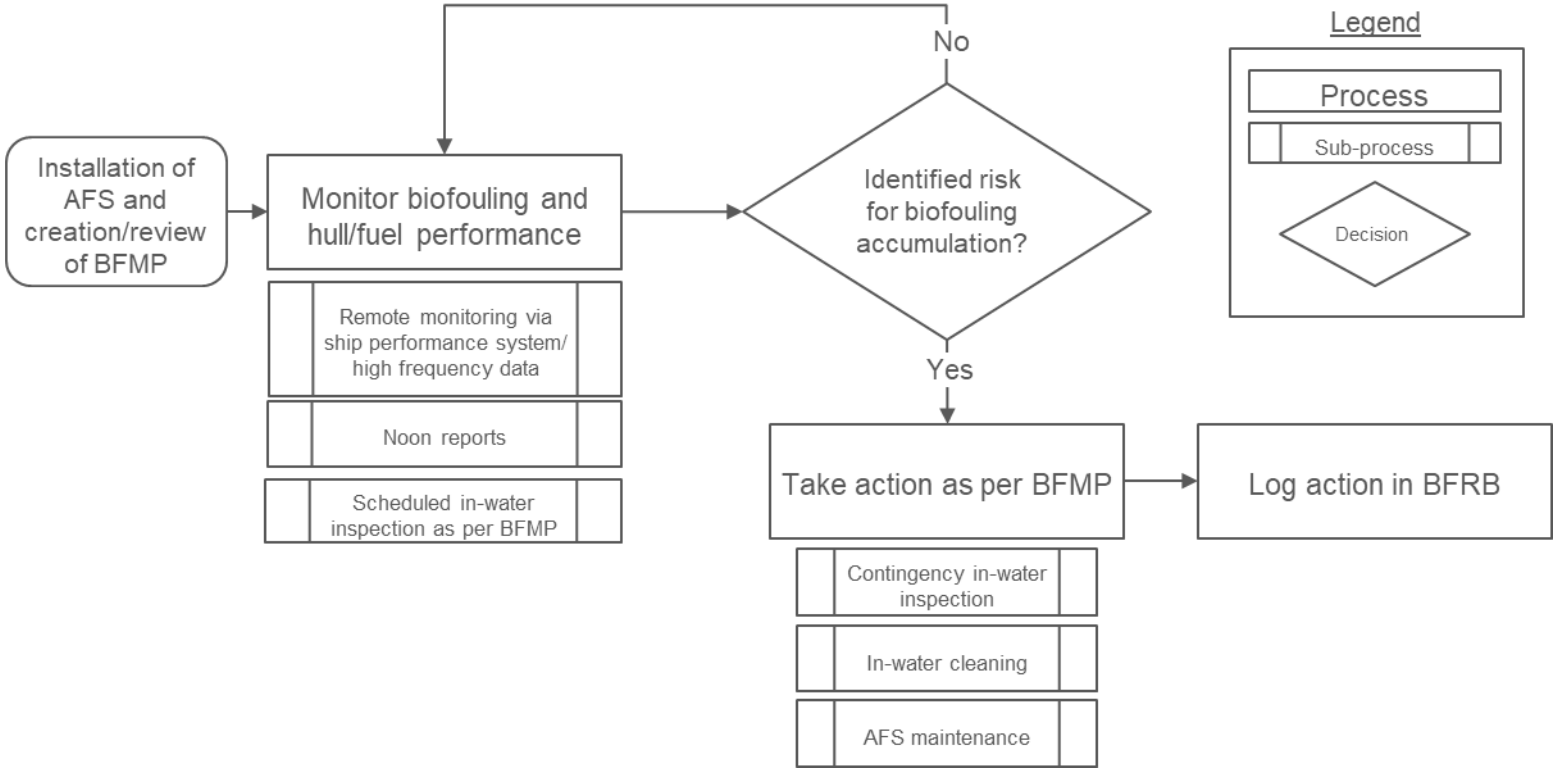

Figure 1: Simplified flow chart visualizing the biofouling management activities of a ship

2 DEFINITIONS

2.1 For the purposes of these Guidelines, the following definitions apply:

Anti-fouling system (AFS) means a coating, paint, surface treatment, surface or device that is used on a ship to control or prevent attachment of organisms.

Anti-fouling coating (AFC) means a surface coating or paint designed to prevent, repel or facilitate the detachment of biofouling from hull and niche areas that are typically or occasionally submerged.

Biofouling is the accumulation of aquatic organisms such as microorganisms, plants and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include pathogens. For microfouling and macrofouling, see definitions below.

Biofouling pressure means the biofouling accumulation rate, which differs regionally and seasonally. High biofouling pressure means the development of dense biofouling within a short period of time.

Capture is the process of containment, collection and removal of biofouling material and waste substances detached from submerged surfaces during cleaning in water or in dry dock.

Cleaning system is the equipment used for, or the process of, removal of biofouling from the ship surface, with or without capture.

Dry-dock cleaning refers to the cleaning of the submerged areas when the ship is out of water.

Fouling rating is the allocation of a number for a defined inspection area of the ship surface based on a visual assessment, including description of biofouling present and percentage of macrofouling coverage.

In-water cleaning is the removal of biofouling from a ship's hull and niche areas while in the water.

Invasive aquatic species are non-native species to a particular ecosystem which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment.

Macrofouling is biofouling caused by the attachment and subsequent growth of visible plants and animals on structures and ships exposed to water. Macrofouling is large, distinct multicellular individual or colonial organisms visible to the human eye such as barnacles, tubeworms, mussels, fronds/filaments of algae, bryozoans, sea squirts and other large attached, encrusting or mobile organisms.

Marine growth prevention system (MGPS) is an AFS used for the prevention of biofouling accumulation in niche areas or other surface areas but may also include methods which apply surface treatments.

Member States means States that are Members of the International Maritime Organization.

Microfouling is biofouling caused by bacteria, fungi, microalgae, protozoans and other microscopic organisms that creates a biofilm also called a slime layer.

Niche areas are a subset of the submerged surface areas on a ship that may be more susceptible to biofouling than the main hull owing to structural complexity, different or variable hydrodynamic forces, susceptibility to AFC wear or damage, or inadequate or no protection by AFS.

Organization means the International Maritime Organization.

Port State authority means any official or organization authorized by the Government of a port State to verify the compliance and enforcement of standards and regulations relevant to the implementation of national and international shipping control measures.

Proactive cleaning is the periodic removal of microfouling on ships' hulls to prevent or minimize attachment of macrofouling.

Reactive cleaning is a corrective action during which biofouling is removed from a ship's hull and niche areas either in water with capture or in dry dock.

Ship means a vessel of any type whatsoever operating in the aquatic environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, fixed or floating platforms, floating storage units and floating production storage and off-loading units.

States means coastal, port, flag or Member States, as appropriate.

Waste substances are dissolved and particulate materials that may be released or produced during cleaning or maintenance, and may include biocides, metals, organic substances, removed biofouling, pigments, microplastics or other contaminants that could have a negative impact on the environment.

3 APPLICATION

3.1 The Guidelines are intended to provide useful recommendations for measures to minimize biofouling for all types of ships. The Guidelines are directed at various stakeholders, such as ship designers, shipbuilders, anti-fouling paint manufacturers and suppliers, States, including environmental and regulatory agencies, classification societies, shipowners, ship operators, charterers, shipmasters, port authorities, ship cleaning and maintenance operators, inspection organizations, ship repair, dry-docking and recycling facilities, and any other interested parties.

3.2 Alternative procedures, methods or actions taken to meet the objectives of these Guidelines which are not described should be reported to the Organization by Members of the Organization and their representatives and be taken into account in future reviews of the Guidelines as appropriate.

3.3 A separate guidance document, based on these Guidelines, provides advice relevant to owners and/or operators of recreational craft less than 24 metres in length, using terminology appropriate for that sector (*Guidance for minimizing the transfer of invasive aquatic species as biofouling (hull fouling) for recreational craft* (MEPC.1/Circ.792)).

3.4 The Guidelines may not be relevant to ships which operate only in the same waters in which the biofouling was accumulated. Although operation in the same waters leads to no risk of introducing invasive aquatic species, measures to avoid discharge of harmful waste substances during cleaning may still be relevant.

3.5 An inspection regime as defined in paragraphs 8.4 to 8.6 may not be relevant to a ship when idle for a longer period. To maintain the anti-fouling effect of an AFS, inspection and reactive cleaning may be needed before the ship is reactivated to reduce the risk of biofouling.

4 OBJECTIVES

4.1 The objective of these Guidelines is to minimize the transfer of invasive aquatic species through biofouling on ships.

4.2 Procedures, methods and actions taken in line with these Guidelines should safeguard the obligation under the United Nations Convention on the Law of the Sea (UNCLOS), article 194, to prevent, reduce and control pollution of the marine environment. This includes ensuring not to transfer, directly or indirectly, damage or hazards from one area to another, or transform one type of pollution into another (ref. UNCLOS article 195), as well as preventing the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment (ref. UNCLOS article 196).

4.3 The objective of these Guidelines is pursued by providing a globally consistent approach to stakeholders on the control and management of biofouling, which will contribute to minimizing the risk of transferring invasive aquatic species from biofouling on ships. An additional effect of good biofouling management can be a reduction in emissions to air from ships, due to lower fuel demand in operation as a result of a clean hull.

5 DESIGN AND CONSTRUCTION

5.1 Initial ship design and construction offers the most comprehensive, effective and long-lasting means to minimize ship biofouling risks. In the design and construction of a ship, or when a ship is being significantly modified, the following items, not exhaustive, should be taken into consideration:

.1 small niches and sheltered areas should be avoided as far as practical, e.g. flush mounting pipes in sea chests (where not practical, these should be designed so that they may be easily accessed for inspection, cleaning and application of AFS like marine growth prevention systems (MGPS));

.2 rounding and/or bevelling of corners, gratings and protrusions to promote more effective coverage of AFC and hinging of gratings to enable diver access;

.3 providing the capacity to block off the sea chest and other areas, such as moon pools, floodable docks and other free-flood spaces, for cleaning and treatment, if applicable and appropriate; and

.4 internal seawater cooling systems should be designed with a minimum number of bends and flanges. The design should be made of appropriate material to minimize biofouling, and be compatible with MGPS, if any. Dead ends, as can be found between different systems like cross-over piping between cooling and general service systems, should be avoided. Standby pumps and piping should be fully integrated into the systems to avoid stagnant water.

6 ANTI-FOULING SYSTEM INSTALLATION AND MAINTENANCE

6.1 AFS are effective means to minimize biofouling on ships' submerged surfaces, including the hull and niche areas.

6.2 Restrictions on the use of certain substances in the AFC are regulated by the AFS Convention.

Choosing an AFS

6.3 It is recommended to install AFS in all submerged surfaces on a ship where biofouling may attach. Various AFS are designed for different ship operating profiles, some suitable for hull and some for niche areas and therefore will require different maintenance activities. Thus, it is essential that shipowners, ship operators and shipbuilders obtain appropriate technical advice. AFS manufacturers are best suited to provide advice to ensure a suitable system is applied, reapplied, installed or renewed. As biofouling may typically be found at higher abundance in niche areas, where flow characteristics change as the ship moves through the water, it is recommended to choose a combination of AFC and MGPS, suitable for different submerged areas. If an appropriate AFS is not applied, biofouling accumulation may increase, and more frequent inspections may be necessary. Some factors to consider when choosing an AFS include the following:

.1 **Ship design and construction:** Where possible and appropriate upon the recommendation of AFS manufacturers, targeted installation of AFS may be employed for different areas of the ship. AFS for the hull may include specific AFC, paint and/or surface treatment. Installation of any proactive cleaning measures should be in accordance with the recommendations from the AFC provider and should not damage the AFC. Different AFS are designed to optimize their performance for specific ship speeds. For niche areas, the selected AFS should be optimized for conditions of the niche area, e.g. an AFC may be recommended for use in combination with effective MGPS to minimize biofouling. AFC selection should be based on expected wear, abrasion and water flow rates.

.2 **Active ingredients of AFC:** Environmental impact assessment of the selected AFC with respect to the release of harmful substances should be considered. The limitations of an AFC to minimize biofouling should be known and may include operating profile, aquatic environment, ship design and life cycle of AFC. Decision makers should be aware of the limitations of each AFC and the recommended in-water cleaning methods in order to minimize potential environmental impacts and damage to the system. Depending on the type of AFC, various types of waste substances may be released when cleaning. Some waste substances may easily be captured but others are fine particles or dissolved substances that may be released into the water. Therefore, not all AFC types are designed for frequent cleaning. The AFC manufacturers should provide key information on any biocides used and coating types on publicly available safety and technical datasheets. Frequent cleaning may impact the effectiveness of a specific AFC, and it is therefore recommended that the AFC manufacturers provide relevant guidance. In-water cleaning service providers and manufacturers of cleaning methods/equipment should provide guidance considering compatibility with AFC type.

.3 **Operating profile:** Patterns of use, operating routes, ship activity levels and periods of inactivity may influence the rate of biofouling accumulation and thus the effectiveness of the AFS. Inactivity may cause higher accumulation of biofouling. Biofouling may attach more easily on slow-moving ships.

.4 **Aquatic environment:** Biofouling pressure differs between areas, depending on temperature, salinity and nutrient conditions. Biofouling grows more slowly, but is not prevented, in low temperature waters. Ships operating in ice conditions should consider special AFC. Different organisms grow in different salinity waters and, if a ship operates in all salinity ranges, the anti-fouling system should target a wide range of organisms causing fouling. The benthic (seabed) environment should also be considered. Increasing depth of water and distance from shore may decrease susceptibility for biofouling. Additionally, higher content of nutrients in the water may increase algal blooms and susceptibility to biofouling.

.5 **Cleaning method:** Although cleaning system manufacturers are encouraged to find technological solutions that allow them to clean a wide variety of AFC, not all AFC can be cleaned by every cleaning system. When selecting the AFC, the available cleaning technologies and techniques and their suitability for the specific AFC should be considered. Therefore, AFC manufacturers should provide key information on any biocides used and coating types. The choice of AFC should be compatible with the cleaning technologies available to ensure both minimum biofouling growth as well as reducing the risk of damage to the AFC and the potential release of harmful waste substances to the environment.

.6 **Maintenance:** The lifespan of an AFS should be considered in combination with dry-docking schedules. AFC lifespan and lifetime of MGPS (e.g. anodes) should exceed the period between dry-dockings.

.7 **Legal requirements:** In addition to the AFS Convention, any national or regional regulatory requirements, if relevant, should be considered in the selection of AFS. This may apply to release of chemicals from MGPS and the AFS.

Installing the AFS

6.4 Installing an AFS in hull and niche areas should be in accordance with the manufacturer's guidance.

6.5 Niche areas are particularly susceptible to biofouling growth. Care should be taken in surface preparation and application of any AFC to ensure adequate adhesion and coating thickness. Particular attention should be paid to corners, edges, pipes, holding brackets and bars of gratings. Corners, edges and welded joints should be smooth and coated with adequate coating thickness to optimize system effectiveness. Additionally, for such areas, it is recommended to apply a touch up to ensure film thickness or a higher-grade AFC.

6.6 A non-exhaustive list of recommended measures for installation of an AFS in niche areas is as follows:

.1 **Sea chest:** Internal surfaces and inlet gratings of sea chests should be protected by an AFS that is suitable for the flow conditions of the area over the gratings and through the sea chest.

.2 **Bow and stern thrusters:** Free-flooding spaces which may exist around the thruster tunnel require special attention. The housings/recesses and retractable fittings such as stabilizers and thruster bodies should have an AFC of adequate thickness for optimal effectiveness.

.3 **Rudder hinges and stabilizer fin apertures:** Rudders and stabilizer fins should be moved through their full range of motion during the coating process to ensure that all surfaces are correctly coated to the specification of the AFC. Rudders, rudder fittings and the hull areas around them should also be adequately coated to withstand the increased wear rates experienced in these areas.

.4 **Propeller and shaft:** Propellers and immersed propeller shafts are generally not coated but polished. Fouling release coatings or other suitable coatings may be applied where possible and appropriate to maintain efficiency.

.5 **Stern tube seal assemblies and the internal surfaces of rope guards:** Exposed sections of stern tube seal assemblies and the internal surfaces of rope guards should be carefully painted with AFC appropriate to the degree of water movement over and around these surfaces.

.6 **Cathodic protection anodes:** Biofouling can be minimized in niche areas if anodes are flush-fitted to the hull, a rubber backing pad is inserted between the anode and the hull or the gap is caulked. Caulking the gap will make the seam or joint watertight. If not flush-fitted, the hull surface under the anode and the anode strap should be coated with an AFC suitable for low water flow to prevent biofouling accumulation. If anodes are attached by bolts recessed into the anode surface, the recess should be caulked to remove a potential niche.

.7 **Pitot tubes:** Where retractable pitot tubes are fitted, the housing should be internally coated with an AFC suitable for static conditions.

.8 **Sea inlet pipes and overboard discharges:** Pipe openings and accessible internal areas should be protected by an AFS as far as practicable. Any anti-corrosive or primer coating used should be appropriate for the specific pipe material and area requirements. Care should be taken in surface preparation and coating application to ensure good adhesion and coating thickness.

6.7 Details for performance monitoring of the AFS should be included in the ship-specific Biofouling Management Plan (BFMP) and be based on recommendations from the manufacturer of the AFS. Necessary measures to ensure that the AFS remains effective over the specified docking interval, plus any recommendations on how to return the AFS to optimal performance, should be included.

6.8 Manufacturers of AFS are also encouraged to provide information on appropriate cleaning methods, details of maintenance or upgrade protocols specific to the AFS and details on inspection and repair to ensure the effectiveness of their products. Such details are encouraged to be included in the ship-specific BFMP.

Reinstalling, reapplying or repairing the AFS

6.9 Reinstalling, reapplying or repairing the AFS should be in accordance with manufacturer's guidance that includes measures for surface preparation to facilitate good adhesion and durability.

6.10 Positions of dry-docking blocks and supports should be varied at each dry-docking, or alternative arrangements made to ensure that areas under blocks are painted with an AFC, at least at alternate dry-dockings. Where it is not possible to alternate the position of dry-docking support strips, these areas should be specially considered and managed by other means, e.g. the application of specialized coatings or procedures or measures for such areas based on the past arrangement of dry-docking support strips to shift their position step by step for each docking.

6.11 Reinstalling or repairing the MGPS in niche areas should be in accordance with manufacturer's guidance.

6.12 When reinstalling, reapplying or repairing AFS in niche areas, the list of recommended items in paragraph 6.6 should be considered. A non-exhaustive list of some additional recommended measures for reinstallation or reapplication of an AFS in niche areas is as follows:

.1 bow and stern thrusters – the body and area around bow, stern and any other thrusters prone to coating damage should be routinely maintained during dry-dockings;

.2 recesses within rudder hinges and behind stabilizer fins need to be carefully and effectively cleaned and recoated during maintenance dry-dockings; and

.3 gratings located in sea chests may require a major-refurbishment type of surface preparation at each dry-docking to ensure coating durability.

7 CONTINGENCY ACTION PLANS

7.1 A ship-specific contingency action plan based on specific triggers from monitoring of biofouling parameters should be described in the BFMP.

7.2 As presented in figure 1, monitoring of hull/fuel performance during ship operation should identify whether there may be an increased risk of biofouling accumulation. When monitoring identifies a possible increase in biofouling accumulation, the ship is at a higher risk level which should lead to contingency actions. A contingency action plan may involve inspection of submerged surfaces in line with chapter 8.

7.3 A contingency action plan may include measures which are ship-specific and relevant for the monitoring parameters. In general, a contingency action plan could include the following aspects:

.1 proactive actions can be implemented to lower the risk of biofouling accumulation if a higher biofouling risk may be predicted owing to planned operational changes;

.2 corrective actions to operating profile, maintenance or other repair plans, if the monitoring identifies an early indication of elevated risk; and

.3 inspection may be necessary to determine biofouling accumulation if the monitoring of biofouling parameters identifies an indication of prolonged elevated risk. The inspection should be in line with chapter 8.

7.4 Depending on the relevant biofouling risk parameters, the contingency action plan should trigger a reaction to be conducted in line with the BFMP.

7.5 If an inspection is conducted and biofouling is identified, cleaning actions should be conducted as described in table 1.

7.6 Monitoring of risk parameters may also identify and trigger a need for maintenance of MGPS or AFC.

8 INSPECTION

8.1 Inspections should be carried out:

.1 by organizations, crew or personnel competent to undertake inspections following these guidelines and competent to use relevant inspection methods or equipment to determine the level of biofouling and the condition of the AFS;

.2 for the purpose of fixed schedule inspections, by inspection organizations or personnel able to provide impartial inspection; and

.3 for the purpose of inspections as part of contingency actions, by organizations, crew or personnel competent for such inspections.

8.2 The fixed schedule of inspections should be carried out in line with the minimum frequencies as described in paragraphs 8.4 to 8.6.

8.3 Inspection frequency or inspection dates (or date ranges) for in-water inspections during the in-service period of the ship should be based on the ship-specific biofouling risk profile (see appendix 1), including inspection as a contingency action, and specified in the BFMP. The BFMP should also specify management actions to be taken when biofouling is identified during inspections (e.g. cleaning), including changes to inspection frequency.

8.4 For ships not undertaking performance monitoring, the first inspection date should be within 12 months of application, reapplication, installation or renewal of AFS to confirm their effective operation.

8.5 Where monitoring indicates that the AFS is not performing effectively soon after application, reapplication, installation or renewal (e.g. increased fuel consumption), an inspection should be carried out to confirm the condition of the AFS and level of biofouling as soon as practical or possible, in line with the BFMP and contingency action plan. If adequate performance of the AFS is observed through monitoring, the inspection could be conducted up to 18 months after application, reapplication, installation or renewal, noting that such monitoring may not reflect the level of biofouling in all niche areas.

8.6 Subsequent inspections should occur at least every 12 to 18 months and may need to increase to confirm the continued effectiveness of ageing or damaged AFS. In-water inspections should seek to coincide with existing subsea operations (e.g. underwater inspections in lieu of dry-dock or any other in-water inspections), including any unscheduled subsea operations. If no AFS are installed in areas of a ship and no other measures are undertaken such as in-water cleaning or propeller polishing, then inspections should occur more frequently (<12 months) to manage the risk of biofouling accumulation.

8.7 In-water inspections should assess biofouling across the entirety of a ship's hull and niche areas. If high levels of biofouling are identified during an inspection and there are reasons to suspect issues with the AFS's effectiveness, actions should be taken to manage the biofouling and subsequent inspections should occur more frequently, for example biannually until dry-docking and recoating of AFC.

8.8 In-water inspections should determine the level of biofouling of the hull and niche areas and the condition of the AFS. The inspection areas should be subdivided into appropriate sections as listed in tables 4 and 5 of appendix 2. The fouling rating for each area on the ship should be the highest rating identified in the inspected areas.

8.9 The following should be investigated during the inspection:

.1 rating of the type and approximate extent of biofouling in line with the definitions in table 1 below;

.2 condition of the AFC on the hull and in niche areas as described in paragraph 8.7 using definitions in table 4; and

.3 functionality of the MGPS in niche areas.

Extent of biofouling and recommended actions

8.10 During an inspection, niche areas in the ship-specific BFMP should be inspected as a priority. All inspected areas should be allocated a fouling rating number in line with the extent of fouling as defined in table 1 below.

Table 1: Rating scale to assess the extent of fouling on inspection areas

Rating	Description	Macrofouling cover of area inspected (visual estimate)	Recommended cleaning
0	**No fouling** Surface entirely clean. No visible biofouling on surfaces.	-	-
1	**Microfouling** Submerged areas partially or entirely covered in microfouling. Metal and painted surface may be visible beneath the fouling.	-	Proactive cleaning may be recommended as further specified in paragraph 9.4.
2	**Light macrofouling** Presence of microfouling and multiple macrofouling patches. Fouling species cannot be easily wiped off by hand.	1-15% of surface	Cleaning with capture is recommended as further specified in paragraph 9.9. It is recommended to shorten the interval until the next inspection. If the AFS is significantly deteriorated, dry-docking with maintenance and reapplication of the AFS is recommended.
3	**Medium macrofouling** Presence of microfouling and multiple macrofouling patches.	16-40% of surface	
4	**Heavy macrofouling** Large patches or submerged areas entirely covered in macrofouling.	41-100% of surface	

Condition of the AFS

8.11 The condition of the AFS on the hull and in niche areas should be observed during the inspection and reported. Recommended action and relevant procedures for inspection of the AFS are described in tables 4 and 5.

Inspection report

8.12 An inspection report should be prepared and a copy should be available on board and listed/linked in the Biofouling Record Book (BFRB). For details on reporting on biofouling levels and AFS condition inspections, see appendix 2, tables 4 to 6.

9 CLEANING AND MAINTENANCE

9.1 Cleaning is an important measure to remove biofouling from the hull and niche areas, but may physically damage the AFC, shorten coating service lifetime and release harmful waste substances and invasive aquatic species into the environment.

9.2 Comprehensive testing of cleaning systems or processes is necessary to understand the cleaning performance, capture efficiency or any release of harmful waste substances as well as improve knowledge concerning the prevention of release of viable fragments, spores and other parts of biofouling organisms that have the potential to be invasive.

9.3 In-water cleaning is a complex activity to manage appropriately and international standards for the management of in-water cleaning may continue to be developed and published in a stand-alone document to the Guidelines.

Procedures for proactive cleaning

9.4 Proactive cleaning is the periodic removal of microfouling on ships' hull and niche areas or other submerged surfaces as relevant prior to macrofouling growth and can be conducted with or without capture. Proactive cleaning without capture should:

.1 not be conducted on biofouling with rating ≥2 in line with table 1; and
.2 be performed in an area accepted by the relevant authority for this activity.

9.5 Operators undertaking proactive cleaning should be aware of any local regulations or requirements. Regulations regarding the discharge of biofouling and waste substances into the marine environment and the location of sensitive areas (such as Marine Protected Areas) may be relevant.

9.6 Procedures for proactive cleaning and frequency should be described in the BFMP. All proactive cleaning, and any determination of biofouling level prior to the cleaning, should be entered in the BFRB.

Procedures for reactive cleaning

9.7 Reactive cleaning systems physically remove micro- and macrofouling from the hull and niche areas. There are various reactive cleaning methods available and more under development.

9.8 Reactive cleaning should be conducted based on the inspection results and contingency actions as outlined in table 1, though cleaning with capture may be used to manage any rating level.

9.9 The reactive cleaning should:

.1 use a reactive cleaning system that is compatible with the AFC in order to minimize damage of the AFC;

.2 be conducted with the aim of achieving a fouling rating ≤1 for the cleaned area in line with table 1;

.3 strive for effective collection and safe disposal of all biofouling material and waste substances when reactive cleaning is performed in water or at dry dock; and

.4 be performed in an area accepted by the relevant authority for this activity.

9.10 Biofouling management in niche areas should include the following or similar adequate measures:

.1 maintenance of any MGPS installed to ensure they operate effectively to prevent accumulation of biofouling in relevant niche areas;

.2 regular polishing (with capture of debris) of uncoated propellers to maintain operational efficiency and minimize macrofouling accumulation;

.3 appropriate treatment of internal seawater cooling systems and discharge of any treated water in accordance with applicable regulations; and

.4 minimizing the use of any soap, cleaner or detergent used on surfaces and ensuring they are toxic- and phosphate-free, biodegradable and non-hazardous to the marine environment.

9.11 Operators undertaking in-water reactive cleaning should be aware of any regulations or requirements. Regulations regarding the discharge of biofouling and waste substances into the marine environment and the location of sensitive areas (such as Marine Protected Areas) may be relevant.

9.12 Captured biological waste and waste substances should be disposed of and treated in a safe and environmentally sound manner, in accordance with local requirements.

9.13 A report on the cleaning should be prepared by the operators undertaking reactive cleaning. The report should have the content as described in appendix 2 and describe the cleaning outcome.

9.14 A copy of the cleaning report or similar outcome in a digital tool should be available on board and the activity entered in the BFRB.

Procedures for recycling facilities

9.15 Ship recycling facilities should adopt measures (consistent with applicable national and local laws and regulations) to ensure that biofouling organisms or waste substances are not released into the local aquatic environment.

9.16 Ship recycling facilities should develop a plan to minimize release of biofouling organisms and/or waste substances. If relevant, it is recommended that hull and niche areas be cleaned prior to recycling to avoid release of viable biofouling organisms or waste substances.

10 BIOFOULING MANAGEMENT PLAN

10.1 It is recommended that every ship have a ship-specific BFMP under the responsibility of shipowners, ship operators and shipmasters. A BFMP may require information from ship designers, shipbuilders, shipowners, AFC and MGPS manufacturers, recognized organizations and suppliers.

10.2 An effective BFMP should contribute to the aim of maintaining a recommended fouling rating ≤1, as described in chapter 8.

10.3 The ship-specific BFMP should include, but not necessarily be limited to, the following:

.1 identification of the officer, or the position (e.g. chief engineer), responsible for the BFMP, ensuring that the plan is properly implemented;

.2 details of the AFS installed and where it is installed;

.3 details of the recommended operating conditions which are suitable for the selected AFS to avoid deterioration of AFC, including recommended conditions such as temperature, salinity, speed;

.4 details of expected AFC efficacy throughout AFC lifetime including the need for inspection or maintenance, if relevant;

.5 description of monitoring on biofouling risk parameters;

.6 regime for cleaning, if any;

.7 details of hull and niche areas where biofouling may accumulate;

.8 schedule for fixed inspections of areas;

.9 procedures for reactive cleaning actions that should be performed if triggered by inspection results;

.10 contingency action plan based on specific triggers from monitoring of biofouling risk parameters;

.11 regime for repairs, maintenance and renewal of AFS, when relevant, in accordance with the manufacturer's instructions;

.12 process for monitoring and maintenance of MGPS as per the manufacturer's instructions to ensure their effectiveness in minimizing biofouling; and

.13 details of the documentation/reports required to document biofouling activities.

Continuous improvements

10.4 Information should be gathered to plan and facilitate efficient and sustainable biofouling management, allowing the evaluation and comparison of the cost-effectiveness of alternative strategies. The optimal solution is case-specific and should be considered in the light of several aspects.

10.5 Monitoring of the hull and the biofouling risk parameters may determine a risk of biofouling to be higher than predicted in the BFMP and therefore trigger more frequent inspections.

10.6 Inspection results may be shared in agreement with stakeholders involved if they are relevant for improvement purposes. To increase the efficiency of biofouling management and inspections, inspection organizations are encouraged to share inspection results with AFS manufacturers.

10.7 The effectiveness of the management actions in place should be reviewed following inspections and cleaning. The BFMP should be updated if the management actions in place are ineffective or deficient. Efficacy of the following items should be evaluated:

.1 ability to minimize biofouling by use of proactive cleaning methods;
.2 biofouling inspections schedule;
.3 ability to minimize biofouling by MGPS;
.4 AFS performance; and
.5 outcome of reactive biofouling management procedures:

.1 efficacy of the biofouling removal (i.e. no areas are missed); and
.2 accessibility for reactive cleaning in niche areas.

10.8 A form of a BFMP is set out in appendix 3 to these Guidelines.

11 BIOFOULING RECORD BOOK

11.1 The overall record-keeping of ship-specific biofouling management activities in a BFRB is the responsibility of shipowners, ship operators and/or shipmasters. The ship-specific BFRB should include information on biofouling management actions with input from AFS manufacturers and suppliers, ship cleaning and maintenance operators, inspection organizations, and ship repair and dry-docking facilities when relevant.

11.2 It is recommended that the BFRB be retained on board for the life of the ship. The book should record details and reports of all inspection and maintenance activities to be undertaken for all hull and niche areas. The BFRB may be maintained physically or electronically, and could be a stand-alone document, or integrated in part or fully into the existing ships' operational and procedural manuals and/or planned maintenance systems.

11.3 The BFRB should assist the shipowner and operator to evaluate the efficacy of the specific AFS and biofouling management measures on the ship.

11.4 All biofouling management activities should be recorded in a BFRB, including the following:

.1 details of repair and maintenance to the AFS including date, location and areas of the ship affected, including the percentage of the ship that was recoated with AFC – this is in addition to recordings in the International Anti-fouling System Certificate;

.2 details of repair and maintenance to the MGPS, including date, location and areas of the ship affected;

.3 the initial date, final date, duration in hours/days and location of in-water inspections, including the inspection report;

.4 the initial date, final date, duration in hours/days and location of cleaning (in water or in dry dock), including a cleaning report;

.5 details of when the ship has been operating outside its normal operating profile including any details of when the ship was laid up or inactive for extended periods of time;

.6 details of relevant performance monitoring parameters used to determine inspection intervals;

.7 a copy of the cleaning report including the information set out in appendix 2, if applicable; and

.8 description of contingency actions taken, including date, time and location.

11.5 A form of a BFRB is set out in appendix 4 to these Guidelines.

12 DOCUMENTATION AND DISSEMINATION OF INFORMATION

12.1 Documentation which is recommended in these Guidelines, such as relevant plans and reports, can be developed, maintained and kept in an electronic format.

12.2 States are encouraged to provide information on the location and the terms of use of proactive cleaning, inspection, reactive cleaning services and facilities to comply with these Guidelines. States requiring inspection or cleaning prior to arrival in their territory should inform the Organization. Member States or other relevant stakeholders are encouraged to communicate the outcome of testing of cleaning systems and applicable test standards to relevant stakeholders via https://bwema.org.

12.3 States are also encouraged to provide technical and research information to the Organization, including any studies on the impact and control of invasive aquatic species in ships' biofouling, information on local biofouling pressure, databases on regional biofouling management options, tools for the choice of AFS, and on the efficacy and practicality of in-water cleaning technologies, risk assessment tools and inspection reporting tools.

12.4 State authorities should provide ships with timely, clear and concise information on biofouling management measures and cleaning requirements that are being applied to shipping and ensure these are widely distributed. Shipowners and operators should endeavour to become familiar with all requirements related to biofouling by requesting such information from their port or shipping agents or competent authorities (i.e. State authorities).

12.5 Organizations or shipping agents representing shipowners and operators should be familiar with the requirements of State authorities with respect to biofouling cleaning and management procedures, including information that will be needed to obtain entry clearance. Verification and detailed information concerning State requirements should be obtained by the ship prior to arrival.

12.6 To monitor the effectiveness of these Guidelines as part of the evaluation process, States are encouraged to provide the Organization with records describing reasons why ships could not apply these Guidelines, e.g. design, construction or operation of a ship, particularly from the viewpoint of ships' safety, or lack of information concerning the Guidelines.

13 TRAINING AND EDUCATION

13.1 Training for ships' masters and crew, in-water cleaning or maintenance facility operators and those surveying or inspecting ships as appropriate should include instructions on the application of biofouling cleaning and management procedures, based upon the information contained in these Guidelines. Instruction should also be provided on the following:

.1 maintenance of appropriate records and logs;

.2 impacts of invasive aquatic species from ships' biofouling;

.3 benefits to the ship of managing biofouling and the threats posed by not applying management procedures;

.4 biofouling management measures and associated safety procedures; and

.5 relevant health and safety issues.

13.2 States and industry organizations should ensure that relevant marine training organizations are aware of these Guidelines and include them in their syllabuses as appropriate.

14 OTHER MEASURES

14.1 To the extent practical, States and port authorities should aim to ensure a smooth flow of ships going in and out of their ports to avoid ships waiting offshore, so that AFS can operate as effectively as possible.

14.2 States may apply other measures to ships within their jurisdiction for the purpose of providing additional protection for their marine environment, or in emergency situations. When managing emergency situations for biofouling, States may find the guidance document for ballast water emergency situations (BWM.2/Circ.17, as may be amended) also relevant to biofouling management.

14.3 States should consider these Guidelines when developing other measures and/or restrictions for managing ships' biofouling.

14.4 Where other measures are being applied, States should notify the Organization of the specific requirements, with supporting documentation, for dissemination to other States and non-governmental agencies where appropriate.

14.5 The application of other measures by States should not place the safety of the ship and crew at risk.

LIST OF APPENDICES

ABBREVIATIONS

APPENDIX 1 ASSESSMENT OF BIOFOULING RISK

APPENDIX 2 INSPECTION AND CLEANING REPORTS

APPENDIX 3 EXAMPLE FORM OF BIOFOULING MANAGEMENT PLAN

APPENDIX 4 EXAMPLE FORM OF BIOFOULING RECORD BOOK

ABBREVIATIONS

AFS	Anti-fouling system
AFC	Anti-fouling coating
BFMP	Biofouling Management Plan
BFRB	Biofouling Record Book
IMO	International Maritime Organization
MGPS	Marine growth prevention system

APPENDIX 1

ASSESSMENT OF BIOFOULING RISK

1 Introduction

The Guidelines recommend taking a proactive approach to biofouling through assessment of biofouling risk profiles for hull and niche areas and by monitoring various risk parameters during operation. An assigned risk profile is dependent on AFS type and protection and should be ship-specific. Definition of risk monitoring parameters and trigger points for actions should also be ship-specific.

Monitoring various risk parameters during operation will lead to a holistic approach to biofouling management in line with a risk-based approach.

2 Identification of risk areas

Typical niche areas and other areas susceptible to biofouling on the hull are indicated in figure 2, but other niche areas may be relevant.

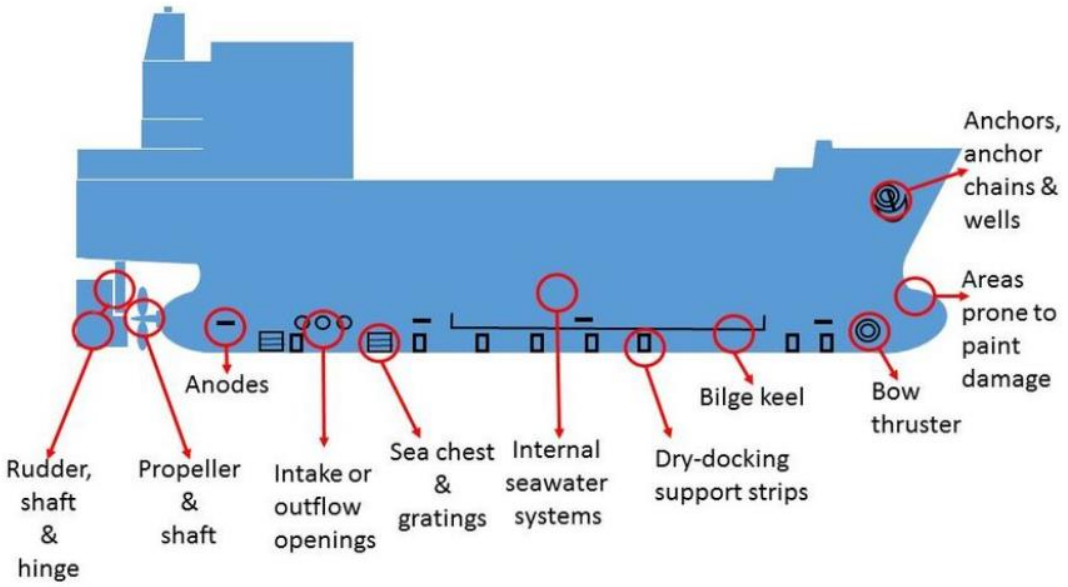

Figure 2: Hull with typical niche areas susceptible to biofouling (source: *Eugene, Conduct of land-based biofouling surveys for domestic vessels)*

3 Relevant parameters to be considered in the risk assessment

A ship-specific assessment should be established based on the possibility for biofouling accumulation. If any ship areas have no AFS installed, there is typically a higher risk of biofouling accumulation. If all ship areas have an AFS installed which is compatible with the ship's operating profile, the ship has an overall lower risk profile.

Based on the risk profile, an inspection regime should be determined and described in the BFMP. If the assessment determines that an area has a high risk for biofouling accumulation, an inspection regime with short intervals between inspections is recommended. Further, the areas with a low risk profile may follow the inspection regime with longer fixed intervals as specified in chapter 8 of the Guidelines.

The risk profile indicates the possibility of accumulating biofouling and increases as a function of biofouling pressure versus biofouling protection over time. The biofouling risk parameters given in table 2 should be monitored as the risk of biofouling accumulation may increase over time. When higher risk is identified, recommended actions in the form of inspection, reactive cleaning and/or maintenance of AFS should be performed as described in the BFMP. Inspection as a contingency action, if completed by an inspection organization in line with chapter 8, can be treated as a starting point to define the interval for the next inspection.

A hull performance monitoring system can be used to assess the changes in the propulsion power and fuel consumption of the ship. Such changes may indicate a degradation of hull or propeller condition due to biofouling.

The results from the hull performance monitoring may indicate biofouling growth on the hull and propeller; however, growth in niche areas will not necessarily be detected with this monitoring method.

Digital tools may be applied for monitoring of biofouling risk parameters. Monitoring of parameters should be as thorough as practicable.

In table 2 below, various biofouling risk parameters are presented with a description of possible risk impact.

Table 2: Biofouling risk parameters

	Examples of biofouling risk parameters	Description and evaluation guidance
1	**Deviation from AFS specifications (e.g. speed, salinity, temperature)**	An AFS/AFC can typically work well within a specific range of operating parameters. The relevant parameters and acceptable ranges for each parameter should be described in the manufacturer's specification and included in the BFMP. Specifications typically include operation routes, ship activity level, speed, water salinity and temperature and cleaning requirements. Specifications may vary depending on the technology of the AFS used. Ship operations should be in accordance with the recommendations from the AFC manufacturer. Deviation from the specification of the ship's AFC may increase the deterioration of the AFC or reduce its efficacy and change the biofouling risk. Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, would lead to an elevated risk profile and more frequent inspection should be part of the contingency plan.
2	**Deviation from AFS maintenance/service regime**	Regular maintenance and service (e.g. calibration or adjustment of treatment dosages for an MGPS) may be necessary actions for proper protection by the AFS. If the maintenance and service time is exceeded, as specified by the manufacturer, the risk profile is elevated. For maintenance of AFC, see item 7. Missing maintenance and/or service should be evaluated as part of the contingency plan for potential biofouling impact.
3	**Deviation from regular proactive cleaning or necessary reactive cleaning**	When proactive cleaning is part of the ship-specific BFMP, deviation from regular use as specified in the BFMP may lead to increased risk of biofouling growth onto relevant areas. The impact should be evaluated as part of the contingency action plan for potential biofouling impact until the missing proactive cleaning is back in regular operation. Ships should be aware of possible macrofouling accumulation and, if fouling rating is >1, cleaning with capture is the recommended cleaning action. If reactive cleaning is not conducted when inspection has determined cleaning is necessary, it will increase the risk of spreading organisms to new locations. This risk should be evaluated as part of the contingency plan until the next cleaning event is undertaken.
4	**Extended ship idle time**	Biofouling accumulation starts immediately when a ship is idle, but the rate depends on AFS type and biofouling pressure (temperature, distance to coast). To avoid risk of biofouling, the operating profile should only allow short periods in port or at anchorage or at least not exceed the recommendation by the AFS manufacturer. Acceptable idle time should be specified in the ship's BFMP. Idle time is often defined in charter party contracts and typically ranges between 18 to 30 days. If the idle time is longer than specified in the BFMP, the risk profile changes. If the number of consecutive idle days is still within what is specified as acceptable as per AFS supplier's guarantee and/or idling takes place in an area far from shore (>200 nm and >200 m depth), the risk may still be considered low. If the number of consecutive idle days is beyond what is specified as acceptable as per AFS supplier's guarantee, the risk may be considered very high if the ship is subject to biofouling pressure. For these cases, the contingency action plan should include immediate actions before the next voyage.

	Examples of biofouling risk parameters	Description and evaluation guidance
5	**Performance loss as per PMS**	Performance monitoring of fuel consumption may give indication on possible biofouling accumulation on the hull. Performance monitoring is mainly for hull monitoring (not niche areas) and may include the following methods: .1 Sensors and collecting high frequency data. .2 Semi-automatic or manual calculations using data collected by ship's crew (e.g. noon reports). .3 Speed trials and comparing the performance data with previous speed trial reports. Note that PMS is often a lagging indicator and may depend on many factors, therefore additional measures may be necessary before it can be used to determine biofouling accumulation. For some ships, a speed loss between 1% and 3% or increased fuel consumption of 3-9% may indicate light biofouling while a speed loss >3% or fuel consumption increase by >9% may indicate higher biofouling risk (examples taken from ISO 19030-2:2016).
6	**AFS damage**	Failure caused by mechanical damage to the AFS may result in higher risk of biofouling in the areas affected, if not rectified within reasonable time. Failures and damage should be recorded in the BFRB. As part of the contingency action plan, the impact from the damage should be evaluated for potential biofouling accumulation and relevant actions should be implemented until a repair is undertaken.
7	**Downtime/malfunction of MGPS, proactive cleaning or other AFS**	Observed downtime of an MGPS, proactive cleaning or other AFS has a direct impact on risk of biofouling accumulation. The impact on the area impacted will be affected depending on the duration of malfunction. The impact should be evaluated as part of the contingency action plan for potential biofouling impact until the missing MGPS/proactive cleaning/other AFS is back in operation. Reduced operation time of proactive cleaning, i.e. longer intervals between cleaning than specified in the BFMP, is defined as downtime and may increase biofouling accumulation particularly in those areas where it is not applied as specified in the BFMP. The impact on the area affected depends on the duration of malfunction and the trading conditions during that time. The evaluation of impact and potential reactions should be part of the contingency action plan. If proactive cleaning without capture is irregular, ships should be aware of possible macrofouling accumulation and take actions to avoid spread of macrofouling. If fouling growth exceeds fouling rating 1, cleaning with capture is recommended.
8	**Exceeding expected lifetime of AFS**	Once an AFS has exceeded its lifetime, as specified by the manufacturer, the biofouling risk profile is elevated. Inspection and cleaning should be performed more often and 1-2 months interval between inspections is recommended. Additionally, the efficacy of the AFS may be reduced as it approaches the end of its lifetime. If macrofouling has been removed in a previous cleaning event, the strong forces needed for removing the fouling can have compromised the lifetime of the AFC. The performance of the AFS, and any necessary change in maintenance or inspection schedule, as given by the AFS manufacturer, should be part of the contingency action plan specified in the BFMP.

4 Flow chart visualizing biofouling management

An example of a flow chart for visualizing biofouling management risk profile and monitoring of parameters is shown in figure 3.

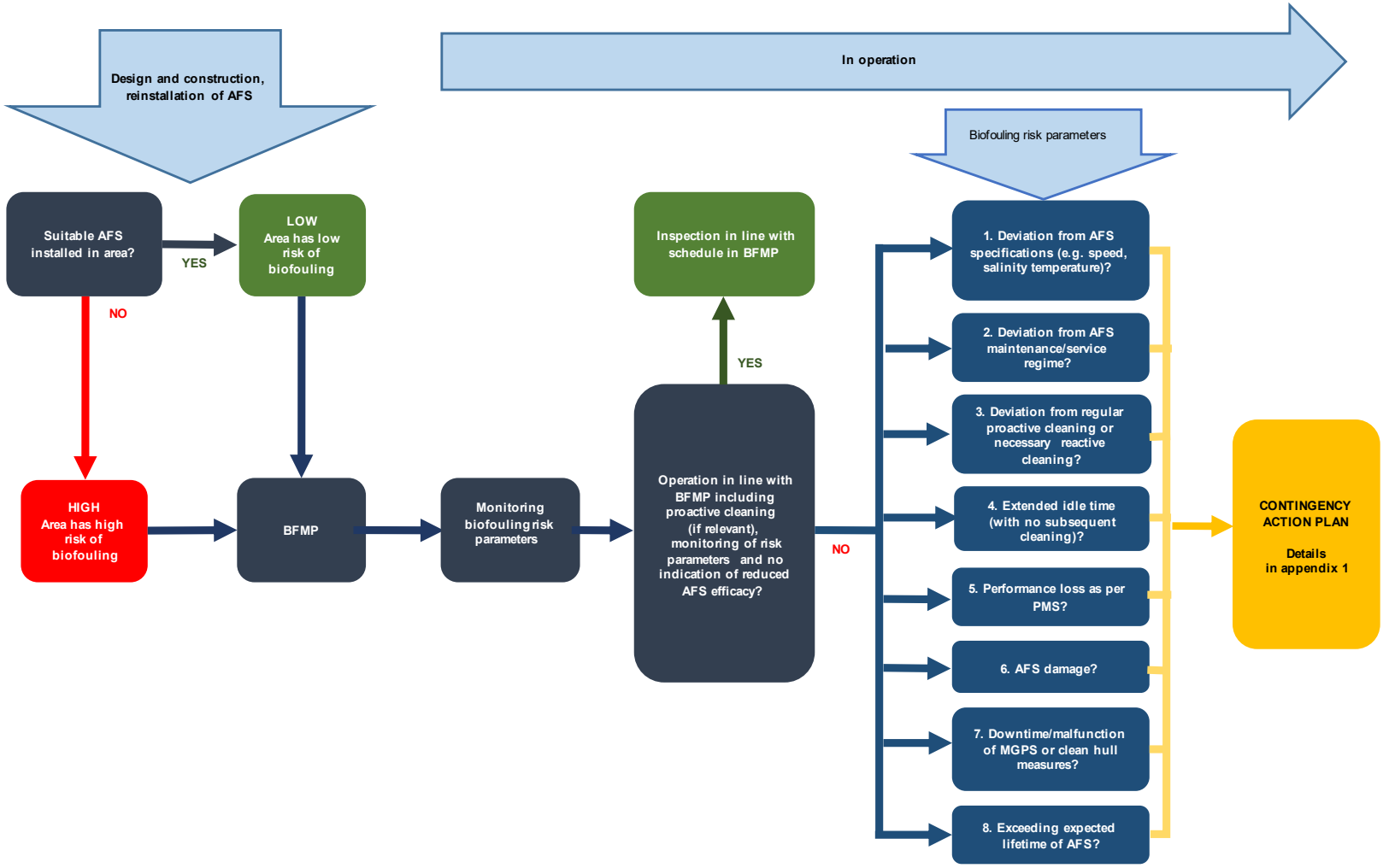

Figure 3: **Flow chart visualizing the biofouling management risk profile and monitoring parameters**

APPENDIX 2 INSPECTION AND CLEANING REPORTS

1 Introduction

The Guidelines recommend that a report should be prepared after an inspection and/or cleaning operation. The report should record the details of the biofouling management actions undertaken on the ship. The inspection report should be prepared by the inspection provider. It may also be relevant to prepare a report after an inspection carried out by ship's crew as part of contingency actions.

The cleaning report should be prepared by either the cleaning operators or the inspection provider as part of a combined cleaning and inspection report.

Digital tools may be applied for the reporting and/or assessment of results. The conclusions from the reports should be recorded in the BFRB including reference to the detailed report/assessment.

2 Entries in the report after a biofouling inspection

The following information should be recorded in the inspection report:

- Ship particulars:
  - Ship name
  - IMO number
- Date and place of inspection
- Name of inspection/cleaning company
- List of all inspected hull and niche areas
- Inspection equipment used (including list of divers/ROV operators participating in the operation)
- Inspection conditions (i.e. duration, estimated visibility underwater)
- Signature of authorized person of the inspection/cleaning company
- Inspection start and end times
- Results:
  - Type of biofouling as per the rating in table 1
  - Quantitative assessments of biofouling cover of area inspected (i.e. estimates of per cent cover) as per table 1
- AFC condition
  - The condition of the AFC should be observed during the inspection and reported. The condition is recommended to be categorized in line with table 4
- MGPS condition
  - The condition of the MGPS should be observed during the inspection and reported. The condition is recommended to be categorized in line with table 5
- Photos/videos
  - Photos and videos submitted or used in a digital assessment tool as evidence of hull fouling

SAMPLE OF INSPECTION REPORT

Name of ship: .....

IMO number: .....

Date: .....

Location/port: ……

Inspection organization/responsible officer: ……

Inspection conditions: ……..

Inspection equipment used: ……..…….

Divers/ROV operators participating: ……

Quantitative assessment of biofouling cover is summarized in table 3 (in line with the ratings in table 1)

Table 3: Quantitative assessment of biofouling cover

For each transect and niche area surveyed, the mode of the fouling rating (most frequent rating) and the range (lowest and highest rating) should be recorded. An average should not be used. If more than one of the same type of area is assessed, these should be recorded separately and each be given their own fouling rating.

Areas	**Fouling rating** (0-4)			**Macrofouling cover** (%)
	Lowest rating	Highest rating	Most frequent rating	
Hull below the waterline				
Port vertical side				
1 m wide belt				
1 m wide belt of subsection X				
1 m wide belt of subsection X				
Starboard vertical side				
1 m wide belt				
1 m wide belt of subsection X				
1 m wide belt of subsection X				
Flat bottom front				
1 m wide belt				
1 m wide belt of subsection X				
Flat bottom mid				
1 m wide belt				
1 m wide belt of subsection X				
Flat bottom aft				

Areas	**Fouling rating** (0-4)			**Macrofouling cover** (%)
	Lowest rating	Highest rating	Most frequent rating	
Hull below the waterline				
1 m wide belt				
1 m wide belt of subsection X				
Niche areas				
Bow subsection X				
Bow subsection X				
Bow thruster				
Bilge keels				
Sea chest gratings				
Location 1				
Location 2				
Stern				
Propeller and its shaft				
Rudder and rudder shaft				
Discharge pipes				
Rope guards				
Sounders/instruments				
Sacrificial anodes				
Internal seawater systems				
…..				
…..				

An area should be assigned a fouling rating equal to the highest rated 1 m^2 identified along the subdivided areas.

The inspection should be as comprehensive as practicable. The more subdivided areas that are inspected, the greater the certainty that the biofouling for the area is realistic. It is recommended that the identified niche areas should be in line with the BFMP.

The condition of the AFC and MGPS should be observed during the inspection and reported. The condition is recommended to be categorized in line with tables 4 and 5, respectively. If the condition of the AFC could only be thoroughly assessed after reactive cleaning, table 4 should be part of the cleaning report.

Table 4: The condition of the AFC

AFC condition								
Areas	**Intact and effective in preventing biofouling**	**Failure of adhesion between a coating and a metallic surface**	**Blistering in coating**	**Cracks in the coatings**	**Cold flow resulting in irregular coating thickness**	**Delamination / peeling / detachment between coatings**	**Polishing off coating during the ship's operation (beyond specifications)**	**Grounding / general damage to coating**
Hull below the waterline								
Port vertical side								
subsection X								
Starboard vertical side								
subsection X								
Flat bottom front								
subsection X								
Flat bottom mid								
subsection X								
Flat bottom aft								
subsection X								
Bow								
Bow thruster								
Bilge keels								
Sea chest gratings								
Location X								
Location X								
Stern								
Propeller and its shaft								
Rudder and rudder shaft								
Discharge pipes								
Rope guards								
Sounders/instruments								
Sacrificial anodes								
…								
…								

Table 5: The condition of the MGPS

Areas examples (typical niche areas)	Condition of MGPS		
	Intact and effective in preventing biofouling	Calibration/maintenance required	Non-effective to prevent biofouling
Bow			
Bow thruster			
Bilge keels			
Sea chest gratings			
Location 1			
Location 2			
Stern			
Propeller and its shaft			
Rudder and rudder shaft			
Discharge pipes			
Rope guards			
Sounders/instruments			

Comments: ……..……

Reference to supporting photos/videos for fouling inspection and assessment of AFC/MGPS: ……

Signature of inspection organization or competent ship crew: ……..……..…….

3 Entries in the report after biofouling management (reactive cleaning)

The following information should be recorded in the cleaning report:

- Ship particulars:
  - Ship name
  - IMO number
- Date and place of inspection
- Name of cleaning company
- All hull and niche areas cleaned/treated specified and documented in the report, including also areas not cleaned/treated
- Cleaning equipment used for hull
- Cleaning equipment used for niche areas
- Inspection equipment used (including list of divers/ROV operators participating in the operation)
- Conditions during cleaning inspection (i.e. duration, estimated visibility underwater)
- Signature of authorized person of the cleaning company
- Cleaning start and end times
- Results:
  - Type of biofouling after reactive cleaning (as per the ratings in table 1)
  - Quantitative assessments of biofouling cover after cleaning (as per table 1)
- AFC condition (unless assessed during inspection)
  - The condition of the AFC should be observed during the cleaning activity and reported using the conditions as categorized in table 4
- Photos/videos
  - Photos and videos submitted or used in a digital assessment tool as evidence of hull cleaning
- Capture
  - Description of capture method
  - Supporting evidence that dislodged material (by mass) has been captured as described in chapter 9

  (Reference to equipment specification and validation test report may be sufficient)
- Treatment* and/or disposal of waste material captured during cleaning should be described in the report. Evidence of delivery to waste management facility or facilities should be attached to the cleaning report. The biofouling waste should be disposed of and/or treated in a safe and environmentally sound manner, in accordance with local regulations, and ensure that the main objective of the Guidelines, to minimize the spread of invasive aquatic species, is safeguarded.

* Treatment is any process designed to remove or deactivate any biofouling material and particulate or dissolved waste substances captured or produced during any stages of cleaning.

SAMPLE OF A BIOFOULING CLEANING REPORT

Name of ship: .....

IMO number: .....

Date: .....

Location/port: …….

Cleaning company: ……...

In-water conditions: ……..

Technologies used for reactive cleaning of hull and niche areas:
……
……

Table 6: Summary of the operations

Areas examples	**New fouling rating after performed cleaning**		
	Lowest rating	Highest rating	Most frequent rating
Hull below the waterline			
Port vertical side			
subsection X			
subsection X			
subsection X			
Starboard vertical side			
subsection X			
subsection X			
subsection X			
Flat bottom front			
subsection X			
subsection X			
Flat bottom mid			
subsection X			
subsection X			
Flat bottom aft			
subsection X			
subsection X			
Niche areas			
Bow			
Bow thruster			
Bilge keels			
Sea chest gratings			
Location 1			
Location 2			
Stern			
Propeller and its shaft			
Rudder and rudder shaft			
Discharge pipes			
Rope guards			
Sounders/instruments			
Sacrificial anodes			
Internal seawater systems			
….			
….			

Description of activity and reference to supporting evidence (photos/videos):

Description of capture and reference to supporting evidence:

Description of treatment and/or biofouling waste disposal with supporting evidence (e.g. receipts):

Description of any problems encountered during cleaning including details of any damage to the AFS that may have occurred:

Comments:

Signature of cleaning organization: ……..……

APPENDIX 3

EXAMPLE FORM OF BIOFOULING MANAGEMENT PLAN

INTRODUCTION

Biofouling on ships can be a significant vector for the transfer of invasive aquatic species. Biofouling management practices may also improve a ship's hydrodynamic performance and can be effective at enhancing energy efficiency, hence reducing air emissions from ships as well as fuel costs.

This Biofouling Management Plan (BFMP) should assist the ship crew in conducting biofouling management and is specific to this ship.

SHIP PARTICULARS

Name of ship	
IMO number	
Date of construction	
Ship type	
Gross tonnage	
Beam or ship's breadth	
Length overall	
Maximum and minimum draughts	

RECORD OF REVISION OF THE BFMP

This plan describes the biofouling management for the period between two scheduled dry-dockings which include application, reapplication, installation or renewal of the AFS. The plan should be re-evaluated and, if necessary, updated after a dry-docking and/or if any changes are made that have an impact on the anticipated biofouling.

	Date:
Most recent scheduled dry-docking	
The next scheduled dry-docking	

The following revisions have been made:

Date/timeline	**Developed by**	**Implemented by/ responsible person**	**Updated parts**

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<A table of contents should be included.>

PURPOSE

The purpose of the BFMP is to outline measures for the control and management of the ship's biofouling to minimize the spread of invasive aquatic species.

DESCRIPTION OF OPERATING PROFILE

The ship's operating profile is described below and is the basis for the selection of the ship's anti-fouling systems (AFS) and operational practices.

Typical operating speed	
Typical trading areas	<EXAMPLE> <Domestic, great coasting, North Sea and Baltic trade, European trade, short international voyage, international voyage, overseas voyage or unrestricted voyages>
Typical operating areas, including climate zones in which the ship will operate	<EXAMPLE> <Temperate, semi-temperate, tropical and/or arctic>
Typical salinities of operating areas in which the ship will operate	<EXAMPLE> <Fresh water, brackish water and/or marine water>
AFS installed are suitable for typical operating profile (Y/N)	

DESCRIPTION OF HULL AND NICHE AREAS WHERE BIOFOULING MAY ACCUMULATE

The hull and niche areas where biofouling may accumulate are described below.

Areas on hull	<EXAMPLE> <flat-bottom- front flat-bottom- mid flat-bottom- aft bow dome boot top vertical sides – port side vertical sides – starboard side vertical side – aft transom or others>
Niche areas (including quantity where relevant)	<EXAMPLE> <Sea chests bow dome bow thruster tunnel tunnel grates cathodic protection anodes bilge keels anchor chain chain locker stabilizer fins rudder dock block positions A-brackets/stern tube cathodic protection anodes and systems draft internal pipework ballast uptake system inlet gratings sea inlet pipes stern thruster thruster body velocity probes propeller propeller shaft stern tube seal echo sounders rope guards box coolers moon pools free-flood spaces/voids engine cooling system fire-fighting system auxiliary service system or others>

LOCATION OF AREAS WHERE BIOFOULING MAY ACCUMULATE ON THE SHIP

<A diagram of both side and bottom of the ship identifying the location of each area that may accumulate biofouling should be included.>

DESCRIPTION OF APPLIED ANTI-FOULING SYSTEM

The selected AFS that are applied, reapplied, installed or renewed on the ship are described below. When more than one type of anti-fouling coating (AFC) or marine growth prevention system (MGPS) are applied, reapplied, installed or renewed, each AFS should be described individually and in accordance with each manufacturer's instructions.

Prior to a scheduled dry-docking, an evaluation of qualitative observations regarding the ship's biofouling should be made with the purpose of a potential improvement of the AFS selection. Previous reports on the performance of the ship's AFS should be part of the evaluation.

Manufacturer(s) and type(s) of AFC	<EXAMPLE> <Hard coating, self-polishing or fouling release, etc.>
Biocides in AFC	<EXAMPLE> <Copper oxide, zineb, etc.>
Dry film thickness	
Expected lifetime and, if any, expected reduction of efficiency of AFC	
Operating profiles which are suitable for the AFC including temperature, salinity, speed, periods of inactivity	
Recommended regime for repairs, maintenance and/or renewal to receive the AFC optimal performance	<EXAMPLE> <Regime for repairs> <Regime for maintenance> <Regime for renewal> <N/A>
Cleaning methods recommended for AFC	
Cleaning methods not appropriate for AFC, if any	
IAFS Certificate	

Manufacturer(s), models and type(s) of MGPS	<EXAMPLE> <Anode, ultrasound, electrode, electrolysis, ultraviolet radiation or other>

Type(s) of harmful discharge from MGPS	<EXAMPLE> <Chlorine, noise or other>
Operating conditions/frequency of use	<EXAMPLE> <dosing frequency temperature, salinity, speed>
Required maintenance and frequency	
Service life of MGPS	

Manufacturer(s), models and type(s) of other AFS	
Type(s) of harmful discharge from other AFS	
Operating conditions/frequency	
Required maintenance and frequency	
Service life and expiry date of AFS	

INSTALLATION OF ANTI-FOULING SYSTEM

The areas on the ship which are protected with the selected AFS are described below. If necessary, the individual AFS could be identified as A and B, respectively. Areas with no protection are also described.

AFS applied	Areas on ship where AFS is applied	Date of application	Recommended cleaning technique
<EXAMPLE> <AFC (A)>	<EXAMPLE> <flat-bottom- front, flat-bottom- mid, flat-bottom- aft, bow dome, boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others>		<EXAMPLE> <soft brush, blades, metal brushes or water jet>
<EXAMPLE> <MGPS (A)>	<EXAMPLE> <Sea chests, internal pipework, ballast uptake system, inlet gratings>		<EXAMPLE> <Steaming>
<EXAMPLE> <Other AFS>			

<EXAMPLE> <No AFS>			

INSPECTION SCHEDULE OF HULL AND NICHE AREAS

An inspection will be carried out by organizations or personnel competent to undertake inspections in line with the fixed intervals described below:

Inspection areas	Initial inspection	Subsequent inspections
<EXAMPLE> <Areas installed with AFS and operating within the profile>	<EXAMPLE> <Inspection within 12 months> <When utilizing a performance monitoring system that indicates adequate performance of the AFS, an inspection will be conducted within 18 months. If the monitoring indicates that the AFS is not performing effectively, an inspection should be carried out as soon as possible.>	<EXAMPLE> <If rating 0-1 in previous inspection, then inspection every 12-18 months If rating 2, 3 or 4 in previous inspection, then more frequent inspections>
<EXAMPLE> <Areas with no AFS and no other measures>	<EXAMPLE> <Inspection within 12 months>	<EXAMPLE> <Inspection more frequent>

CLEANING

Reactive cleaning should be performed as a result of any inspection with a fouling rating ≥2. It should be performed in line with procedures of the ship cleaning operator or the dry-dock facilities used, and the cleaning practices should be conducted in accordance with the jurisdiction's policies or regulations of the relevant authority. Preferred cleaning methods and procedures that can be used are described below. The methods and cleaning operator used in each cleaning occasion should be recorded in the BFRB.

Reactive cleaning method(s)	**Areas where cleaning method will be applied**	**Operating condition when cleaning method will be applied**	**Cleaning schedule**
<EXAMPLE> <Water jet and suction with capture in line with <name of the standard>>	<EXAMPLE> <flat-bottom-front, flat-bottom-mid, flat-bottom-aft, bow dome, boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others>	<EXAMPLE> <moored in harbour, drifting in open sea, on anchorage in coastal waters, on voyage>	<EXAMPLE> <When recommended based on monitoring of biofouling parameters and/or in case unforeseen biofouling levels are detected on hull or in niche areas>
<EXAMPLE> <Steaming with capture performed in line with <name of the standard>>	<EXAMPLE> <Sea chests, internal pipework, ballast uptake system, inlet gratings>	<EXAMPLE> <in dry dock>	<EXAMPLE> <When recommended based on monitoring of biofouling parameters and/or in case unforeseen biofouling levels are detected in niche areas>
Possible harmful discharge from cleaning with reactive cleaning method			
Manufacturer and model of ship-specific reactive cleaning device, if applicable			
Reactive cleaning method suitable for AFC			

Reactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
Required maintenance and frequency, as applicable			
Reactive cleaning suitable for typical operating profile, i.e. is the ship expected to stay enough time in locations where reactive cleaning can be carried out			
Reactive cleaning device tested in line with <name of the standard> (Y/N), if applicable			

Proactive cleaning should take into account recommendations from the AFS manufacturer listed in this BFMP. Description of proactive cleaning activities which are planned on a regular basis, if any, are listed below.

Proactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
<EXAMPLE> <ROV with water jet, ROV with soft brush,	<EXAMPLE> <flat-bottom-front, flat-bottom-mid, flat-bottom-	<EXAMPLE> <moored in harbour, drifting in open	<EXAMPLE> <every <XX> days when operating in temperate waters;

Proactive cleaning method(s)	Areas where cleaning method will be applied	Operating condition when cleaning method will be applied	Cleaning schedule
manual device with soft brush or other>	aft, bow dome, boot top, vertical sides – port side, vertical sides – starboard side, vertical side – aft, transom, or others>	sea, on anchorage in coastal waters, on voyage>	every <XX> days when operating in tropical/semi-tropical waters; when recommended based on monitoring of biofouling parameters; and in case of unforeseen biofouling levels defined as rating 1 are detected on hull or in niche areas>
Possible harmful discharge from cleaning with proactive cleaning method		<EXAMPLE> <AFC biocides, biofouling, particles or other>	
Manufacturer and model of ship-specific proactive cleaning device, if applicable			
Proactive cleaning method suitable for AFC			
Required maintenance and frequency, as applicable			
Proactive cleaning suitable for typical operating profile, i.e. is the ship expected to stay enough time in locations where proactive cleaning can be carried out			
Description of how to avoid biofouling cleaning and discharge of macrofouling, if possible			
Proactive cleaning device tested in line with <name of the standard> (Y/N), if applicable			

MONITORING OF BIOFOULING RISK PARAMETERS AND CONTINGENCY ACTIONS

Relevant digital tools applied for monitoring of biofouling risk parameters and/or digitalized real-data input are <describe the tools and data used for this ship>.

The biofouling risk parameters given below should be monitored when the ship is in operation. When a parameter goes beyond the deviation limit, the risk of biofouling is increased, and the recommended contingency actions should be used as described.

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
<EXAMPLE> <Deviation from speed specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions>.	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>
<EXAMPLE> <Deviation from salinity specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions.>	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>
<EXAMPLE> <Deviation from temperature range specifications acceptable for the AFS>	<EXAMPLE> <Incidental deviations should be evaluated for potential biofouling impact. Continuous or regular deviations, or deviations not rectified, should lead to contingency actions.>	<EXAMPLE> <Shorter inspection interval with inspection every 4 months. When recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented between inspections.>	<EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior to the next dry-docking.>

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
<EXAMPLE> <Deviation from the maintenance/service regime of the AFC>	<EXAMPLE> <If the maintenance and service time, specified by the manufacturer, is exceeded, the risk of biofouling is elevated, and contingency actions should be implemented>.	<EXAMPLE> <An inspection should be carried out for the relevant area. Maintenance or repair should be performed at earliest possible opportunity.>	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the AFC. Evaluate the need to update maintenance programme.>
<EXAMPLE> <AFC damage>	<EXAMPLE> <Failure caused by mechanical damage to the AFC may result in higher risk of biofouling in the areas affected, if not rectified within reasonable time. The damage should be evaluated for potential biofouling accumulation.>	<EXAMPLE> <An inspection should be carried out for the relevant area. Repair should be performed at earliest opportunity. More frequent inspections of damaged area should be implemented until a repair is undertaken.>	
<EXAMPLE> <Deviation from the maintenance/service regime of the MGPS>	<EXAMPLE> <If the maintenance and service time, specified by the manufacturer, is exceeded, the risk of biofouling is elevated, and contingency actions should be implemented.>	<EXAMPLE> <An inspection should be carried out for the relevant niche area where MGPS is installed. Maintenance, calibration, or adjustment of treatment dosages for a MGPS should be performed at earliest possible opportunity.>	<EXAMPLE> <Regular maintenance and service (e.g.) may be necessary actions for proper protection by the AFS. Evaluate the need to update maintenance programme>

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
<EXAMPLE> <Downtime/malfunction of MGPS>	<EXAMPLE> <Observed downtime of an MGPS could have a direct impact on risk of biofouling accumulation. The impact will depend on the duration of malfunction and operating areas (coastal area).>	<EXAMPLE> <More frequent inspections of relevant area should be implemented until the MGPS is back in operation.>	
<EXAMPLE> <Downtime/malfunction of other AFS>	<EXAMPLE> <Reduced operation time of other AFS may increase biofouling accumulation in areas where it is usually applied.>	<EXAMPLE> <More frequent inspections of relevant area should be implemented until the AFS is back in operation.>	
<EXAMPLE> <Exceeding expected lifetime of AFS>	<EXAMPLE> <Once an AFS has exceeded its lifetime, as specified by the manufacturer, the biofouling risk is increased.>	<EXAMPLE> <More frequent inspections should be implemented until the AFS is back in operation.>	<EXAMPLE> <The performance of the AFS, and any necessary change in maintenance or inspection schedule, based on experience, should be included in the next update of this BWMP.>
<EXAMPLE> <Deviation from regular proactive cleaning>	<EXAMPLE> <When proactive cleaning is implemented as part of the AFS, deviation from regular use could lead to increased risk of biofouling growth onto relevant submerged areas.>	<EXAMPLE> <An inspection should be carried out. If there is macrofouling (fouling rating ≥2) in the relevant area, reactive cleaning with capture should be performed before	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the proactive cleaning.

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
		proactive cleaning is used again. Maintenance or repair should be performed at earliest possible opportunity. More frequent inspections should be implemented until the missing proactive cleaning is in regular use.>	Evaluate the need to update maintenance programme.>
<EXAMPLE> <Deviation from necessary reactive cleaning>	<EXAMPLE> <If reactive cleaning is not conducted as scheduled or after an inspection has determined that reactive cleaning is necessary, it will increase the risk of spreading organisms to new locations.>	<EXAMPLE> <Prior to departure reactive cleaning should be performed, to avoid risk of spreading invasive aquatic species. If no reactive cleaning is performed prior to departure, a reactive cleaning activity should be scheduled at earliest possible opportunity. If no reactive cleaning is performed, an acceptance could be required to arrive in the next port. Contact next port for further advice.>	<EXAMPLE> <More frequent reactive cleaning may be necessary actions for proper biofouling management. Evaluate the need to update the cleaning schedule.>
<EXAMPLE> <Extended ship idle time (berthed, anchored, moored)>	<EXAMPLE> <If the idle time is longer than estimated in the ship's operating profile, it could lead to	<EXAMPLE> <If the idle time is within the guarantee of the AFS supplier, a short voyage with speed as specified for the AFS could be	EXAMPLE> <Evaluate the need for a potential improvement of the AFS selection prior

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
	an elevated risk of biofouling. If the idle time is beyond the guarantee of the AFS supplier, the risk of biofouling accumulation increases. The risk also depends on biofouling pressure, e.g. temperature and distance to the coastline. If the ship is idle in an area far from shore (>200 nm and >200 m depth) and far from other installations, the risk may still be considered low.>	conducted, sea chests could be blanked off or, when recommended by the AFS manufacturer, more frequent proactive cleaning activities could be implemented. If the idle time is beyond the guarantee of the AFS supplier, an inspection should be carried out.>	to the next dry-docking.>
<EXAMPLE> <Performance loss as per Performance Monitoring System>	<EXAMPLE> <Performance monitoring may detect biofouling growth on the hull, but not necessarily in niche areas. Performance monitoring of fuel consumption may give indication on possible biofouling accumulation on the hull and may include the following methods: .1 Sensors and collecting high-frequency data. .2 Semi-automatic or manual	<EXAMPLE> <When the data show a trend in performance loss over time, the time since last cleaning activity in combination with operating profile should be evaluated to determine if an inspection should be carried out.>	<EXAMPLE> <Experience from fuel consumption and cleaning activity over time may lead to optimization and changes to the cleaning schedule.>

Biofouling risk parameters to monitor	Evaluation of a deviation including deviation limit of the risk parameter	Contingency actions	Long-term actions
	calculations using data collected from ship's crew (e.g. noon reports). .3 Speed trials and comparing the performance data with previous speed trial reports. <Percentage of the speed loss and percentage of increased fuel consumption, that may indicate light biofouling on the ship>.>		
<EXAMPLE> <Downtime/malfunction of proactive cleaning >	<EXAMPLE> <When proactive cleaning is implemented as part of the AFS, long periods of downtime could lead to increased risk of biofouling growth.>	<EXAMPLE> <More frequent inspections of relevant areas should be implemented until the proactive cleaning is back in operation. Maintenance or repair should be performed at earliest possible opportunity. If macrofouling accumulation is found (fouling rating ≥2), reactive cleaning with capture should be conducted before the proactive cleaning is put into service again.>	<EXAMPLE> <Regular maintenance and repair (e.g.) may be necessary actions for proper protection by the proactive cleaning. Evaluate the need to update maintenance programme.>

CAPTURE AND DISPOSAL OF WASTE

In-water reactive cleaning companies should arrange for capture of debris during cleaning. The biofouling waste should be disposed of and/or treated in a safe and environmentally sound manner, in accordance with local regulations, to ensure that the main objective of the Guidelines, to minimize the transfer of invasive aquatic species, is safeguarded.

Documenting evidence of collection/delivery of the wastes (a receipt) will be appended to the BFRB.

SAFETY PROCEDURES FOR THE SHIP AND THE CREW

<Details of specific operational or safety restrictions associated with the AFC or MGPS systems that affect the ship and/or the crew.

Details of specific safety procedures to be followed during ship inspections and cleaning operations.>

CREW TRAINING AND FAMILIARIZATION

<Information on the provision of crew training and familiarization on biofouling management.

Detailed description of how inspections are to be carried out by ship crew as part of contingency actions.>

APPENDIX 4

EXAMPLE FORM OF BIOFOULING RECORD BOOK

PART I – Biofouling management activities

Name of ship: .....

IMO number, distinctive numbers or letters:.....

Gross tonnage: .....

Period from:..... to: .....

Note:

Biofouling Record Book Part I should be provided to every ship with a Biofouling Management Plan (BFMP), to record relevant biofouling activities such as inspections, maintenance and cleaning activities. Biofouling Record Book Part II should also be provided to record when the ship has a higher risk of biofouling accumulation and related contingency actions.

1 Introduction

The following pages of this section show a comprehensive list of items of biofouling management activities which are, when appropriate, to be recorded in Biofouling Record Book Part I. Management of biofouling should be in line with an approved Biofouling Management Plan (BFMP) and take into account guidelines developed by the Organization. The items have been grouped into operational sections, each of which is denoted by a letter code.

When making entries in Biofouling Record Book Part I, the date, operational code and item number should be inserted in the appropriate columns and the required particulars should be recorded chronologically in the blank spaces. Each completed operation should be signed for and dated by the officer or officers in charge. The master of the ship should sign each completed page.

The use of an electronic record book to record activities is an alternative method to a hard copy record book. Electronic recording and reporting should be encouraged as it may have many benefits and may allow ships to utilize their technology to reduce administrative burdens and contribute to onboard environmental initiatives, e.g. reduction of paper use. In case electronic recording is to be used, resolution MEPC.312(74) may be used for guidance.

Biofouling Record Book Part I contains many references to observations regarding fouling rating. These observations may be included in separate reports including observations of subsections and corresponding photos/video. The entries in Biofouling Record Book Part I may be a summary only including a conclusion on whether the activity is in line with the BFMP. Biofouling Record Book Part I should be kept on board the ship in a place where it is readily available for inspection at all reasonable times and for the life of the ship. Any inspection of Biofouling Record Book Part I should be performed as expeditiously as possible without causing the ship to be unduly delayed.

LIST OF ITEMS TO BE RECORDED

(A) Proactive cleaning

1 Date and location of ship when proactive cleaning occurred.

2 General observations with regard to biofouling prior to cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).

3 Records of permits required to undertake in-water proactive cleaning, if applicable.

4 Details of hull and niche areas cleaned.

5 General observations with regard to biofouling after the cleaning, if any (i.e. extent of microfouling and macrofouling in line with the defined ratings).

6 Reference to any supporting evidence/reports of the cleaning (e.g. report from supplier, photographs/videos and/or receipts), if any.

7 Method, manufacturer and model of proactive cleaning method used, if not given in BFMP.

8 Reference to test standard for which the method has been tested, if not given in BFMP.

9 Name, position and signature of the person in charge of the activity.

(B) Inspection

1 Date and location of inspection.

2 Methods used for inspection (including inspection tools/devices).

3 Areas inspected of the ship.

4 Observations with regard to biofouling (extent of microfouling and macrofouling in line with the defined fouling rates).

5 Observations with regard to anti-fouling system (AFS) condition.

6 Reference to any supporting evidence/reports of the inspection.

7 Name, position and signature of the person in charge of the activity.

(C) Reactive cleaning

1 Date and location of ship when cleaning occurred.

2 Records of permits required to undertake in-water cleaning, if applicable.

3 Description of hull and niche areas cleaned.

4 Methods of reactive cleaning used.

5 Estimation of overall biofouling after cleaning in line with the defined fouling rates.

6 Reference to any supporting evidence/reports of the activity.

7 Receipt or other documenting evidence of collection/delivery of the wastes.

8 Name, position and signature of the person in charge of the activity.

9 Manufacturer and model of cleaning and capture device as well as cleaning company executing the cleaning.

10 Reference to test standard for which the method has been tested, if relevant.

(D) Additional operational procedures and general remarks

Name of ship .....

IMO number, distinctive numbers or letters .....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of activity / signature of officer in charge

Signature of master .....

PART II – Monitoring of biofouling risk parameters

Name of ship: .....

IMO number, distinctive numbers or letters:.....

Gross tonnage: .....

Period from:..... to: .....

Note:

Biofouling Record Book Part II should be provided to every ship with a Biofouling Management Plan, to record when the ship is at higher risk of biofouling accumulation given by monitoring of biofouling risk parameters. Relevant contingency actions should also be recorded.

1 Introduction

The following pages of this section show a comprehensive list of risk parameters to be monitored and recorded in Biofouling Record Book Part II whenever the risk is increased according to the BFMP. The items have been grouped into sections, each of which is denoted by a letter code.

When making entries in Biofouling Record Book Part II, the date, code and item number should be inserted in the appropriate columns and the required particulars should be recorded chronologically in the blank spaces. Each completed operation should be signed for and dated by the officer or officers in charge. The master of the ship should sign each completed page.

The use of an electronic record book to record when the ship is subject to higher risk of biofouling accumulation is an alternative method to a hard copy record book. Electronic recording and reporting should be encouraged as it may have many benefits and may allow ships to utilize technology to monitor the risk parameters as defined in the BFMP. This may reduce administrative burdens and contribute to better surveillance of potential risk. In case electronic recording is to be used whenever the ship has higher risk, resolution MEPC.312(74) may be used for guidance.

Biofouling Record Book Part II may contain many references to contingency actions. When actions include inspection, maintenance and/or cleaning, these may be recorded in Biofouling Record Book Part I.

Biofouling Record Book Part II should be kept on board the ship in a place where it is readily available for inspection at all reasonable times and for the life of the ship.

Any inspection of Biofouling Record Book Part II should be performed as expeditiously as possible without causing the ship to be unduly delayed.

LIST OF ITEMS TO BE RECORDED

(A) When the ship operates outside the expected operating profile specified in the BFMP (e.g. speed, temperature or salinity)

1 Duration and dates when ship is not operating in line with its BFMP.

2 Reason for departure from normal operation.

3 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections) taken in the period when the ship is operating outside the expected operating profile.

4 Time and location (port name or latitude/longitude) when the ship operates again as specified in the BFMP.

(B) Maintenance/service or damage to AFC

1 Date/period and description of any observed reduction of the efficacy, damage or deviation from maintenance/service to anti-fouling coating (AFC) during its lifetime.

2 Date/period and description of any operation beyond expected lifetime.

3 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

4 Date/period and location where any AFC maintenance or repair was performed (e.g. in dry dock).

5 Description of any AFC, including patch repairs, that was applied during maintenance. Detail the type of AFC, the area and locations it was applied to (including the location of dry-dock support blocks if relevant), an estimated percentage cover of reapplication of the AFC, the coating thickness achieved and any surface preparation work undertaken (e.g. complete removal of underlying AFC or application of new AFC over the top of existing AFC).

6 Reference to any supporting data for AFC maintenance (e.g. AFC technical file).

7 Name, position and signature of the person in charge of the activity.

(C) Maintenance/service or downtime/malfunction of MGPS

1 Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of marine growth prevention system (MGPS) during its lifetime.

2 Date/period and description of operation beyond the expected lifetime.

3 Date and location of any instances when the system was not operating in line with the BFMP.

4 Records of maintenance (including regularly monitoring the electrical and mechanical functions of the systems, calibration, or adjustment of treatment dosages).

5 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

6 Name, position and signature of the person in charge of the activity.

(D) Maintenance/service or downtime/malfunction of other AFS

1 Date/period and description of any observed reduction of the efficacy, downtime, malfunction or deviation from maintenance/service of other AFS during its lifetime.

2 Date/period and description of operation beyond expected lifetime.

3 Date and location of any instances when the system was not operating in line with the Biofouling Management Plan.

4 Records of maintenance.

5 Contingency actions taken to minimize biofouling accumulation (e.g. more frequent inspections).

(E) Deviation from regular use of expected proactive cleaning as specified in the BFMP

1 Date and location where ship did not conduct proactive cleaning as specified.

2 Contingency actions taken to minimize biofouling accumulation (e.g. inspections of biofouling and/or reactive cleaning before return to proactive cleaning activity).

3 Records of maintenance, if any.

4 Date when ship returned to normal activities with proactive cleaning.

(F) Deviation from necessary reactive cleaning as specified in the BFMP

1 Date and location where ship was inspected and reactive cleaning found necessary.

2 Contingency actions taken until reactive cleaning, including scheduling of reactive cleaning activity.

3 Date when ship completed the reactive cleaning and reference to relevant recording in Part I.

(G) When the ship is idle (berthed, anchored, moored) for a longer period

1 Date and location where ship was laid up, including general description of biofouling pressure, e.g. temperature and distance to the coastline.

2 Contingency actions taken to minimize biofouling accumulation (e.g. inspections, sea chests blanked off or short voyages taken prior to and following the period laid up).

3 Precautions taken to minimize biofouling accumulation (e.g. short voyage).

4 Date when ship returned to normal operations.

(H) When the ship has performance loss as per Performance Monitoring System for a period beyond the expected period as specified in the BFMP

1 Date and location where ship started with performance loss beyond the expectations.

2 Inspections or biofouling management actions taken prior to and following the period with performance loss.

3 Contingency actions taken to minimize biofouling accumulation.

4 Date when ship returned to normal performance.

(I) Other deviations

Name of ship .....

IMO number, distinctive number or letters .....

BIOFOULING MANAGEMENT ACTIVITIES

Date	Code (letter)	Item (number)	Record of risk / signature of officer in charge

Signature of master .....

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