

# Guidelines on **Biofouling Management**

**December 2022**



**IRCLASS**  
Indian Register of Shipping

# **Guidelines**

## **Biofouling Management**

**December 2022**

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## Introduction

The transfer of invasive aquatic species which leads to or may lead to disruption of local ecosystems has been recognized by the International Maritime Organization (IMO) as a key issue for protection of the environment. Invasive aquatic species may be transferred via several modes such as:

- Discharge of Ballast Water and/ or Sediments whose uptake is from a different region
- Biofouling accumulated on the ship's hull and appendages which may detach, releasing such organisms

In order to address transfer of invasive aquatic species through discharge of Ballast Water, IMO has adopted the Ballast Water Management Convention (BWM) which provides regulatory requirements to ensure that discharge of ballast water by ships does not have an adverse impact on the local ecosystems.

As regards the accumulated biofouling growth, IMO Resolution MEPC.207(62) provides Guidelines (hereinafter referred to as the IMO Guidelines) on management of biofouling so as to prevent invasive aquatic species from disrupting the ecosystem. The IMO Guidelines are intended to be utilized by various stakeholders such as Member States, Ship Operators, Owners, Masters, Cleaning Companies, Anti-fouling Systems manufacturers and suppliers. The IMO Guidelines recommend development and implementation of a Biofouling Management Plan. The Biofouling Management Plan should be specific for each ship. Further, the IMO Guidelines recommend maintenance of a Biofouling Record Book onboard to record relevant details of actions and measures undertaken in relation to Biofouling Management.

Though the application of IMO Guidelines is not mandatory, some Member States such as Australia, New Zealand, United States of America, Canada etc. recognizing the need to protect sensitive ecosystems within the coastal waters under their jurisdictions, mandate ships calling at their ports to develop and implement a plan to manage biofouling. Ship owners/ operators are advised to take cognizance of such specific local regulations implemented in certain countries with respect to biofouling management.

Implementing practices to control and manage biofouling can greatly assist in reducing the risk of the transfer of invasive aquatic species. Such management practices can also improve a ship's hydrodynamic performance and can be an effective tool in enhancing energy efficiency and reducing GHG emissions from ships.

Biofouling Management is not a mandatory requirement within the scope of Classification. However, considering the growing importance of this topic, the present Guidelines are developed towards assisting Ship Operators/ Owners on best practices in reducing biofouling, developing, and implementing a Biofouling Management Plan and maintaining a Biofouling Record Book.

### Abbreviations

*AFS* – Anti-fouling Systems

*AFCS* – Anti-fouling Coating System

*BWM* – Ballast Water Convention

*BFM* – Biofouling Management

*BFMP* - Biofouling Management Plan

*BFRB* – Biofouling Record Book

*MPGS* – Marine Growth Prevention System

## Section 1

### Biofouling Management

#### 1.1 General

1.1.1 All ships may have biofouling to some degree, even those which may be recently cleaned or had a new application of an anti-fouling coating system. Biofouling on ships is influenced by a range of factors such as:

- a) design and construction (particularly the design, number, and location of niche areas (refer 1.3)
- b) operating profile, including factors such as operating speeds, ratio of time underway to time alongside, moored or at anchor
- c) trading routes and places visited
- d) maintenance history including hull cleaning practices, type, age and condition of anti-fouling system

1.1.2 This Section provides guidance on the design aspects to be considered to reduce biofouling, development and implementation of an effective Biofouling Management Plan (BFMP) as well as maintenance of a Biofouling Record Book (BFRB) onboard the ship.

1.1.3 The IMO Guidelines should also be referred to for various aspects to be considered when developing and implementing a BFMP for a ship. Local requirements may also be applicable (please see 'References' for a non-exhaustive list of applicable local authority requirements).

1.1.4 Ships complying with the requirements in these Guidelines may be assigned additional class notation **BFM** (Biofouling Management). Existing ships may also be assigned BFM notation, provided they follow biofouling management practices, have a biofouling management plan and biofouling record book in accordance with the requirements in these Guidelines. Such ships need not comply with design and construction requirements stipulated in these Guidelines.

#### 1.2 Definitions

1.2.1 *Anti-Fouling Coating System (AFCS)*: The combination of all component coatings, surface treatments (including primer, sealer, binder, anti-corrosive and anti-fouling coatings) or other surface treatments, used on a ship to control or prevent attachment of unwanted aquatic organisms

1.2.2 *Anti-Fouling System (AFS)*: A coating, paint, surface treatment, surface, or device that is used on a ship to control or prevent attachment of unwanted organisms.

1.2.3 *AFS Convention*: The International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001

1.2.4 *Biofouling*: The accumulation of aquatic organisms such as micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling

1.2.5 *Invasive Aquatic Species*: A species which may pose threats to human, animal and plant life, economic and cultural activities, and the aquatic environment.

1.2.6 *In-water cleaning*: The physical removal of biofouling from a ship while in the water.

1.2.7 *Macrofouling*: Large, distinct multicellular organisms visible to the human eye such as barnacles, tubeworms, or fronds of algae.

1.2.8 *Microfouling*: Microscopic organisms including bacteria and diatoms and the slimy substances that they produce. Biofouling comprised of only microfouling is commonly referred to as a slime layer.

1.2.9 *Marine Growth Prevention Systems (MGPS)*: An anti-fouling system used for the prevention of biofouling accumulation in internal seawater cooling systems and sea chests and can include the use of anodes, injection systems and electrolysis

1.2.10 *Niche Areas*: areas on a ship that may be more susceptible to biofouling due to different hydrodynamic forces, susceptibility to coating system wear or damage, or being inadequately, or not painted.

### 1.3 Design and Construction

1.3.1 Greater attention during design and construction can help in reduction of biofouling on the ship. At least the following niche areas should be considered as applicable, during design, construction and when developing the BFMP:

- .1 Sea-Chests
- .2 Dry-docking support strips
- .3 Bow and Stern Thrusters
- .4 Edges and Weld joints
- .5 Rudder hinges and stabilizer fin apertures
- .6 Propellers and shafts
- .7 Stern tube sea assemblies
- .8 Internal surfaces of rope guards
- .9 Cathodic protection fittings and anodes
- .10 Pitot tubes
- .11 Sea inlet pipes and overboard discharges
- .12 A-brackets
- .13 Inlet gratings
- .14 Anchors and Chains

1.3.2 For ships assigned **BFM** notation, the following aspects may be considered in plan approval and surveys during new construction/ major conversion, as far as practicable:

- .1 Small niches and sheltered areas should be excluded from the ship 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 anti-fouling measures
- .2 Rounding and/or beveling of corners, gratings and protrusions to promote more effective coverage of anti-fouling coating systems and hinging of gratings to enable diver access
- .3 Internal seawater cooling systems should be designed and made of appropriate material to minimize biofouling and constructed with a minimum of bends, kinks and flanges in seawater piping
- .4 sea chests – minimize size and number, and use smooth surfaces to maximize flow efficiency, fit MGPS, and steam or hot water cleaning systems, grills and their opening arrangements designed for in-water inspection and maintenance
5. retractable fittings and equipment – avoid external reinforcement (such as stiffeners) where possible, design for in-water inspection and maintenance
- .6 tunnel thrusters – tunnels to be above light water line or accessible to divers, grills and their opening arrangements designed for in-water inspection, maintenance and operation

.7 stern tube seal assemblies and rope guards – design for in-water inspection, cleaning and maintenance

.8 immersible and seabed equipment – ensure facilities for equipment washdown during retrieval and enclosed washdown areas for cleaning of equipment on board, if necessary, are provided

## 1.4 Biofouling Management Practices

1.4.1 Biofouling can also be managed by choice of a suitable Anti-fouling system and operational practices. An anti-fouling system can be a coating system applied to exposed surfaces, bio-fouling resistant materials used for piping and other unpainted components, MGPSs for sea chests and internal seawater cooling systems, or other innovative measures to control biofouling. The anti-fouling system used should comply with the AFS Convention, as relevant and applicable.

1.4.2 The choice of an appropriate Anti-fouling system is a primary means to prevent biofouling growth. The choice of anti-fouling system should be based on the following aspects:

- .1 planned periods between dry-docking – including any mandatory requirements for ships survey
- .2 ship speed – different anti-fouling systems are designed to optimize anti-fouling performance for specific ship speeds
- .3 operating profile – patterns of use, trade routes and activity levels, including periods of inactivity
- .4 ship type and construction
- .5 whether AFS is to be applied in a niche area

1.4.3 In-water surveys can provide useful information about the ship's underwater hull and appendages regarding biofouling. These may be periodically undertaken to identify biofouling growth and take appropriate actions for mitigation. Such inspections should be performed in accordance with an inspection plan by approved cleaning companies who are suitably qualified, experienced, and familiar with risks associated with biofouling and associated invasive aquatic species and the safety risks related to in-water surveys. Niche areas should also be targeted within the inspection plan as these are more susceptible to biofouling growth.

1.4.4 In addition to periodic in-water inspections, inspection of the underwater hull and appendages may also be triggered based on certain events such as:

- .1 indication of possible increase in hull resistance e.g. rise in fuel consumption in propulsion engine/ plant
- .2 before and after any planned period of inactivity or significant or unforeseen change to the ship's operating profile
- .3 prior to undertaking in-water cleaning to determine the presence of known or suspected invasive aquatic species or other species of concern
- .4 after a known or suspected marine pest or other species of concern is discovered in a ship's internal seawater cooling systems
- .5 following damage to, or premature failure of the anti-fouling system

1.4.5 The results of the in-water inspections as carried out by the cleaning company should be reviewed by the Owner regarding the need for cleaning of the ship's hull to remove the biofouling growth. Cleaning may be performed in-water by approved cleaning companies or in dry-dock. (Note: In-water cleaning if

performed, would be subject to the requirements of the local Statutory authorities). Damage (if any) arising to the AFS during the cleaning activities should be reported to IRS.

1.4.6 In order to manage biofouling in niche areas, greater care may be taken with respect to the following:

.1 *Dry-docking support strips* – Positions of dry-docking blocks and supports should be varied at each dry-docking. Alternatively, arrangements may be made to ensure that areas under blocks are painted with anti-fouling, at least at alternate dry-dockings. Where it is not possible to alternate the position of dry-docking support strips, e.g., in critical weight bearing areas such as under the engine-room, these areas should be specially considered and managed by other means, e.g., the application of specialized coatings or procedures.

.2 *Bow and stern thrusters* – The body and area around bow, stern and any other thrusters prone to coating damage, should be routinely maintained at dry-dockings. Particular attention should be paid to any free flooding spaces which may exist around the thruster tunnel. The housings/recesses, and retractable fittings such as stabilizers and thruster bodies, should have an anti-fouling coating system of adequate thickness for optimal effectiveness.

.3 *Edges and weld joints* – Exposed edges on the hull, such as around bilge keels and weld joints, should be faired and coated to ensure adequate coating thickness to optimize system effectiveness.

.4 *Rudder hinges and stabilizer fin apertures* – Recesses within rudder hinges and behind stabilizer fins need to be carefully and effectively cleaned and re-coated at maintenance dry-dockings. 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 anti-fouling system. Rudders, rudder fittings and the hull areas around them should also be adequately coated to withstand the increased wear rates experienced in these areas.

.5 *Propellers and shaft* – Propellers and immersed propeller shafts may be coated with fouling release coatings where possible and appropriate, to maintain efficiency and enable self-cleaning, so that the need for regular in-water cleaning and polishing is minimized.

.6 *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 anti-fouling coating systems appropriate to the degree of water movement over and around these surfaces.

.7 *Cathodic protection anodes* – Biofouling can be minimized 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 anti-fouling coating system 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.

.8 *Sea chests, sea inlet pipes and overboard discharges* – Anti-fouling coating systems should be applied inside the sea chests, pipe opening and accessible internal areas. The anti-corrosive or primer coating selected should be appropriate to the specific pipe material if this material is different to the hull. Care should be taken in surface preparation and coating application to ensure good adhesion and coating thickness.

1.4.7 In-water cleaning and maintenance

.1 In-water cleaning (also refer 1.6.5) can be an important part of biofouling management. In-water cleaning can also introduce different degrees of environmental risk, depending on the nature of biofouling (i.e. microfouling versus macrofouling), the amount of anti-fouling coating system residue

released and the biocidal content of the anti-fouling coating system. Certain aspects to be considered whilst undertaking in-water cleaning and maintenance, are as follows:

- .1 Any local requirements for the conduct of in-water cleaning, including any regulations regarding the discharge of chemicals into the marine environment and the location of sensitive areas (such as marine protected areas and ballast water exchange areas). Where available, appropriate technology should be used to minimize the release of both anti-fouling coating or paint debris, and fouling organisms. The collected material should be disposed of in a manner which does not pose a risk to the aquatic environment.
- .2 For immersed areas coated with biocidal anti-fouling coatings, cleaning techniques should be used that minimize release of biocide into the environment and prevent damage to antifouling coating surface.
- .3 Immersed areas coated with biocide-free anti-fouling coating systems may require regular in-water cleaning as part of planned maintenance to maintain hull efficiency and minimize the risk of transferring invasive aquatic species. Cleaning techniques should be used which do not damage the coating and impair its function.
- .4 Any maintenance or repair activities should take care not to impede future in-service cleaning and/or maintenance, e.g., care should be taken to ensure sea chest grates do not become welded shut during repair work.
- .5 Regular polishing of uncoated propellers to maintain operational efficiency will also minimize macrofouling accumulation and calcareous deposits.
- .6 Internal seawater cooling systems need to be regularly monitored to ensure effective biofouling control is maintained. Seawater cooling systems that operate while the ship is in port may be vulnerable to biofouling accumulation and should be closely monitored. If seawater cooling systems become fouled, they should be appropriately treated. Any discharge of treated water from internal seawater cooling systems should be undertaken in accordance with applicable regulations.
- .7 The cleaning company is to have procedures in place to
  - avoid release of materials throughout the entire cleaning operation, including when mobilising and demobilising the cleaning equipment
  - describe the handling of material as well as the capture, separation and/or treatment of seawater

In addition, the separated material is to be disposed of in accordance with local regulations and sea water effluent is to conform with the port specifications.

## 1.5 Biofouling Management Plan (BFMP)

1.5.1 A BFMP should be developed which is specific to a given ship. This may be a stand-alone document or may be incorporated in the ship's operational documentation/ procedures and/ or planned maintenance systems. The BFMP is intended to provide for procedures or actions to effectively manage biofouling growth on the ship's underwater hull and niche areas. The Plan should address at least the following aspects:

- .1 compliance with relevant requirements of the IMO Guidelines
- .2 details of the anti-fouling systems and operational practices or treatment chemicals used, including those for niche areas
- .3 hull locations susceptible to biofouling, schedule of planned inspections, repairs, maintenance and renewal of anti-fouling systems



- .4 details of the recommended operating conditions suitable for the chosen anti-fouling systems and operational practices
- .5 contingency planning for managing biofouling when the ship is inactive for an extended period
- .6 details relevant for the safety of the crew, including details on the anti-fouling system(s) used
- .7 contingency planning for incidents such as grounding, contact with a tug etc. that may cause damage to the AFS
- .8 details of the documentation required to verify any treatments recorded in the Biofouling Record Book

1.5.2 A recommended template for use while developing the BFMP shown in Appendix 1. The BFMP should be written in the language(s) which can be understood by the crew.

1.5.3 A person from the onboard crew should be designated as the person responsible for effective implementation of the BFMP.

1.5.4 For ships assigned **BFM** notation, the BFMP should be reviewed periodically by the Owner, at least on an annual basis and updated as necessary.

## 1.6 Biofouling Record Book (BFRB)

1.6.1 A BFRB should be maintained onboard the ship to record details of actions and outcomes of all measures as identified within the BFMP. The record book should include documentation or references to documentation about actions undertaken in connection with biofouling management such as service reports, incidents, video/photo recordings of inspection/ cleaning etc. The BFRB should be retained onboard for the life of the ship. The BFRB should be used to review the effectiveness of the procedures and actions specified in the BFMP.

1.6.2 The following information as minimum should be recorded in the BFRB:

- .1 details of the anti-fouling systems and operational practices used (where appropriate as recorded in the Anti-fouling System Certificate), where and when installed, areas of the ship coated, its maintenance and, where applicable, its operation
- .2 dates and location of dry dockings, including the date the ship was re-floated, and any measures taken to remove biofouling or to renew or repair the anti-fouling system
- .3 the date and location of in-water inspections, the results of that inspection and any corrective action taken to deal with observed biofouling
- .4 the dates and details of inspection and maintenance of internal seawater cooling systems, the results of these inspections, and any corrective action taken to deal with observed biofouling and any reported blockages
- .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 and geographic location.

1.6.3 A recommended template which may be used to record information in the Biofouling Record Book is shown in Appendix 2.

1.6.4 The BFRB maybe kept onboard in paper form or in an electronic form.

## 1.7 Surveys

1.7.1 For ships assigned **BFM** notation, at each annual, intermediate and drydocking survey or in water survey, the biofouling management plan and the biofouling record book are to be made available to the Surveyor for verification that the biofouling management plan is being implemented satisfactorily onboard.

## 1.8 Suspension/ Withdrawal of BFM notation

1.8.1 Compliance with the requirements will be verified during surveys. The BFM notation may be suspended or withdrawn in case of non-compliance with the requirements.

## References

1. Resolution MEPC.207(62) - 2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species
2. MEPC.1/ Circ. 792 - Guidance for Minimizing the Transfer of Invasive Aquatic Species as Biofouling (Hull Fouling) for Recreational Craft
3. MEPC.1/ Circ. 898 – New Biofouling Management Requirements for Ships; Communication received from the Government of Australia
4. USCG 33 CFR 151.2050 – Additional requirements – nonindigenous species reduction practices
5. Australian Government, Department of Agriculture, Fisheries and Forestry. Notice 8-2022. Australian Biofouling Management Requirements. <https://www.agriculture.gov.au/biosecurity-trade/import/industry-advice/2022/80-2022>
6. Ministry of Primary Industries, New Zealand Government. Craft Risk Management Standard – Biofouling on Vessels arriving to New Zealand. <https://www.mpi.govt.nz/dmsdocument/11668-Biofouling-on-Vessels-Arriving-to-New-Zealand-Craft-Risk-Management-Standard>
7. California Code of Regulations, title 2, section 2298.1.et seq. Guidance document for Biofouling Management Regulations to minimize the transfer of non-indigenous species from vessels arriving at California Ports. <https://www.slc.ca.gov/wp-content/uploads/2018/08/MISPGuidanceDoc.pdf>
8. Canadian Government, Transport Canada, Voluntary Guidance for Relevant Authorities on In-Water Cleaning of Vessels. <https://tc.canada.ca/en/marine-transportation/marine-pollution-environmental-response/preventing-aquatic-invasive-species-marine-transportation/managing-biofouling/voluntary-guidance-relevant-authorities-water-cleaning-vessels>

## Appendix 1 – Template for Biofouling Management Plan

A sample Biofouling Management Plan is presented in this Appendix to illustrate the key elements. It is recommended that the plan should also indicate the following on each page

1. Page number
2. Revision number
3. Date of Issue

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### BIOFOULING MANAGEMENT PLAN

<b>Name of Ship</b>	
<b>IMO Number</b>	
<b>Flag</b>	
<b>Port of Registry</b>	
<b>Call Sign</b>	
<b>MMSI Number</b>	
<b>Type of Ship</b>	
<b>Gross Tonnage</b>	
<b>Length Overall</b>	
<b>Beam</b>	
<b>Maximum Draft</b>	
<b>Other details 1 ...</b>	...
<b>Other details 2 ...</b>	...
<b>Other details 3 ...</b>	...
<b>..</b>	
<b>..</b>	
<b>Developed by</b>	XX (Designation)
<b>Reviewed by</b>	YY (Designation)
<b>Issued by</b>	ZZ (Designation)

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5	Operation and Maintenance of the Anti-Fouling System	.
	Timing of Operation & Maintenance Activities including In-Water inspections	.
	In-Water Cleaning and maintenance procedures	.
	Operation of onboard treatment processes	.
6	Safety Procedures for Ship & Crew	
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## Section 1: Purpose

The purpose of the Plan is to outline measures for the control and management of ships' biofouling in accordance with the Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (the Guidelines). It provides operational guidance for the planning and actions required for ships' biofouling management. .... <Other additional text may be added>

## Section 2: Description of the Anti-Fouling Systems

**Table 1: Anti-Fouling systems installed are as shown in below table: (example is shown below only for purpose of illustration)**

Sr.no	Type of AFS	Manufacturer##	Location/Areas	AFS Specifications**
1.	XYZ_SAMPLE (FRC)	PAINT_1  Certificate No. XX_YYY_ZZZ  Date of expiry MMDDYYYY	Bottom, Bilge	DFT 120 microns, Coating Life 60 months from application date, Ship should not be stationary for periods exceeding 14 consecutive days in Baltic Areas. Operating Speed for functionality of coating should not be less than 12 knots for at least 1 hour every day. Cleaning to be performed in consultation with manufacturer if biofouling detected
2	...	...	...	...
3	...	...	...	...
4	...	...	...	...

## Please also provide reference to the AFS certificate/ statement of compliance including the date of expiry of validity

\*\* Please provide anti-fouling system specifications (including dry film thickness for coatings, dosing and frequency for MGPSs, etc.) together with the expected effective life, operating conditions required for coatings to be effective, cleaning requirements and any other specifications relevant for paint performance

### Other Details

Details of Areas/Locations on hull/appendages where AFS is not installed	
Details of Marine Growth Prevention Systems (MGPS)	Please provide details, locations where installed, typical dose and frequency, limitations if any
AFS Performance (as understood from previous inspections)	Please provide reference to previous inspection reports and attach them as annex
Any other information	Please mention as applicable

## Section 3: Description of the Operating Profile

Typical Operating Speeds	e.g. > 10 knots for not less than 1 hour every day
Operating Areas/Locations considered during selection of AFS	e.g. Voyages within Tropical zones
Percentage of time ship is underway	75
Percentage of time ship is at berth/anchor	25
Planned duration between drydockings/ slippings	Not to exceed 36 months (if in-water inspections are performed, please specify)
Any other information	Please mention as applicable

### Section 4: Description of Areas on the Ship Susceptible to Biofouling

(Please enter text in the table below considering the specific ship for which biofouling management plan is developed)

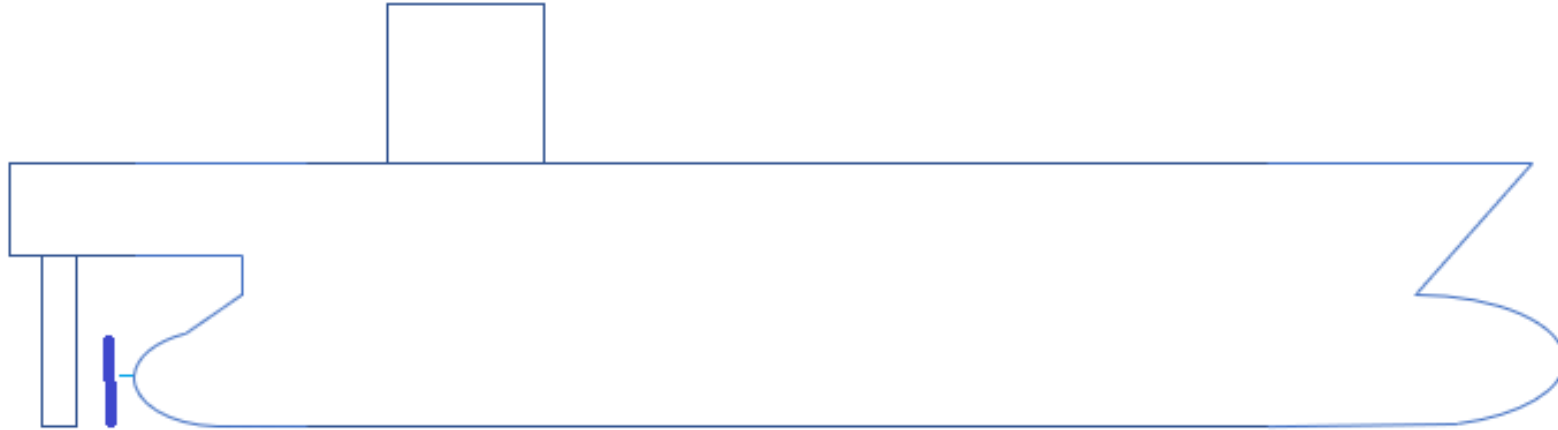
(Please also include a diagram of the ship to identify the location of the areas of the ship listed in below table that are particularly susceptible to biofouling (including access points in the internal seawater cooling systems). It is recommended that these should show both side and bottom views of the ship.

Areas of the ship which are particularly susceptible to biofouling	Management actions required for each area	Management actions to be undertaken if ship operates outside its usual operating profile	Maintenance activities (as applicable, e.g. in-water inspection, in-water or drydock cleaning etc.
<b>External Hull Surfaces</b>			
<b>Vertical Sides</b>	e.g. to be inspected in-water every XX months	e.g. to perform in-water inspections every YY months,	e.g. to clean if undue biofouling accumulation detected
<b>Bottom Flat</b>			
<b>Boot-top</b>			
<b>Bow dome</b>			
<b>Transom</b>			
<b>Others 1</b>			
<b>Others 2</b>			
.	.	.	.
<b>Hull Appendages and Fittings</b>			
<b>Bilge Keel</b>			
<b>A-Bracket</b>			
<b>Stabilizer Fins</b>			
<b>CP Anodes</b>			
<b>Others 1</b>			
<b>Others 2</b>			
.	.	.	.
<b>Steering &amp; Propulsion</b>			
<b>Propeller</b>			
<b>Propeller shaft</b>			
<b>Stern Tube Seal</b>			
<b>Anchor Chain</b>			
<b>Chain Locker</b>			
<b>Rope Guard</b>			
<b>Rudder</b>			
<b>Bow/Stern Thruster</b>			
<b>Propeller</b>			

<b>Thruster Body</b>			
<b>Tunnel</b>			
<b>Tunnel Grates</b>			
<b>Others</b>	.	.	.
.	.	.	.
<b>Seawater intakes and internal seawater cooling systems</b>			
<b>Engine Cooling System</b>			
<b>Sea Chests (also provide their location on the ship)</b>			
<b>Sea Chest 1 &amp; Gratings</b>			
<b>Sea Chest 2 &amp; Gratings</b>			
<b>Sea Chest 3 &amp; Gratings</b>			
.	.	.	.
<b>Sea Chest N &amp; Gratings</b>			
<b>Internal Pipework and Heat Exchangers</b>			
<b>Fire-fighting system</b>			
<b>Ballast Uptake System</b>			
<b>Auxiliary Services System</b>			
<b>Others 1</b>			
<b>Others 2</b>			
.	.	.	.

Sample Diagrams to indicate location of susceptible areas (including access points in the sea water cooling systems) (Note: Detailed drawings indicating these locations can also be referenced or attached here)

**A. Sides (Please use separately for each side of ship)**



**B. Bottom**



## **Section 5: Operation and Maintenance of the Anti-Fouling Systems**

This section should contain a detailed description of the operation and maintenance of the anti-fouling system(s) fitted/ used, including schedule(s) of activities and step-by-step operational procedures. This section should also include advice for ship operators on procedures for biofouling management if the anti-fouling systems (e.g. MGPSs) are temporarily out of operation.

## **Section 6: Safety Procedures for Ship and Crew**

Details of specific operational or safety restrictions, including those associated with the management system that affects the ship and/or the crew should be provided here.

Details of specific safety procedures to be followed during ship inspections should be provided here.

The Safety Procedures should also take into account the AFS Manufacturers' recommendations as well as the requirements from Local Authorities (if in-water cleaning is carried out)

## **Section 7: Disposal of Biological Waste**

This section should contain procedures for the disposal of biological waste generated by treatment or cleaning processes when the cleaning is conducted by, or under the direct supervision of, the shipowner, master or crew. Requirements enforced by Local Authorities are also to be complied with and should be referenced here.

## **Section 8: Recording Requirements**

This section should contain details of the types of documentation to be kept to verify the operations and treatments to be recorded in the Biofouling Record Book as outlined in Appendix 2.

## **Section 9: Training & Familiarization**

This section should contain instructions/ procedures on the provision of crew training and familiarization. It is also recommended to provide the details of when such training will be provided, who is in charge of providing the training, the training materials etc. The various areas covered by training and familiarization should also be mentioned here and should include the following at least:

- Ship's Biofouling management plan
- Safety Procedures to be followed during in-water inspection and cleaning (as applicable)
- Roles and Responsibilities of each crew during the operation
- Contingency measures
- Ensuring adequate maintenance of records



## Appendix 2 – Template for Biofouling Record Book

### A.2.1 General

A.2.1.1 A Biofouling Record Book should be maintained for each ship. The details of all inspections and biofouling management measures undertaken on the ship should be recorded.

### A.2.2 Entries in the Biofouling Record Book

A.2.2.1 After **each drydocking**, the following information should be recorded in the Biofouling Record Book:

- Date
- Location of drydocking
- Date of refloating
- Observations with regard to biofouling (i.e. extent of biofouling and predominant biofouling types, e.g., mussels, barnacles, tubeworms, algae and slime)
- Any hull cleaning that was performed while dry-docked, including areas cleaned, method used for cleaning and the location of dry-dock support blocks
- Ranging and cleaning of anchor(s), chains (as relevant and applicable), flushing and cleaning of chain lockers
- Whether damage(s) to AFS were detected
- Cathodic protection, anodes or dielectric coatings cleaned and/or replaced
- Any anti-fouling coating system, including patch repairs, that was applied while dry-docked. Detail the type of anti-fouling coating system, the area and locations it was applied to, the coating thickness achieved, and any surface preparation work undertaken (e.g., complete removal of underlying anti-fouling coating system or application of new anti-fouling coating system over the top of existing anti-fouling coating system).
- Name, position and signature of the person in charge of the activity for the ship.

A.2.2.2 After **each in-water inspection**, the following information should be recorded in the Biofouling Record Book:

- Date
- Location of in-water inspection
- Areas and items of the ship inspected (this should cover the underwater hull as well as niche areas)
- External conditions (environment, visibility underwater etc.)
- General observations with regard to biofouling (i.e. extent of biofouling and predominant biofouling types, e.g., mussels, barnacles, tubeworms, algae and slime)
- Whether damage(s) to AFS were detected
- Actions taken (if any) in relation to biofouling
- Supporting evidence such as photographs, videos etc.
- Name, position and signature of the person in charge of the activity for the ship

A.2.2.3 After in-water inspection, if the underwater hull has been cleaned (by an in-water cleaning company), the following information should be recorded in the Biofouling Record Book:

- Date(s) (if cleaning was completed more than one day)
- Details of in-water cleaning company
- Location(s) (if cleaning was completed at more than one location)

- Date on which the in-water inspection was performed prior to cleaning (report should also be attached)
- Records of permits required to undertake in-water cleaning (if applicable).
- External conditions (environment, visibility underwater etc.)
- Areas of the ship cleaned
- Methods of cleaning/treatment utilized
- General observations with regard to biofouling (i.e. extent of biofouling and predominant biofouling types, e.g., mussels, barnacles, tubeworms, algae and slime), before and after the cleaning is performed.
- Supporting evidence such as photographs, videos etc.
- Whether biofouling waster was captured during cleaning. If yes, then amount (in kg or m<sup>3</sup>) of the captured material should be mentioned.
- Damage(s) to AFS (if any) during cleaning. If yes, then the repairs performed should also be described along with evidence
- Name, position and signature of the person in charge of the activity.

A.2.2.4 When the **internal seawater cooling systems have been inspected and cleaned or treated**; the following information should be recorded in the Biofouling Record Book

- Date
- Location
- General observations with regard to biofouling of internal seawater cooling systems (i.e. extent of biofouling and predominant biofouling types, e.g., mussels, barnacles, tubeworms, algae, slime).
- Whether any cleaning actions were undertaken, if yes then details of the cleaning actions along with evidence should be provided.
- Supporting evidence such as photographs, videos etc.
- Name, position and signature of the person in charge of the activity

A.2.2.5 For **ships fitted with MGPS**, the following information should be recorded in the Biofouling Record Book:

- Records of operation and maintenance (such as regularly monitoring the electrical and mechanical functions of the systems).
- Any instances when the system was not operating in accordance with the biofouling management plan. If such instances are present, then the corrective actions taken by the ship should also be documented (until the time when the MGPS operation is restored in accordance with biofouling management plan)

A.2.2.6 Periods **when ship was inactive/laid up** for an extended period of time (typically more than two weeks) should also be recorded in the Biofouling Record Book

- Date
- Location
- Date when ship resumed regular operations after being laid up/lying idle
- Actions taken to minimize biofouling accumulation

A.2.2.7 Periods of time **when the ship was operating outside the profile** considered during development of Biofouling management plan should also be recorded in the Biofouling Record Book

- Duration and dates when ship was not operating in accordance with its normal operating profile
- Reason(s) for departure from normal operating profile
- Actions taken (if any) to minimize biofouling accumulation

**A.2.2.8 Details of inspection (by PSC) or during periodic review of implementation of the Biofouling Management Plan**

- Date of review
- Date of inspection (if inspected by the Port State Authority)
- Location of the ship at time of review/inspection
- Outcome of the inspection/review (records of these should be attached)
- Name, position, signature of the person in charge of the activity for the ship.

**A.2.2.9 Any other observations and/or general remarks**

The biofouling record book should follow the format as below:

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**Biofouling Record Book**

Ship Name	
IMO Number	
Flag	
Gross Tonnage	

Date	Item	Record of Management Actions	Signature of onboard person in charge
DDMMYY	1	each dry-docking (refer A.2.2.1)	
DDMMYY	2	each in-water inspection (refer A.2.2.2)	
DDMMYY	3	cleaning of underwater hull (refer A.2.2.3)	
DDMMYY	4	inspection/ cleaning of internal sea water cooling systems (refer A.2.2.4)	
DDMMYY	5	ships fitted with MGPS (refer A.2.2.5)	
DDMMYY	6	periods when ship was inactive/ laid-up (refer A.2.2.6)	
DDMMYY	7	periods when ship is operating outside the profile (refer A.2.2.7)	
DDMMYY	8	details of PSC inspection (refer A.2.2.8)	

Signature of Master: \_\_\_\_\_

**End of the Guidelines**