GloFouling PARTNERSHIPS

Guide to Developing National Biofouling Strategies

on Biofouling Management to Minimize the Introduction of Invasive Aquatic Species

Guide 3

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Building Partnerships to Assist Developing Countries to Minimize the Impacts from Aquatic Biofouling (GloFouling Partnerships) is a collaboration between the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) and the International Maritime Organization (IMO). The project aims to develop tools and solutions to help developing countries to reduce the transfer of aquatic invasive species through the implementation of the IMO Guidelines for the control and management of ships' biofouling.
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This Guide to Developing National Biofouling Strategies on Biofouling Management to Minimize the Introduction of Invasive Aquatic Species (Guide 3) is the third out of a series of three guides, which were developed under the GEF-UNDP-IMO GloFouling Partnerships project. The three guides aim at assisting governments and interested stakeholders to minimize the risk of Invasive Aquatic Species (IAS) transferred through biofouling, by: conducting national status assessments to identify pathways, gaps and needs (Guide 1); assessing the economic costs and benefits of biofouling management to minimise the introduction of IAS (Guide 2); developing and adopting national biofouling strategies and action plans to minimize the introduction of IAS via biofouling (Guide 3).

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Acronyms and Abbreviations

BFMP – Biofouling Management Plan

BFRB – Biofouling Record Book

BIMCO - Baltic and International Maritime Council

CRMS – Craft Risk Management Standard: Biofouling on Vessels Arriving to New Zealand

FTE – Full Time Employee

GEF – Global Environment Facility

GFP – Building Partnerships to Assist Developing Countries to Minimize the Impacts from Aquatic Biofouling (GloFouling Partnerships) referred to as 'GEF-UNDP-IMO GloFouling Partnerships Project'

GHG – Greenhouse gases

IAS – Invasive Aquatic Species

IMarEST – Institute of Marine Engineering, Science and Technology

IMO – International Maritime Organization

IPPIC – International Paint and Printing Ink Council, now known as the World Coatings Council

IWC – In-Water Cleaning

MARPOL – International Convention for the Prevention of Pollution from Ships

MEPC – Marine Environment Protection Committee (IMO)

NACE – National Association of Corrosion Engineers

NAVSEA – Naval Sea Systems Command

PSC – Port State Control

Redmap – Range Extension Database and Mapping project

UNDP – United Nations Development Programme

Glossary of Terms

Anti-fouling system	A coating, paint, surface treatment, surface, or device that is used on a ship to control or prevent attachment of unwanted organisms.
Biocidal Coating	Paints or coatings that inhibit macrofouling attachment and growth using biocides, e.g. copper and zinc.
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. May include microfouling and macrofouling.
Debris (in relation to in-water cleaning)	Biological and coating material released during in-water cleaning.
Guide	Refers to this document throughout.
IMO Biofouling Guidelines	*The Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species* (resolution MEPC.207(62)), 15 July 2011.
IMO Biofouling Guidance for Recreational Craft	*Guidance for Minimizing the Transfer of Invasive Aquatic Species as Biofouling (Hull Fouling) for Recreational Craft* (MEPC.1/Circ.792), 12 November 2012.
Implementing agency	The agency that is responsible for implementing that aspect of the biofouling policy or strategy.
In-water cleaning	The physical removal of biofouling from a ship or other submerged structure while in the water.
Invasive aquatic species (IAS)	A non-indigenous species which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment.
Macrofouling	Large, distinct multicellular organisms visible to the human eye such as barnacles, tubeworms, or fronds of algae.
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.
National Status Assessment Guide	Guide to Developing National Status Assessments of Biofouling Management to Minimize the Introduction of Invasive Aquatic Species.
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, e.g. sea chests, bow thrusters, propeller shafts, inlet gratings, dry-dock support strips, etc.
Non-indigenous species	Species introduced outside their natural past or present range, which might survive and subsequently reproduce.
Transfer pathway	The process or mechanism by which an organism is moved from its native area to a new area.
Primary transfer pathway	International movements, from one country to another, of ships and structures that are responsible for the initial introduction of non-indigenous fouling organisms into a new region.
Secondary transfer pathway	Domestic movements, from one area to another within a country, of ships and structures that can distribute already introduced non-indigenous species more widely.

Ships	For the purposes of this guide, the definition of ships is consistent with the definition in the IMO Biofouling Guidelines: 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 and production units (FSUs) and floating production storage and off-loading units (FPSOs).
Vector	The specific mode via which a pathway transfers a non-indigenous species. In the case of shipping, ballast water and biofouling are recognised vectors of non-indigenous species.

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[1] The views expressed are those of the author, who undertook this task as an independent consultant, and do not reflect the view or policy of the Australian Government.

Preface

Biofouling is recognized as a major vector for the introduction and spread of Invasive Aquatic Species (IAS). The introduction of IAS to new aquatic environments has been identified as one of the four main threats to the world's oceans, along with land-based sources of pollution, over-exploitation of fisheries, and physical alteration of marine habitats[2]. Invasive species were also identified in the Global Assessment Report on Biodiversity and Ecosystem Services as one of the five drivers that impact biodiversity globally[3].

Biofouling can reduce ship performance and increase fuel consumption and emissions. As a consequence, biofouling management is already part of operational maintenance for many ships and submerged structures. However, a sole focus on fuel efficiency gains can lead to some submerged areas being ignored, such as niche areas on ships where biofouling accumulates rapidly. This does not effectively reduce the risk of transfer of IAS via biofouling.

The International Maritime Organization (IMO) has been at the forefront of international efforts to tackle IAS, developing guidance and international standards to reduce the risks of transfer of IAS through shipping. The International Convention for the Control and Management of Ships' Ballast Water and Sediments entered into force globally in 2017 to prevent the spread of harmful aquatic organisms though ships' ballast water. In 2011, the IMO, through its Marine Environment Protection Committee (MEPC), adopted the *Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species*[4] (IMO Biofouling Guidelines). MEPC also approved the *Guidance for Minimizing the Transfer of Invasive Aquatic Species as Biofouling (Hull Fouling) for Recreational Craft* [5] in 2012.

The IMO Biofouling Guidelines establish a globally consistent approach to the management of biofouling by listing measures and operational practices that should be undertaken by ship operators and other stakeholders to manage biofouling. Member States are requested to take urgent action to implement the IMO Biofouling Guidelines.

To support implementation of the IMO Biofouling Guidelines, the *GEF-UNDP-IMO GloFouling Partnerships Project* (GFP) was launched in December 2018. The GFP aims to build capacity in twelve Lead Partnering Countries (LPCs) to implement the IMO Biofouling Guidelines, as well as other relevant guidelines and best practices relating to biofouling management, to catalyse overall reductions in the transboundary introduction of biofouling-mediated IAS.

With GFP assistance, LPCs will develop, implement and enforce a broad range of legal, policy and institutional reforms, to improve biofouling management practices and thereby mitigate the risk of transferring IAS. Specifically, LPCs will, using guidance developed under the GFP, conduct national status assessments with regard to the risk of IAS transfer via biofouling, as well as economic impact assessment of IAS. LPCs are also expected to define national biofouling management strategies, based on the outcomes of the national status assessment, by using the present guide.

This guide is the third in a series of three guidance documents developed under the GFP to support legal, policy and institutional reforms in LPCs and in any other country concerned with the risk of transfer of IAS via biofouling. The other two guidance documents include:

- *Guide to Developing National Status Assessments of Biofouling Management to Minimize the Introduction of Invasive Aquatic Species (hereby referred to as the "National Status Assessment Guide"),* and
- *Guide to Developing National Rapid Economic Assessments of Biofouling Management to Minimize the Introduction of Invasive Aquatic Species.*

[2] Scianni & Georgiades, 2019

[3] IPBES, 2019

[4] International Maritime Organization, 2011

[5] International Maritime Organization, 2012

How to use this Guide

The development of country-specific National Biofouling Strategies and Action Plans is a key output for countries participating in the GFP. The purpose of national strategies and action plans are to define how countries establish and implement national biofouling management frameworks, consistent with the IMO Biofouling Guidelines.

Recognising the complexities of developing a biofouling policy, the GFP has developed this *Guide to Developing National Biofouling Strategies on Biofouling Management to Minimize the Introduction of Invasive Aquatic Species* (hereafter referred to as "this Guide") to assist the beneficiary countries to develop their own National Biofouling Strategy and Action Plan.

This Guide builds on the work that beneficiary countries are expected to have completed in a National Status Assessment and identifies the process for developing a national biofouling strategy.

A. Purpose of this Guide

The purpose of this Guide is to assist governments in developing a national strategy that will:

1) Outline the **national high-level biofouling policy**, including key biofouling measures that can adequately manage the risk of IAS transfer via biofouling and facilitate biofouling management, such as in-water cleaning, and
2) **Identify the high-level actions** required to implement the high-level biofouling policy, including who is responsible and the timeframe that actions should be completed in.

It is **intended that a finalized national biofouling strategy will have been endorsed by the national government**. This endorsement is crucial before the strategy, and its associated national biofouling management measures, can be implemented.

This Guide also identifies, and provides guidance on, the work that may need to be completed once the national biofouling strategy is adopted.

B. Summary of the Strategy Development and Implementation Phases

There are five identified phases for strategy development. A final phase (Phase 6) includes post-strategy work to prepare for implementation, as shown in **Figure 1.**

Phase 1 (Preparatory Work)

Phase 1 involves establishing the strategy development team, familiarising the team with the issue and the national situation and identifying governance arrangements.

During this phase, an individual or team should be appointed to develop the

Figure 1 - Phases of strategy development and implementation

strategy. To prepare to develop the strategy, the team or individual must have a good understanding of the biofouling issue and the national situation, through revision of the National Status Assessment outcomes. Biofouling transfer pathways should be identified so that it is clear which government agencies will be involved in the strategy development process. Establishing a plan and governance arrangements ensures that there is clarity on the approach and decision makers.

Phase 2 (Develop the Proposed High-level Biofouling Policy)

Phase 2 involves drafting a high-level biofouling policy document. The high-level biofouling policy document will include the overarching policy goals and, for each relevant pathway, the nature of biofouling management measures to be introduced (mandatory or voluntary). The policy will also include decisions on key measures and in-water cleaning, that will allow a more accurate estimate of the post-strategy work to prepare for implementation.

Phase 3 (Consult Stakeholders and Finalize the High-level Policy)

It is important to gain stakeholder perspective on the high-level policy intentions and make any required adjustment to the policy prior to developing the high-level action plan.

During phase 3, the high-level biofouling policy should be provided to relevant stakeholders for feedback. Based on stakeholder feedback, the high-level policy should be reviewed and any necessary updates made. In order to finalize the high-level policy, approval should be sought in accordance with the governance arrangements identified in Phase 1.

Phase 4 (Develop the High-level Action Plan)

Phase 4 involves identifying the actions required to implement the high-level biofouling policy, and incorporating these in a high-level action plan.

Once the high-level policy and high-level action plan have been finalized, the national biofouling strategy can be drafted.

> The high-level biofouling policy and high-level action plan will be integrated into the National Strategy document

Phase 5 (Prepare and Endorse the National Biofouling Strategy)

Phase 5 has two steps, including drafting the strategy and seeking government endorsement of the strategy.

The National Strategy document will communicate, to the government and stakeholders, how and when biofouling management measures will be implemented. When the strategy has been drafted, government endorsement of the strategy should be sought.

> Government endorsement of the strategy finalizes the strategy and commits the government to taking the actions identified in it.

Phase 6 (Post Strategy Work: Prepare for Implementation)

Post-strategy work will depend on the high-level biofouling policy and high-level action plan. Potential work may be required to:

- Finalize voluntary guidelines (if relevant),
- Further develop the mandatory biofouling requirements (if relevant),
- Further develop the in-water cleaning arrangements (if relevant),
- Determine how to monitor the effectiveness of the biofouling management measures, and
- Assess the feasibility of implementing measures and arrangements.

C. Strategy Development Timeline

The total estimated timeline for developing and implementing a national biofouling strategy will depend on the post-strategy work that is required.

The minimum estimated time required is summarised in **Figure 2**.

The approximate timing associated with each phase of strategy development is captured in **Figure 3 - Roadmap for development of a national biofouling strategy.**

The strategy development process is anticipated to take approximately between 10 and 12 months in total.

Estimated timing is included as a guide only, and will vary depending on a number of aspects, including (but not limited to) the:

- Size of the strategy development team,
- Outcomes of the National Status Assessment,
- Support provided to the strategy development team, and the
- Number of pathways and stakeholders involved in the process.

The length of time it takes to complete the National Biofouling Strategy will also be affected by government processes, including whether there is political will to progress the implementation of biofouling management measures, and the length of time it takes to gain government endorsement of the strategy.

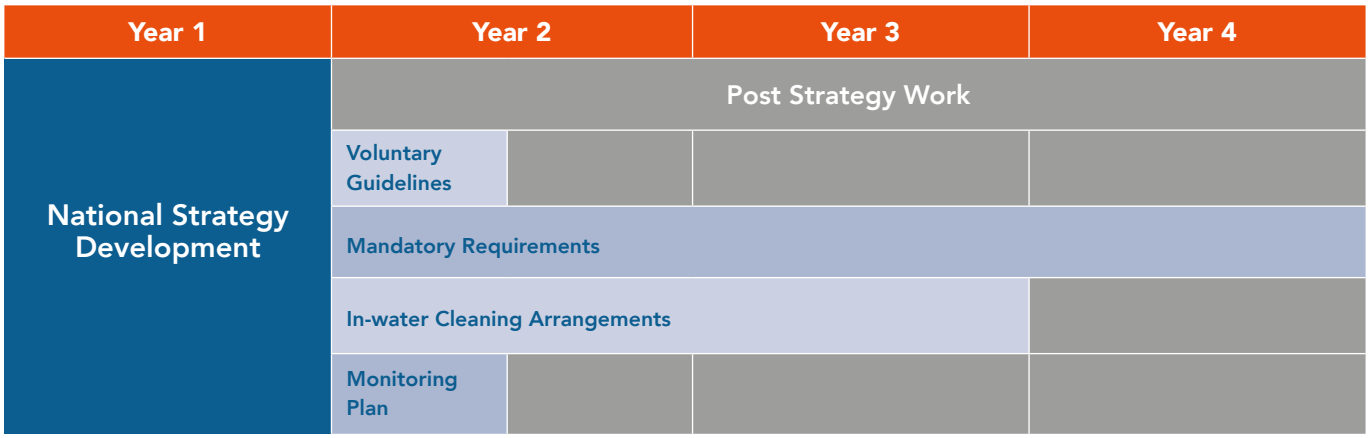


Figure 2 - Estimated timeframes for implementation of aspects of biofouling policy

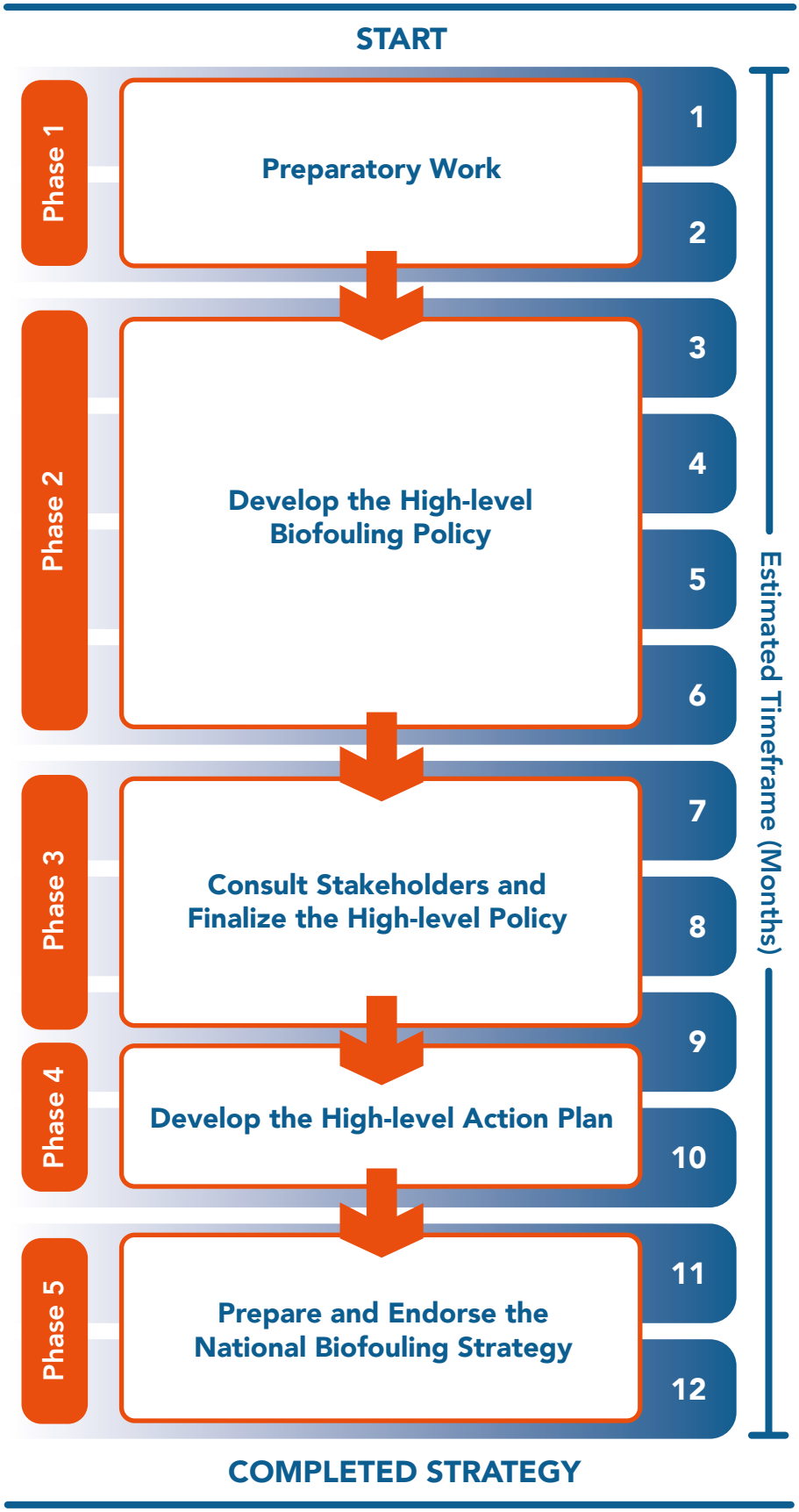


Figure 3 - Roadmap for development of a National Biofouling Strategy

D. Post Strategy Work and Preparing for Implementation

Once the strategy is finalized, the work required to implement the strategy will vary depending on the high-level biofouling policy. This should be broadly identified in the high-level action plan.

If mandatory biofouling requirements are intended to be implemented for one or more pathways, **detailed policy work** will be required to define the requirement and compliance and enforcement arrangements, and additional work may be required to amend or introduce legislation, train personnel and develop systems to support implementation.

Similarly, if the high-level policy includes an intention to manage the risks associated with in-water cleaning, there will be additional policy work to determine what the in-water cleaning requirements will be, and build these into legislation. It will also be important to determine how the effectiveness of the measures will be monitored, through options such as field surveillance and/or gathering information from stakeholders.

Prior to implementing any measure or arrangement, it will be necessary to assess the feasibility of doing so, to ensure the agency responsible for implementation has sufficient resources and capability to do so effectively.

E. Guide Structure and Content

This guide has **six chapters in total, with each chapter** corresponding to each of the six phases of strategy development and implementation as outlined in **Figure 1.** Each chapter (or phase) includes several sections (steps for completion).

Each **section** of a chapter refers to a step needed to complete the phase.

Example:
Chapter 1 (Preparatory Work) outlines preparatory work required to achieve **phase one** for the strategy development. This phase has three steps, each addressed in a section of the chapter:

- Step 1 - Establish strategy development team and plan (section 1.1),
- Step 2 – Understand the biofouling issue and national status (section 1.2), and
- Step 3 - Develop governance arrangements (section 1.3).

Sections include **information** that can be used to guide decision making.

Information is highlighted blue.

Each step has **tasks** that must be completed in order to complete the step. The tasks are presented in a Table with the description of the task, the person(s) responsible for completion, and a column “Completed?” to serve as a check-list.

Tasks are highlighted orange.

When relevant, the section also includes **recommendations.**

Recommendations are highlighted green.

Where **recommendations** are included, they are designed to assist strategy development, promote consistency with the IMO Biofouling Guidelines and provide effective biofouling management measures with limited resources. These recommendations should be considered in the national context so that the policy

is appropriate to the resources available and biofouling risk.

The **Annexes** provide templates for the high-level biofouling policy, communication plan, high-level action plan and national biofouling strategy, and additional supporting tools and information to prepare for implementation, including an example of a biofouling risk assessment, templates for feasibility and impact assessments and legislative frameworks for mandatory biofouling requirements and in-water cleaning arrangements, if relevant.

1 Phase One – Preparatory Work

Phase One (Preparatory Work) involves establishing the **strategy development team,** getting the team **familiar with the biofouling issue** in the national context, and **developing a plan** and **governance arrangements** for developing the strategy.

The steps required to complete Phase One, and the approximate timing associated with each step, are summarised in **Figure 4** below. The work in Phase One should be led by the government policy agency that has the lead responsibility for managing IAS.

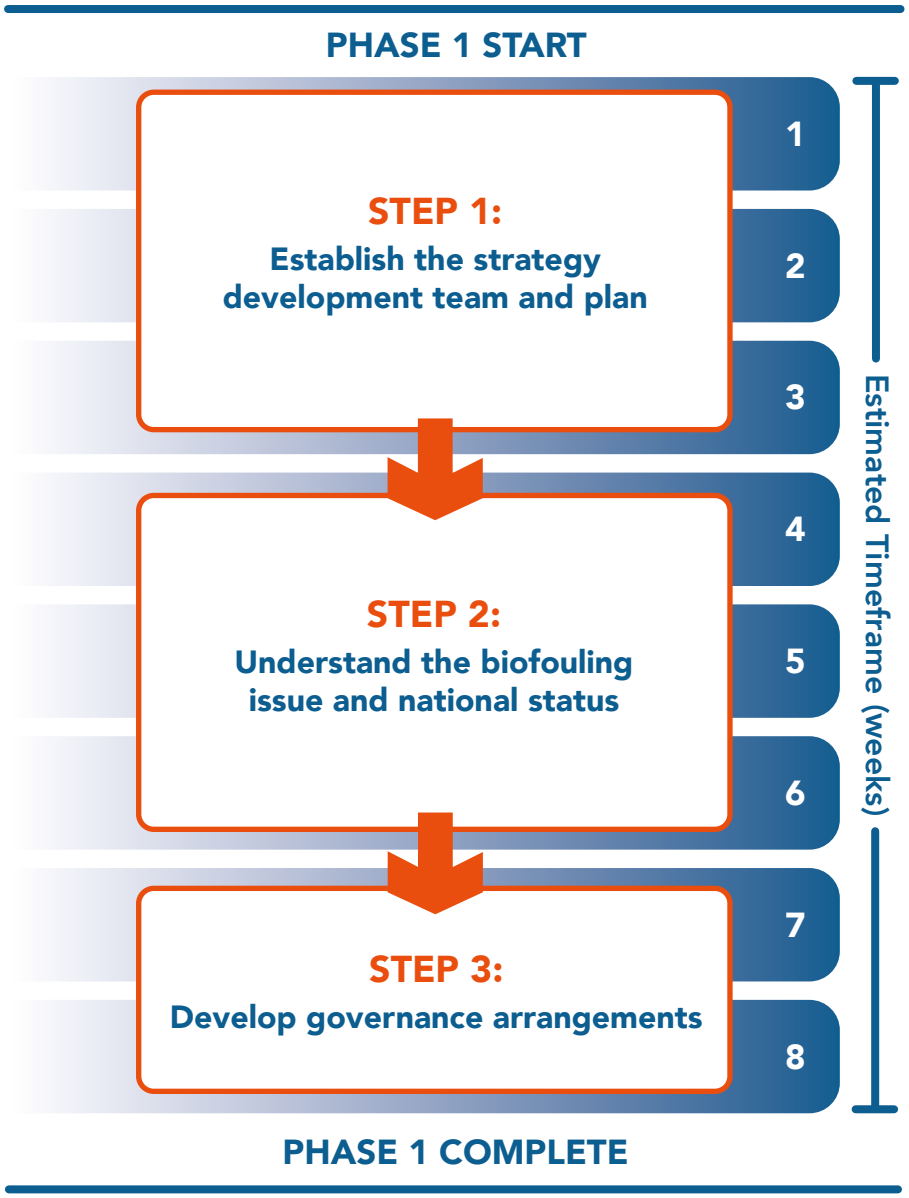


Figure 4 - Steps to complete Phase One - Preparatory Work

1.1 STEP 1 - Establish the Strategy Development Team and Plan

Successful development of the strategy will require ensuring there are dedicated officers that are capable of preparing the strategy. The **government policy agency that has the lead responsibility for managing IAS should nominate the strategy development team.**

If possible, at least one member of the strategy development team, ideally the

leading expert, should be based within the lead IAS agency. The strategy development team should:

1) Consist of one or more individuals, with expertise in:

- Biofouling, IAS and maritime policy,
- Building effective working relationships across government agencies, and
- Experience implementing biofouling, IAS or maritime policies.

2) Complete all phases of strategy development and work with other relevant agencies to:

- Develop the high-level biofouling policy,
- Incorporate pathway-specific biofouling policies into the high-level biofouling policy,
- Consult stakeholders and finalize the high-level biofouling policy,
- Develop the high-level action plan, and
- Develop the national strategy document.

3) Have a mix of skills, including the ability to:

- Manage projects,
- Develop policy,
- Analyse and understand complex information,
- Write reports, briefs and communication materials, and
- Communicate with stakeholders and other government agencies.

In most cases, a team, rather than an individual, will be needed to deliver all these skills.

The strategy development team should report to an overall decision maker - a senior manager appointed by the policy agency to be accountable for development of the strategy and to approve and progress the strategy for government endorsement.

The strategy development team should provide the overall decision maker with a project plan for completing the strategy prior to embarking on the strategy development process.

The plan should be based on the phases and suggested timing in **Figure 3.**

The plan should indicate how and when the team will update the manager on their progress. The team should also seek advice from the manager on their expectations for the strategy. This will help guide the strategy development team and lead to a smoother approval and endorsement process.

Tasks	Responsibility	Completed?
1. Identify overall decision maker	Lead IAS policy agency	
2. Nominate strategy development team	Lead IAS policy agency	
3. Develop strategy development plan	Strategy development team	

Table 1 - Tasks required to establish the strategy development team and plan

1.2 STEP 2 – Understand the Biofouling Issue and National Status

In order to prepare the strategy, the strategy development team should have a sound knowledge of the biofouling issue in the national context.

This requires knowledge of key aspects of biofouling, including:

- The **movement of ships and other floating structures provides pathways for the introduction of IAS** to new marine areas. Introduction may be intentional, such as for fisheries or aquaculture, or unintentional, through discharge of ships' ballast water and biofouling on ship hulls, submerged structures and equipment.
- Whilst management of ballast water has been the focus of the international community's efforts to reduce the risk of transfer of IAS until recently, **biofouling represents an equal, if not greater, risk for the introduction of IAS than ballast water, in some circumstances[6].**
- Biofouling on ships and submerged structures can cause the **introduction and spread of IAS through organisms that attach to the structure, survive a voyage and are released in a new aquatic environment.** If conditions are suitable, IAS can thrive in the new environment. If there are no natural predators, IAS can become dominant and disrupt the biodiversity in the new habitat. This can have a variety of impacts, including disrupt fisheries, cause significant maintenance and operational problems for coastal industry and infrastructure and interfere with human amenity.
- On ships, **biofouling can also significantly impact the fuel consumption and total GHG emissions** produced. Biofouling increases surface roughness; so, the more fouling, the greater the impact on fuel consumption. The IMO is focused on improving ship energy efficiency and adopted an initial strategy for the reduction of GHG emissions from ships under MARPOL[7] Annex VI (Regulations for the Prevention of Air Pollution from Ships) in 2018. **Management of biofouling to reduce fuel consumption, improve efficiency and reduce GHG emissions is recognised as a practical measure that is a 'win-win' for the environment and the shipping industry[8].**

1) Review the national status assessment

A national status assessment, prepared in line with the guide: Guide to Developing National Status Assessments of Biofouling Management to Minimize the Introduction of Invasive Aquatic Species[9] (hereby referred to as the National Status Assessment Guide), provides the baseline information needed to develop a national biofouling strategy. The **national status assessment report** should include:

- Identified transfer pathways and their relative risk profiles,
- A description of any current biofouling management measures, or level of preparedness to implement biofouling management measures, and
- A determination of whether one or more biofouling management measures, in addition to any current measures, are required to reduce or mitigate the risk from the introduction and/or spread of IAS as a result of biofouling.

The strategy development team should have an in-depth knowledge of the national status assessment, if a national status assessment was conducted, or collect baseline information, prior to embarking on strategy development.

[6] Hewitt et al., 1999; Hewitt and Campbell, 2010

[7] MARPOL is the International Convention for the Prevention of Pollution from Ships, 1973

[8] The GloFouling website has additional information and references for the relationship between biofouling and GHG emissions.

[9] GEF-UNDP-IMO GloFouling Partnerships, 2021

2) Understand biofouling pathways

There are a number of potential pathways for biofouling as shown in **Figure 5** below.

Figure 5 - Potential pathways for the introduction of IAS through biofouling

These can be distinguished into two categories:

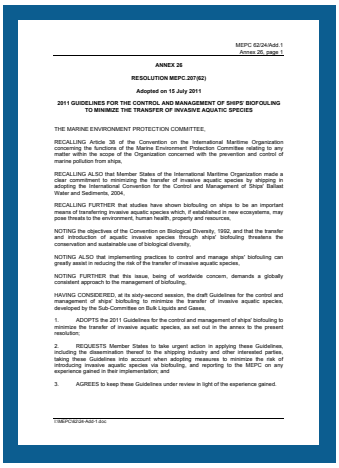
- **Primary transfer pathways** - international movements, from one country to another, of ships and structures (for example trading and non-trading ships, large superyachts, offshore oil and gas structures) that are responsible for the initial introduction of non-indigenous fouling organisms into a new region, and
- **Secondary transfer pathways** – domestic movements, from one area to another within a country, of ships and structures (for example domestic shipping, including small recreational craft, measuring and aquaculture equipment) that can distribute already introduced non-indigenous species more widely.

A full description of the pathways, and biofouling problems associated with these pathways, is included in the National Status Assessment Guide.

With pathways identified, it should also be possible to **identify the relevant lead government policy agency for each pathway.** Not all pathways will have the same lead policy agencies. For example, transport or maritime agencies may be responsible for commercial shipping, whilst energy and resources agencies may be responsible for oil and gas structures and deep-sea mining. Recreational boating may be managed nationally or by regionally-based agencies and may fall under fisheries or transport portfolios.

Identifying the lead government policy agencies for each pathway early in the strategy development process allows government agencies to communicate and coordinate appropriately.

3) Know the IMO Biofouling Guidelines



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ANNEX 26

RESOLUTION MEPC.207(62)

Adopted on 15 July 2011

2011 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 transfer and introduction of aquatic invasive species through ships' biofouling threatens the conservation and sustainable use of biological diversity,

NOTING ALSO that 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,

HAVING CONSIDERED, at its sixty-second session, the draft Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species, developed by the Sub-Committee on Bulk Liquids and Gases,

1. ADOPTS the 2011 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 introduction of invasive aquatic species via biofouling, and reporting to the MEPC on any experience gained in their implementation; and

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

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The international nature of shipping and marine industries means that a **patchwork of regulations should be avoided.** International consistency is a priority of the International Maritime Organization (IMO), a specialised agency of the United Nations responsible for creating a regulatory framework for the shipping industry for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships.

In July 2011, IMO adopted the IMO Biofouling Guidelines[10], in response to concerns raised by its Member States about the risks posed by biofouling on ships. The IMO Biofouling Guidelines are broadly applicable, as the definition of 'ships' includes:

***"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 and production units (FSUs) and floating production storage and off-loading units (FPSOs)".*

As guidelines, the IMO Biofouling Guidelines are a **non-mandatory** part of the IMO framework for the shipping industry.

The IMO Biofouling Guidelines recognise that effective anti-fouling application and maintenance are the primary means of biofouling prevention and control for existing ships' submerged surfaces, including hull and niche areas. They include guidance on anti-fouling systems installation and maintenance; in-water inspection, cleaning and maintenance; design and construction; disseminating information; and training and education.

The guidelines focus on preventative measures to minimize biofouling. The guidelines recommend that all ships have a **Biofouling Management Plan (BFMP)** and **Biofouling Record Book (BFRB).**

A BFMP is to be **ship-specific** and provide a description of the biofouling management strategy for the ship with **sufficient details** to allow the ship's Master and crew members to understand and implement the plan. The IMO Biofouling Guidelines includes the recommended format and content for a BFMP.

A BFRB should include **records of all inspections and biofouling management measures** undertaken on the ship.

The BFMP and BFRB assist interested Member State authorities to **assess the potential biofouling risk of the ship**. Under the IMO Biofouling Guidelines, the BFMP and BFRB may stand alone, or be integrated into a ship's existing operational and procedural manuals and/or planned maintenance programme.

In addition to the IMO Biofouling Guidelines, the IMO also adopted the ***Guidance for Minimizing the Transfer of Invasive Aquatic Species as Biofouling (Hull Fouling) for Recreational Craft***[11] in 2012. The guidance is for use by all owners and operators of recreational craft less than 24 metres in length and provides recommendations on antifouling systems and good maintenance practices, including the cleaning of hull and niche areas.

[10] International Maritime Organization, 2011

[11] International Maritime Organization, 2012

4) Be informed about the review of the IMO Biofouling Guidelines

A **review of the 2011 IMO Biofouling Guidelines began in 2020** in accordance with the *2013 Guidance for Evaluating the 2011 Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species*[12] (resolution MEPC.207(62)).

Member States and observers have identified impediments to the implementation of the IMO Biofouling Guidelines[13]. Many noted that **even where efforts had been made to disseminate information and promote the guidelines, there was variable awareness and limited uptake.**

As a result, there are specific aspects that are being considered in the review. The report of the Correspondence Group on Review of the Biofouling Guidelines[14] identifies key elements for revision, including:

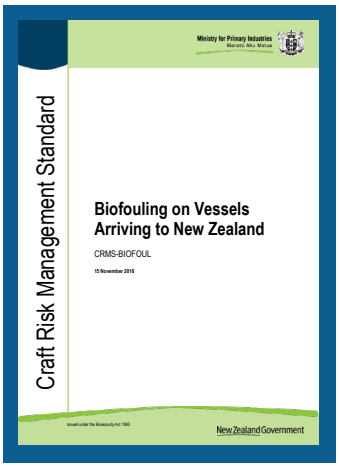
- **Restructure** of the Guidelines to result in more user-specific guidance that is clearer, more concise and less general,
- More **specific guidance on Biofouling Management Plans and Record Books** so that plans are ship-specific and user-friendly,
- A **quantitative definition of micro- and macro-fouling** in terms of thickness and substances/species and recommended maximum acceptable levels,
- Inclusion of **recommendations for format and content of inspection and cleaning reports** and records for maintenance of the anti-fouling system,
- A **recommended biofouling level that should lead to cleaning or other management actions,** in order to minimize or avoid the transfer of IAS,
- A **recommended outcome (biofouling level) for in-water cleaning operations** and how cleaning operations should be documented in the record book,
- **Recommended handling (capture and disposal) of biological waste** from cleaning operations, and
- **General guidance on assessment of biofouling management practices** and appropriate contingency measures.

National biofouling policies should retain sufficient flexibility so as to align with the 2011 IMO Biofouling Guidelines and any future amendments.

5) Be aware of current and emerging domestic regulations

Internationally, **few governments have introduced mandatory requirements** that are consistent with the IMO Biofouling Guidelines.

New Zealand was the first country to introduce mandatory biofouling requirements consistent with the direction of the IMO Biofouling Guidelines. The Craft Risk Management Standard: Biofouling on Vessels Arriving to New Zealand[15] (CRMS) was implemented in 2018.



The CRMS **applies to all ships arriving into New Zealand**, including commercial ships and recreational craft.

[12] International Maritime Organization, 2013

[13] International Maritime Organization, 2020 (a-g)

[14] International Maritime Organization, 2021

[15] Ministry of Primary Industries, 2018 (a)

The **State of California also introduced biofouling regulations in 2018** under the California State Lands Commission's Article 4.8 Biofouling Management to Minimize the Transfer of Nonindigenous Species from Vessels Arriving at California Ports[16].

The **Californian regulation applies to all ships 300 gross tons or more**, after delivery into service or their first dry-docking after 1 January 2018.

The requirements in New Zealand and California vary due to the differing legislative frameworks in each jurisdiction, however **both are consistent with the IMO Biofouling Guidelines** and focus on preventative, proactive biofouling management[17]. The approaches taken by New Zealand and California are referred to and discussed throughout this guide.

Other countries, such as Australia and the United States, are in the process of developing mandatory biofouling requirements. Australia released a consultation regulation impact statement on Australian biofouling management requirements for international ship arrivals in 2019[18]. Australia has also released a number of pathway specific biofouling guidelines and anti-fouling and in-water cleaning guidelines[19].

The United States Environment Protection Agency has developed a proposed rule that incorporates standards of performance for biofouling under the *Vessel Incidental Discharge Act 2018*[20], which is currently pending review with the United States Office of Information and Regulatory Affairs.

Tasks	Responsibility	Completed?
1. Understand the biofouling issue, the IMO Biofouling Guidelines and become familiar with the review of the IMO Biofouling Guidelines	Strategy development team	
2. Review the outcomes of the national status assessment	Strategy development team	
3. Identify all relevant pathways and responsible government agencies	Strategy development team	

Table 2 - Tasks required to familiarise the strategy development team with the biofouling issue

If a national status assessment has not been completed, an assessment should be conducted in accordance with the National Status Assessment Guide.

[16] California State Lands Commission, 2018

[17] Scianni *et al., in press.*

[18] Australian Government, 2019

[19] Marine Pest Sectoral Committee, 2009 (a-e) and 2013; Australian Government, 2015

[20] United States Government, 2018

1.3 STEP 3 - Develop Governance Arrangements

Clearly assigned roles are important in a coordinated approach to development of the strategy. Development of the strategy is likely to require input from multiple government agencies, and **each agency must understand its responsibilities and its role in decision making.** Governance arrangements will vary from country to country depending on how many pathways are relevant in the national context and how the government currently addresses each pathway and IAS.
It may be necessary to:

Establish governance arrangements for:

- The lead IAS policy agency (to clarify who is responsible for the strategy), and
- Pathway-specific policy agencies (to clarify who is responsible for drafting and approving pathway-specific high-level biofouling policy).

Developing pathway-specific governance arrangements is important to ensure the high-level biofouling policy is developed and implemented consistently and effectively for the entire pathway.

AND

Identify how the overall decision maker and the strategy development team will interact and work with the relevant agencies for each pathway, to ensure pathway-specific policies are nationally consistent with overarching policy goals.

Governance arrangements in **pathway-specific agencies** may consist of:

A decision maker (or board of decision makers)

To provide high-level oversight of pathway-specific policy development and resolve conflicts in relation to policy, funding, resource allocations and communications,

AND

A project team

To lead the pathway-specific policy development, consisting of a team leader (most likely a policy expert), communications expert, legal expert and compliance and enforcement expert.

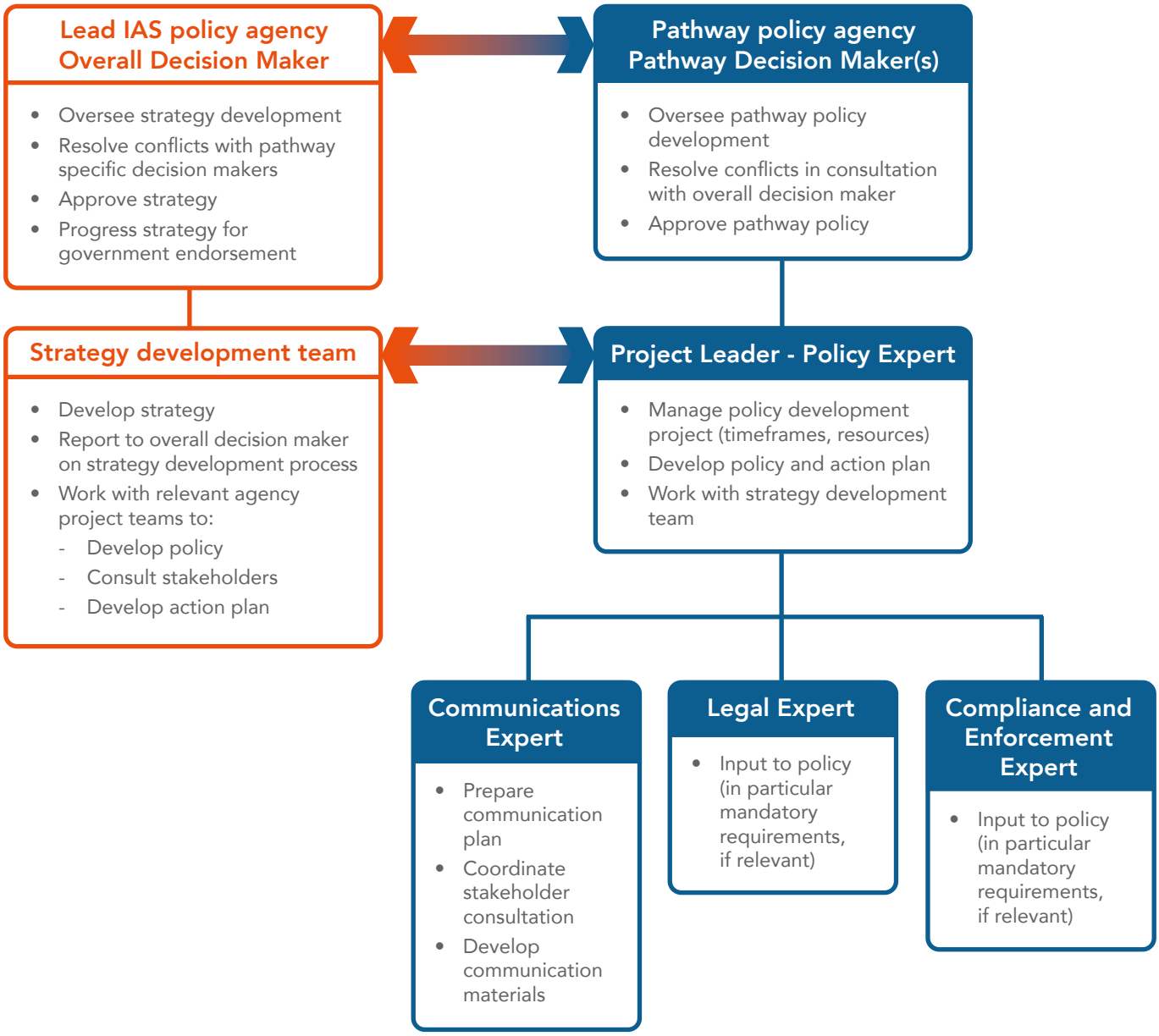


Figure 6 - Strategy and high-level policy development governance framework

Figure 6 outlines a suggested governance framework, including roles, responsibilities and reporting arrangements for development of the strategy and high-level biofouling policy.

During development of the high-level policy, the legal and compliance and enforcement experts may only be required to provide advice. If the high-level policy includes implementation of mandatory requirements, then the legal and compliance experts will play a more prominent role in further detailed policy and legislative amendments work post-strategy.

Tasks	Responsibility	Completed?
1. Seek agreement from relevant government agencies to participate in strategy development and nominate a lead officer	Overall decision maker / Strategy development team	
2. Identify pathway-specific decision maker(s) (or a decision-making board) for the pathway-specific high-level biofouling policy development	Pathway-Specific Policy Agencies	
3. Identify pathway-specific project teams to develop pathway-specific high-level biofouling policy	Pathway-Specific Policy Agencies	
4. Liaise with pathway-specific decision makers and project teams to obtain high level commitment to national consistency in biofouling policy across all agencies and jurisdictions	Strategy Development Team and Overall Decision Maker	
5. Provide all relevant agencies with governance arrangement structure for clarity and transparency	Strategy Development Team and Overall Decision Maker	

Table 3 - Tasks required to develop governance arrangements

Recommendation for developing governance arrangements:

Use the framework included in Figure 6 - Strategy and high-level policy development governance framework - as a template to develop governance arrangements.

2

Phase Two – Develop the High-Level Biofouling Policy

Preparing a high-level biofouling policy is a critical step in the development of an effective national biofouling strategy as it will define the nature and key aspects of the management measures (voluntary vs. mandatory) to address the risk of IAS transfer via biofouling.

This Phase Two (Develop the high-level biofouling policy) includes several steps (**Figure 7**) for the development of high-level policy and involves using the **high-level biofouling policy template, provided in ANNEX A**, to prepare a proposed high-level biofouling policy.

The proposed high-level biofouling policy will be released for consultation and finalized in Phase Three (**CHAPTER 3**).

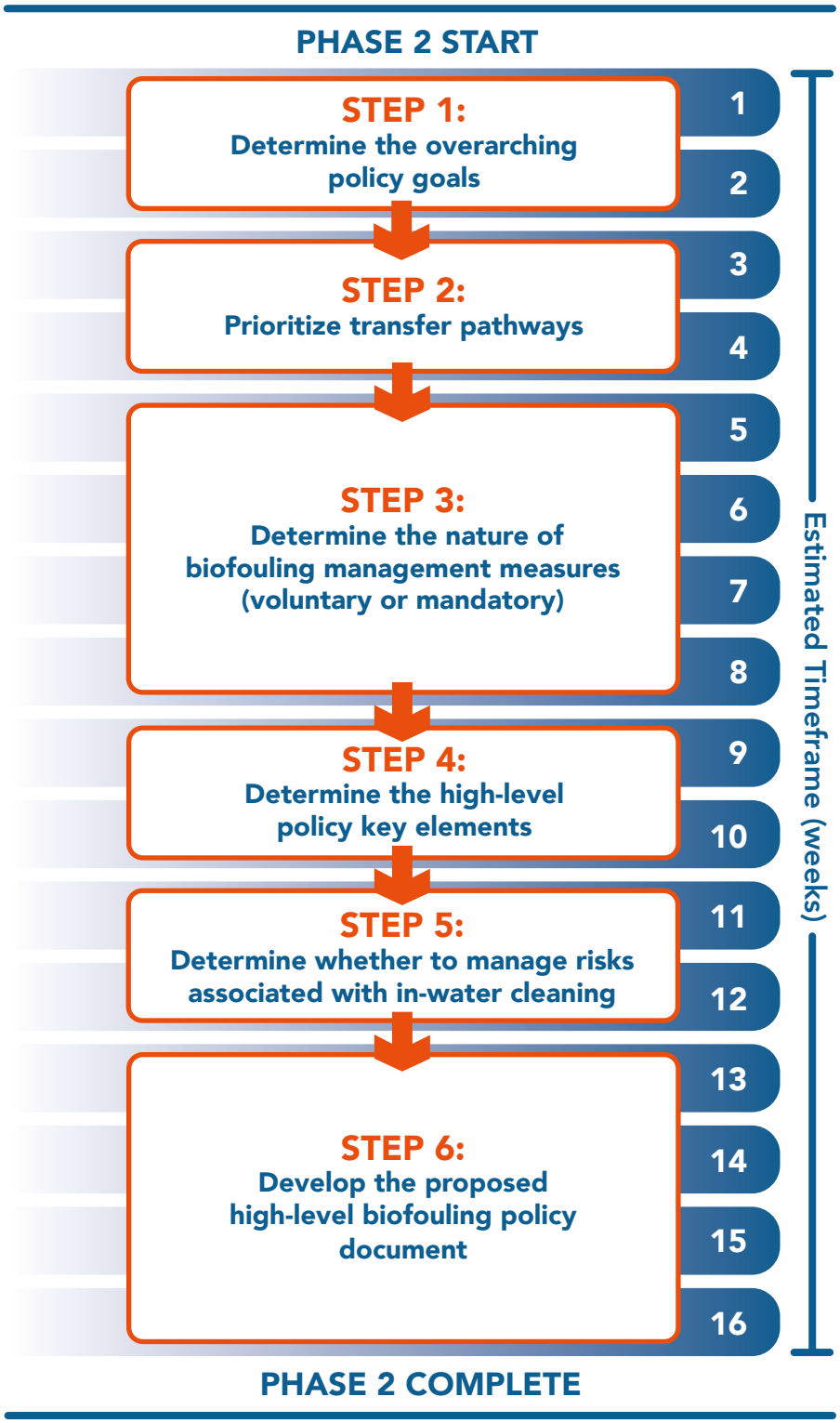


Figure 7 - Steps to complete Phase Two - Develop High-Level Biofouling Policy

2.1 STEP 1 - Determine the Overarching Policy Goals

There are **three overarching policy goals that must be agreed by all relevant government agencies** in order to set direction for the biofouling strategy and ensure consistency in policy decision making.

These are the **national vision, guiding principles and overall outcome** (or result) that is sought.

All policy decisions should be in line with the overarching policy goals to ensure consistency. The national vision, guiding principles and overall outcome set the direction for the biofouling strategy, and can be described as:

> **National Vision:** Identifies the desired outlook and sets broad direction for all related initiatives, including the strategy
>
> **Guiding Principles:** What are the foundations of the strategy that all policies must be consistent with
>
> **Overall Outcome:** What will be achieved by implementing the strategy

The **national vision may be broader than biofouling** and relate to management of all vectors to reduce the impact of IAS. The national vision may already be set in government policy and may have been identified in the national status assessment.

An example is: *Maintaining a healthy and resilient marine environment that is protected from the threat of IAS, and which supports our economy and social amenity.*[21] This national vision indicates an intention to manage IAS vectors whilst minimising the impact on industries.

The **guiding principles and overall outcomes are specific to biofouling management.** Guiding principles that are consistent with the IMO Biofouling Guidelines and the mandate of the IMO are:

1) **To minimise the risk of transferring Invasive Aquatic Species (IAS) through biofouling, and**
2) **To seek international consistency in biofouling management measures.**

Member States that have explored implementation of biofouling management measures have identified two possibilities for the overall outcome. These include:

> A. The **amount of biofouling** entering the jurisdiction on ships and submerged structures is minimized,
>
> B. The number of IAS entering the jurisdiction on ships and submerged structures is minimized (otherwise known as the 'species-based' approach).

Of these possibilities, only **A (minimize the amount of biofouling entering a jurisdiction) is consistent with the IMO Biofouling Guidelines and guiding principle 2 (to seek international consistency).**

To reduce the likelihood of IAS entering and establishing in a new location, the number of IAS entering the jurisdiction must be minimised. However, practically managing for individual species, as approach B does, is problematic. These difficulties, for both government and industry, are described more fully in the detailed **comparison of the advantages and disadvantages of these overall outcomes included in ANNEX B.**

[21] Adapted from the Australian MarinePestPlan 2018-2023 (Australian Government, 2018).

[22] Bell et al., 2011; Georgiades *et al.*, 2020.
[23] Australian Government, 2015

New Zealand[22] and Australia considered both approaches in the development of biofouling management measures. Both countries acknowledged the difficulties with a species-based approach and found that minimizing the amount of biofouling (A) was favoured. In Australia, minimizing the amount of biofouling was also favoured by industry stakeholders[23].

Minimizing the amount of biofouling (A):

- **Is a pragmatic approach to managing biofouling risks.** It acknowledges the difficulties associated with identifying IAS in situ and the need for rapid border clearance of ships and structures whilst reducing the risk as far as possible,
- **Identifies all biofouling as a risk,** recognizing the uncertainty in determining which species may become an IAS,
- **Promotes proactive behaviour** with a focus on prevention and allows for an internationally consistent approach, and
- Is **consistent** with biofouling policies in Australia, New Zealand, the United States (including specific policies in the state of California).

Tasks	Responsibility	Completed?
1. Identify communication mechanisms, forums, regional agreements or partners that will be used to ensure international and regional alignment	Strategy Development Team	
2. Review the national status assessment to identify if a national vision is already defined. If not, define the national vision.	Strategy Development Team	
3. Define the guiding principles and overall outcome	Strategy Development Team	
4. Engage regionally and internationally (for example, other GFP lead partner countries and strategic partners, regional environment organizations, informal and formal communications with experts from other countries, including experts from Australia, New Zealand and the United States) to seek international consistency and align overarching policy goals	Strategy Development Team	
5. Review any existing biofouling or IAS policies to ensure they align with the national vision, guiding principles and overall outcome	Strategy Development Team	

Table 4 - Tasks required to determine the overarching policy goals

Recommendations for overarching policy goals:

National Vision

Maintain a healthy and resilient marine environment that is protected from the threat of Invasive Aquatic Species, and which supports the economy and social amenity.

Guiding Principles

1. To minimize the risk of transferring Invasive Aquatic Species (IAS) through biofouling, and
2. To seek international consistency in biofouling management control measures.

Overall Outcome

To minimize the amount of biofouling entering the country on ships and submerged structures.

2.2 STEP 2 – Prioritise Transfer Pathways

It is likely that more than one transfer pathway was identified in the national status assessment. It may be necessary to prioritise transfer pathways so that biofouling management measures are implemented for the highest risk pathways first.

In order to **prioritise pathways**, it may be necessary to:

1) Review the primary pathways first

Primary pathways include ships and/or structures that operate in international ports, and therefore are able to **accumulate biofouling from different marine areas which can result in introduction of IAS to a country.**

Introducing **biofouling management measures for primary pathways will reduce the likelihood of IAS introduction,** and therefore reduce the need to control the spread of IAS through secondary pathways.

2) Review the biofouling risk posed and current biofouling management arrangements in place for each pathway

Risk of a pathway can be determined by a review of the information gathered in the national status assessment, including:

- The **number of ships or structures operating in the pathway,**
- The **operating profile of those ships/structures** – including the most common origin of travel, time commonly spent stationary and average travel speed, and
- **Critical gaps** in the current biofouling management arrangements for the pathway.

These factors contribute to the amount of biofouling likely to accumulate on the submerged surface, and therefore are good indicators of biofouling risk.

More ships/structures can mean a greater submerged surface area that biofouling can accumulate on, noting that the size of the ships/structures should be taken into consideration. **The more biofouling, the greater the likelihood of IAS introduction.** Therefore, primary pathways with the highest numbers of ships/structures are likely to be the highest priority, particularly where there are gaps in current biofouling arrangements.

Primary pathways with fewer ships/structures but operating profiles that involve significant periods of slow movement or time spent stationary, and no, or inadequate, current biofouling management arrangements, are also a priority. **Slow movement and stationary periods can increase the rate of biofouling accumulation.**

Primary pathways that operate predominantly on the high seas should be a lower priority than those that visit international ports. IAS are present in higher numbers in ports and therefore have a greater chance of settling in biofouling communities when ships are in port and stationary.

Secondary pathways should then be prioritized based on similar factors – the number of ships or structures operating, the operating profile of those ships/structures and the current biofouling arrangements.

Tasks	Responsibility	Completed?
1. Develop an initial list of transfer pathways in order of priority for the development and implementation of biofouling management measures, based on the outcomes of the national status assessment.	Strategy Development Team	
2. Consult pathway-specific agencies on the initial list of priorities.	Strategy Development Team	
3. Finalize the prioritisation of transfer pathways.	Strategy Development Team	

Table 5 - Tasks required to prioritise transfer pathways

Recommendation for prioritising transfer pathways:

Prioritize primary transfer pathways representing the highest risk and with critical gaps in current biofouling management measures.

2.3 STEP 3 - Determine the Nature of the Biofouling Management Measures for each Pathway

Biofouling management measures may take the form of either **voluntary guidelines** or **mandatory requirements.**

The **high-level biofouling policy should include decisions, for each relevant pathway, on whether voluntary guidelines will be distributed, or mandatory requirements will be implemented.**

Distribution of voluntary guidelines differs considerably compared to implementation of mandatory requirements in relation to:

- The **possible compliance actions** that are available to the implementing government agency under the measure (Table 6),
- The **time and processes** required to develop and implement the measure (Table 7), and
- The **resource implications** for developing and implementing the measure (Table 8).

Effective communication and education are critical to the successful implementation of both voluntary and mandatory measures. However, **only mandatory measures provide the ability to mitigate risk**. Under voluntary measures, owners and operators of suspected high-risk ships/structures can be asked to mitigate biofouling risk, however this cannot be enforced.

Unlike voluntary measures, though, **mandatory measures can require a significant amount of time to develop and implement.** If the national status assessment identified critical gaps in the current biofouling management measures for the pathway, and it is a priority to get *something* in place as soon as possible, it is an option to i**ntroduce voluntary measures as a first step.** This provides an opportunity to start communication and education activities as soon as possible.

Agencies considering implementing mandatory measures should also consider the resources that may be needed. **Developing and implementing mandatory measures can be resource intensive.** Decisions relating to key policy elements for mandatory measures, such as who will undertake inspections, whether pre-arrival reporting will be required, and whether in-water inspections will be conducted, will influence the number of personnel and the equipment required.

Internationally, **there is growing concern amongst some countries that the voluntary nature of the IMO Biofouling Guidelines has limited their implementation** and the guidelines are not reducing biofouling on ships or minimizing the potential risk of introduction and spread of IAS.

Input to the review of the IMO Biofouling Guidelines at the seventh session of the Pollution Prevention and Response Sub-Committee (PPR) in 2020 indicated that, whilst awareness of the guidelines in some countries is high, the implementation of the guidelines remains variable[24]. This suggests that part of the commercial shipping industry is choosing not to implement the guidelines.

In response to this, New Zealand implemented mandatory biofouling requirements for all commercial and recreational ships arriving into New Zealand in 2018[25]. California introduced mandatory biofouling requirements for most commercial ships in 2018[26], and Australia and the United States both have biofouling related legislation, with policy to implement mandatory requirements being developed.

Almost all members of the Correspondence Group to review the IMO Biofouling Guidelines[27] agreed that regulations such as implemented in New Zealand helps the uptake and implementation of the guidelines.

[24] International Maritime Organization, 2020 (a-g), 2021

[25] New Zealand Ministry of Primary Industries, 2018 (a) – Craft Risk Management Standard

[26] California State Land Commission, 2018

[27] International Maritime Organization, 2021

Table 6 - Comparison of compliance actions possible under voluntary vs mandatory measures

Compliance Action	Voluntary	Mandatory
Undertake education and communication activities to promote proactive biofouling management and encourage all ships/structures to develop a Biofouling Management Plan (BFMP) and Record Book (BFRB)	☑	☑
Undertake a biofouling risk assessment on in-coming ships/structures prior to arrival	Only if ships/ structures voluntarily report their biofouling status pre-arrival	Only if ships/ structures voluntarily report or there is a mandatory requirement to report
Require high risk incoming ships/ structures manage biofouling before or on arrival	No	☑
Require ships/structures to hold an appropriate BFMP and BFRB specific to the ship/structure and its operating profile	No	☑
Penalise ships/structures that do not have a BFMP and BFRB	No	☑
Inspect ships/structures to inform a biofouling risk assessment	Only if ships/ structures voluntarily allow an inspection	☑
Direct suspected high-risk ships/ structures to provide evidence (for example, an in-water inspection report) of actual biofouling status	No	☑
Direct high-risk ships/structures to mitigate biofouling risk (for example, in-water clean the submerged surfaces)	No	☑
Penalise ships/structures for not complying with a direction to provide evidence or mitigate risk	No	☑

Time and processes to prepare to implement biofouling management measure	Voluntary	Mandatory
Minimum time required to prepare for implementation (estimate only)	6 months	3 years
Processes that may be required prior to implementation	1. Finalize guidelines 2. Develop communications plan 3. Complete feasibility assessment 4. Prepare guidelines for distribution 5. Train personnel	1. Develop detailed mandatory requirement policies 2. Develop detailed compliance and enforcement arrangements 3. Develop communications plan 4. Complete feasibility assessment 5. Undertake impact assessment 6. Consult stakeholders 7. Review and finalize detailed policies and arrangements 8. Gain government approval to proceed 9. Draft and implement legislative changes 10. Prepare materials and guidance for distribution 11. Communicate with stakeholders about upcoming requirements 12. Develop necessary systems and databases 13. Purchase necessary equipment 14. Train personnel

Table 7 - Comparison of the time and processes needed to develop and implement voluntary vs mandatory measures

	Resource Implications	Voluntary	Mandatory
Preparing for Implementation	Policy/communications officers to undertake communication and education activities	1-2 Full Time Employees (FTE)	1-2 FTE
	Policy officer develop detailed policies	0	1-2 FTE
	Compliance officer to develop compliance and enforcement arrangements	0	1-2 FTE
	Policy and legal officers to draft and amend legislation	0	1-2 FTE
	Total *(estimate only)*	**1-2 policy / communications officers**	**1-3 policy officers 1 communications officer 1-2 compliance officers**
Implementing the measure	Policy/communications officers to distribute guidelines/ requirements and communicate with stakeholders	1-2 FTE	1-2 FTE
	Policy officer to respond to enquiries	0.5-1 FTE	1-2 FTE
	Policy/compliance officers to collect, assess and store biofouling reports submitted pre-arrival (if relevant)	0.5 FTE	2 FTE (if pre-arrival reporting is mandatory)
	Compliance officer to target and plan ship/ structure inspections	0	1 FTE
	Inspectors to undertake inspections	0	3-10 FTE (depends on the number of ship/ structure arrivals and how inspections are targeted)
	Senior manager to make compliance decisions	0	1 FTE
	Training officer to provide ongoing inspector training/refresher training	0	0.5 FTE
	Technical officer to maintain equipment	0	0.5 FTE
	Equipment required to implement policies	0	May include underwater cameras, remote controlled vehicles
	Total *(estimate only)*	**1-2 policy / compliance officers**	**2-3 policy officers 1 communications officer 2 compliance officers 3-10 inspectors 1 senior manager 0.5 training officer 0.5 technical officer**

Table 8 - Comparison of estimated resource implications to prepare and implement voluntary vs mandatory measures

Tasks	Responsibility	Completed?
1. Review the regulatory assessment and critical gaps identified in the national status assessment for the pathway.	Pathway-specific project team	
2. Decide whether voluntary guidelines or mandatory requirements will be implemented for the pathway.	Pathway-specific project team	
3. If mandatory measures will be implemented, consider if there is an urgent need to fill critical gaps through implementing voluntary measures initially.	Pathway-specific project team	

Table 9 - Tasks required to determine the nature of biofouling management measures

2.4 STEP 4 - Determine the High-Level Policy Key Elements

The high-level biofouling policy should include decisions on key elements of the biofouling management measure for each pathway. These will differ for voluntary and mandatory measures.

For **voluntary guidelines:** if a decision is made to go for voluntary guidelines, using already existing guidelines will save time. If new guidelines are to be prepared, reviewing existing guidelines will help identifying key relevant elements, to be developed later on (see section 6.1).

Which voluntary guidelines are available?

The high-level policy should provide an indication of **what existing guidelines will be used, or what key elements the guidelines will include, what references these will be based on,** and **what, if any, additional guidelines need to be developed** (see section 6.1) after the strategy is finalized to prepare for implementation. Relevant guidelines that could be used include:

Global guidelines for shipping:

- IMO Biofouling Guidelines[28], and
- IMO Biofouling Guidelines for Recreational Craft[29].

Examples of pathway-specific guidelines prepared by individual countries:

Australian[30] pathway-specific guidelines:

- Aquaculture (released in 2013)
- Commercial ships (released in 2009)
- Commercial fishing ships (released in 2009)
- Non-trading ships (released in 2009)
- Recreational craft (released in 2009)
- Offshore infrastructure (released in 2009), with specific advice also released in 2020[31] and New Zealand[32] pathway-specific advice (last reviewed in 2020):
- Commercial ships
- Work ships
- Commercial fishing ships
- Recreational craft.

These can be used as references to ensure guidelines are effective, internationally consistent and easy to use.

[28] International Maritime Organization, 2011

[29] International Maritime Organization, 2012

[30] Marine Pest Sectoral Committee, 2009 (a-e), 2013

[31] Australian Government, 2020.

[32] These are available from the New Zealand Government Ministry for Primary Industries website

Tasks	Responsibility	Completed?
1. Review the regulatory assessment and critical gaps identified in the national status assessment for the pathway.	Pathway-specific project team (with support from the strategy development team)	
2. Decide which resources will be used to develop voluntary guidelines for the relevant pathways.	Pathway-specific project team (with support from the strategy development team)	
3. Determine if new guidelines, or new parts to guidelines, will be needed to implement voluntary guidelines in the pathway.	Pathway-specific project team (with support from the strategy development team)	

Table 10 - Tasks required to determine which voluntary guidelines will be implemented

For mandatory **biofouling requirements,** the policy key elements to address the transfer of IAS via biofouling should be determined in the high-level policy. Further work will be needed to prepare to implement these key measures, once the strategy is finalized. These include:

1) Deciding which ships/structures the mandatory requirement will apply to, and when

A pathway may contain multiple types and sizes of ships or structures, so it is important to be clear which ships and structures will be required to comply with the mandatory biofouling requirement and when.

As biofouling can occur on any submerged surface, it is logical that **the mandatory requirement should apply to all ships or structures in the pathway.**

However, this may not be possible if the mandatory requirement will be added to existing legislation which applies only to certain types or size classes of ships or structures.

It is also necessary to be clear **when the requirement will apply.**

The mandatory requirement may apply to any ship/structure entering the country's **jurisdiction**, which is likely to be defined under national law. This may be, for example, 12 nautical miles from the territorial sea baseline.

It may be important to consider any **sensitive sea areas or marine protected areas.** For example, if there are offshore sensitive sea areas outside 12 nautical miles, it is worth considering if there is a legal mechanism to enforce the requirement for ships/structures operating in that area.

2) Determining what the mandatory requirement will be

Defining what owners/operators must do and how they demonstrate compliance may vary from pathway to pathway. It is important to ensure that the mandatory requirement for any pathway is **consistent with the overarching policy goals** (minimize the amount of biofouling entering a jurisdiction).

Options that are in line with the recommended overarching policy goals are:

A. **Require ships or structures entering the jurisdiction to have an appropriate Biofouling Management Plan (BFMP) and Biofouling Record Book (BFRB), OR**

B. **Require ships or structures entering the jurisdiction to present an acceptable biofouling risk and demonstrate this by having an appropriate BFMP and BFRB, OR**

C. **Require ships or structures entering the jurisdiction to meet a level of fouling requirement and demonstrate this by having an appropriate BFMP and BFRB.**

All options require appropriate BFMP and BFRB, in line with the IMO Biofouling Guidelines.

More information to assist in determining an appropriate **BFMP and BFRB is included in ANNEX C.**

A comparison of these options is included in ANNEX D.

If Option B is chosen: detailed policy work may be required to define what is an acceptable biofouling risk - **see ANNEX E for more information.**

If Option C is chosen: detailed policy work may be required to determine the acceptable level of fouling - **see ANNEX F for more information.**

3) Who will perform inspections?

Inspections can either be performed by existing ship/structure inspectors or new, dedicated biofouling inspectors.

Using new, dedicated inspectors: If resources allow, having dedicated biofouling inspectors ensures inspections are focused on biofouling and allows inspections to be targeted based on biofouling risk factors, such as the time a ship/structure has spent idle and the age of the anti-fouling coating.

Targeting inspections based on these factors ensures suspected high-risk ship or structures are inspected and allows for efficient use of resources.

However, the time it takes for the on-board component of the inspection may be less than the time taken to travel to the ship or structure, which may make it difficult to justify having inspectors dedicated to only biofouling. If dedicated resources are used, time will be needed after the strategy is finalized to employ and train inspectors in both biofouling and boarding the relevant ships or structures in the pathway. Detailed policy work will also be needed to determine how inspections will be targeted.

Using existing inspectors: Using existing inspectors can be an efficient use of resources and means that inspectors are already familiar with boarding and conducting inspections. Inspections may already occur on ships and/or structures for purposes of national security, border clearance for quarantine, Port State Control or fishing catch inspections or, for recreational craft, inspecting for compliance with local safety requirements.

Inspectors performing these will be experienced in the procedures for boarding and interacting with ship and structure operators. This reduces the training time required prior to implementation. However, biofouling may be one of many considerations when inspections are targeted. In addition, existing inspectors may not be part of the same agency that will be implementing biofouling requirements, so time may be needed to develop an agreement between agencies to ensure inspections include biofouling, determine decision making protocols and delegations, and ensure the results of biofouling inspections are made available to the implementing agency.

4) Will pre-arrival reporting of biofouling related information be mandatory?

Early notification of biofouling risks, for example through reporting of biofouling management activities from ships/structures prior to arrival, can allow more efficient targeting of inspections.

However, it is important to consider whether or not to require pre-arrival reporting of biofouling management activities in the high-level biofouling policy as doing so will require additional policy and implementation work after the strategy is finalized.

Additional policy work will be needed to determine what needs to be reported and when, and additional implementation preparation to build the necessary IT systems and/or train personnel to assess reports and provide timely feedback to ships/structures.

Stakeholder views on pre-arrival reporting should be sought. If industry stakeholders are already required to report prior to arrival for other purposes, such as security or quarantine, then adding biofouling related questions to that report may be relatively straightforward for industry and the implementing agency. However, if pre-arrival reporting is not currently required, industry stakeholders may have strong views on the feasibility and impact of introducing a new reporting requirement. Issues such as connectivity and response time must be taken into account.

The decision on pre-arrival reporting also relates to who will conduct inspections - if existing inspectors will be used, and there is an established system for targeting inspections, then information gathered in pre-arrival reporting may not be able to contribute to inspection targeting.

If dedicated biofouling inspectors will be used, or there is an opportunity to contribute to targeting inspections, there may also be other ways to target inspections. An alternative may be to use the wetted surface area of a ship/structure as a proxy for the potential amount of biofouling on a submerged surface[33]. Whilst this may still require some systems development prior to implementation, it is likely to be less resource intensive than that required to implement pre-arrival reporting.

5) Will in-water inspections be conducted?

In-water inspections can provide an accurate picture of the level of fouling which allows more informed decisions about whether risk mitigation actions are required for high-risk ships/structures.

However, there are logistical and technical difficulties with ensuring there is a capability to perform in-water inspections at all locations where they may be needed and additional policy work post-strategy will be required.

In-water inspections require port and ship/structure access, equipment to record video or capture good quality images and the ability to analyse these images. There are also potential safety risks and limited access to hard-to-reach submerged areas. The quality of images can be affected by the environment, including turbidity and currents. Whilst these can be overcome to an extent with preparation, quality equipment and well-trained operators, there is a resource cost involved.

The prospect of unduly delaying a ship or structure should also be considered. If the level of fouling detected turns out to indicate an acceptable biofouling risk, then the ship/structure may challenge that the in-water inspection was needed at all, and they should be compensated if undue delay was caused. If in-water inspections are included as part of the inspection regime, it will be important to seek legal advice on the evidence required to ensure a decision to perform an in-water inspection is justified.

[33] Ceballos-Osuna et al., 2021.

Tasks	Responsibility	Completed?
1. Review current ship/structure inspections in the pathway to determine if it is feasible to use existing inspectors, and decide who will undertake inspections to check for compliance.	Pathway-specific project team (with support from strategy development team)	
2. Decide whether pre-arrival reporting will be part of the mandatory requirement for the pathway (now or in the future).	Pathway-specific project team (with support from strategy development team)	
3. Decide whether in-water inspections will be part of the inspection regime for the pathway (now or in the future).	Pathway-specific project team (with support from strategy development team)	

Table 11 - Tasks required to determine the policy key elements for mandatory requirements

Recommendations for the policy key elements for mandatory requirements:

Option B (acceptable biofouling risk) is the recommended mandatory biofouling requirement

This option provides certainty to industry on how to comply (have an appropriate BFMP and BFRB) and the legal basis to risk assess non-compliant ships or structures, but does not require the capability to perform in-water inspections. If there is already a capability to undertake in-water inspections, then Option C (acceptable level of fouling) can also be an option.

If possible, existing inspectors should perform inspections, adding biofouling to their current inspection regime.

This is an efficient use of resources and ensures inspectors are trained and experienced in on-board inspections.

Mandatory pre-arrival reporting is not recommended as a requirement, at least initially, unless there is an existing pre-arrival reporting system in place.

The time that it may take to develop mandatory pre-arrival reporting arrangements may delay implementation. If there is an intention to develop this capability, and justification for having it (i.e. that it will be used to target inspections), this should be noted in the high-level biofouling policy.

Instead, the high-level policy may indicate a willingness to accept voluntary reporting of biofouling related information.

In-water inspections are not recommended initially, unless there is an existing capability to undertake these.

Developing the capability to perform in-water inspections at all locations where they may be needed is resource intensive. A documentary risk assessment of ships/structures can be used to determine if risk mitigation actions are needed for non-compliant ships.

Instead, the high-level policy may indicate an intention to develop an in-water inspection capability.

2.5 STEP 5 - Determine whether to Manage Risks Associated with In-Water Cleaning

In-water cleaning (IWC) can be an important part of a proactive biofouling management regime for a ship; however, IWC activities vary in effectiveness and the risks they pose to the marine environment.

Governments that are considering implementing any form of biofouling management measures (voluntary or mandatory) can **expect an increasing number of enquiries about requirements and approvals for IWC** in their jurisdiction.

It is important to **understand the risks associated with IWC,** and make a decision if there is an intention to manage the risks associated with in-water cleaning. This decision should be captured in the high-level biofouling policy.

A **decision to manage the risks associated with in-water cleaning will result in more detailed policy work after the strategy is finalized**, including what standards and arrangements will be put in place to manage risks, whether new or amended legislation is required to ensure compliance with the arrangements, and how these will be implemented and communicated.

There are a number of considerations, including:

1) The potential environmental risks from IWC

The potential environmental risks from IWC include:

- Release or escape of IAS from biofouling, and
- Chemical contamination (and potentially microplastics) from coating debris[34].

The risk of any IWC activity depends on the amount and location of biofouling on the submerged surface, the type and age of anti-fouling coating used on the surface and the IWC method used.

In-water cleaning (IWC) methods can fall into two categories:

1) IWC to remove microfouling (i.e. biofilms or the slime layer) – or proactive IWC, or
2) IWC to remove macrofouling – or reactive IWC.

Proactive IWC (sometimes referred to as 'grooming') reduces the likelihood of macrofouling accumulating on the surface and may involve cleaning units with brushes or water jets, operated either by divers or remotely.

It is generally agreed that the release of IAS from the slime layer during proactive cleaning poses minimal risk of introduction of IAS. However, chemical contamination may still be a concern, particularly when cleaning a biocidal anti-fouling coating. Proactive cleaning systems do not typically capture debris that results from the cleaning activity.

Reactive IWC can involve a variety of methods, from divers with hand tools, through to sophisticated systems that capture the debris removed. The ability of IWC systems to capture debris and minimise environmental risks is the subject of current research. Testing protocols have been developed for both proactive and reactive IWC systems[35].

[34] Scianni and Georgiades, 2019, Tamburri *et al.*, 2020

[35] Morrisey et al., 2015, Tamburri, 2020; Tamburri *et al.*, 2020

2) International standards in development

There is **not currently an internationally agreed standard for how to conduct IWC** (for example, the level of filtration or collection of debris) **or what level of biofouling should remain after IWC.**

Some jurisdictions, including Australia, New Zealand and California, are considering the development of standards for IWC. Industry standards are also being developed, for example by BIMCO and NACE[36]. In February 2021, BIMCO and the International Chamber of Shipping (ICS) published the first version of their industry standard[37] and approval procedure[38] for in-water cleaning of ships, which are now being trialled. This industry standard does not specify standards to avoid risks associated with chemical contamination.

Whilst these efforts may result in an internationally agreed standard in the future, currently **governments that decide to manage the risks associated with IWC in their jurisdictions will need to determine the acceptable standard,** which will require detailed policy work prior to implementation. It may also be necessary to develop legislation and management arrangements to ensure compliance with the standard.

3) There are a range of stakeholders involved in IWC

Managing the risks associated with in-water cleaning should be discussed with all relevant agencies and authorities. The impacts of IWC activities might affect port operations, sediment and water quality as well as the marine environment. Port authorities, environmental policy agencies and policy agencies with responsibility for managing IAS, at local, regional and national government levels, should all be involved in decision-making regarding IWC.

In addition to government agencies and port authorities, it will be necessary to engage with any existing or potential IWC providers.

Some may already be providing IWC services, others will be looking to expand their operations to include IWC. The development of standards or requirements for IWC will directly impact their business, so decision-makers should gain an understanding of local IWC providers' current practices, standards and equipment.

In making a decision whether or not to manage the risks associated with IWC, it should be taken into account that the number of requests to IWC will be difficult to predict.

However, if there is no standard or requirements associated with managing the environmental risks of IWC:

- There is an increased risk of IAS introduction and chemical contamination, and
- Ships or structures may choose to come specifically to IWC and may do so in an uncontrolled manner, especially if neighbouring countries do implement IWC requirements.

[36] BIMCO – Baltic and International Maritime Council; NACE – National Association of Corrosion Engineers

[37] Baltic and International Maritime Council and International Chamber of Shipping, 2021 (a)

[38] Baltic and International Maritime Council and International Chamber of Shipping, 2021 (b)

Tasks	Responsibility	Completed?
1. Identify and engage with agencies and authorities relevant to IWC decision making, including agencies that regulate water and sediment quality and impacts on the marine environment, and port authorities.	Strategy development team	
2. Identify and engage with existing or prospective IWC providers.	Strategy development team	
3. Consider the potential environmental risks associated with IWC in the national context.	Strategy development team and other relevant agencies	
4. Decide whether or not the environmental risks associated with IWC will be managed.	Strategy development team and other relevant agencies	

Table 12 - Tasks required to determine whether in-water cleaning risks will be managed

Recommendation regarding managing the environmental risks associated with in-water cleaning:

The high-level biofouling policy should include an intention to manage the environmental risks associated with IWC.

This is consistent with the overarching policy goals to minimise the risk of transferring IAS through biofouling, and to seek international consistency.

If some countries implement standards and requirements in relation to IWC and others do not, those that do not risk being targeted for IWC, increasing the risks in those countries of the introduction of IAS.

It is also recommended that the strategy development team engages with experts from other countries that are considering the development of IWC standards, to seek international consistency when developing measures to manage the risks associated with in-water cleaning.

2.6 STEP 6 – Develop the Proposed High-Level Biofouling Policy Document

Once the nature (voluntary or mandatory) and policy key elements of biofouling management measures have been determined, it is recommended to capture these in a policy document that will be shared with stakeholders for feedback. A proposed structure can be found in the **high-level biofouling policy template (ANNEX A)**, which includes:

PART 1: define the overarching policy goals.

PART 2: address each transfer pathway identified as relevant in the national status assessment.

Part 2, Section 1: provide a brief description of all primary and secondary transfer pathways that are relevant in the national context, and will include the priority of the pathway.

Part 2, Section 2: include each pathway-specific high-level biofouling policy. This section should be repeated for each relevant pathway. In this section, include:

- A brief overview of the pathway and its risk profile identified in the national status assessment,
- The nature of the biofouling management measures that will be implemented for the pathway (either voluntary guidelines or mandatory requirements), and
- Decisions on high-level policy key elements of the biofouling management measures. For voluntary guidelines, this includes identifying the guidelines that will be developed and/or implemented. For mandatory requirements, this includes key aspects of the compliance and enforcement regime.

PART 3: include whether there is an intention to manage the environmental risks associated with in-water cleaning.

The template also includes sections for references used to develop the policy, and attachments.

Tasks	Responsibility	Completed?
1. Use the template in ANNEX A and the information in this chapter to complete Part 1 and Part 2 (Section 1) of the high-level policy.	Strategy development team	
2. Distribute the proposed Part 1 and Part 2 (Section 1), and the high-level policy template, to pathway-specific project teams.	Strategy development team	
3. Complete Part 2 (Section 2) of the high-level policy and provide to the strategy development team.	Pathway-specific project teams	
4. Complete Part 3 of the high-level policy.	Strategy development team	
5. Compile all parts of the high-level policy into a single document.	Strategy development team	

Table 13 - Tasks required to develop the high-level biofouling policy

3

Phase Three – Consult Stakeholders and Finalize the High-Level Policy

Phase Three (Consult Stakeholders and Finalize the High-Level Policy) involves **consulting will all relevant stakeholders on the high-level biofouling policy.** As the high-level biofouling policy identifies the intentions for each relevant pathway, it is important to seek this input to the policy to determine if it will be practical and effective.

The documentation that is shared with stakeholders should be carefully prepared, to ensure feedback is targeted appropriately and can be assessed and used to update the high-level biofouling policy, if needed.

The project teams from the pathway-specific policy agencies should lead consultation with stakeholders related to their pathway, whilst the strategy development team should work with these agencies and engage stakeholders more broadly, in particular in relation to in-water cleaning arrangements, to ensure all stakeholders are consulted.

The steps required to complete Phase Three are summarised in **Figure 8** below.

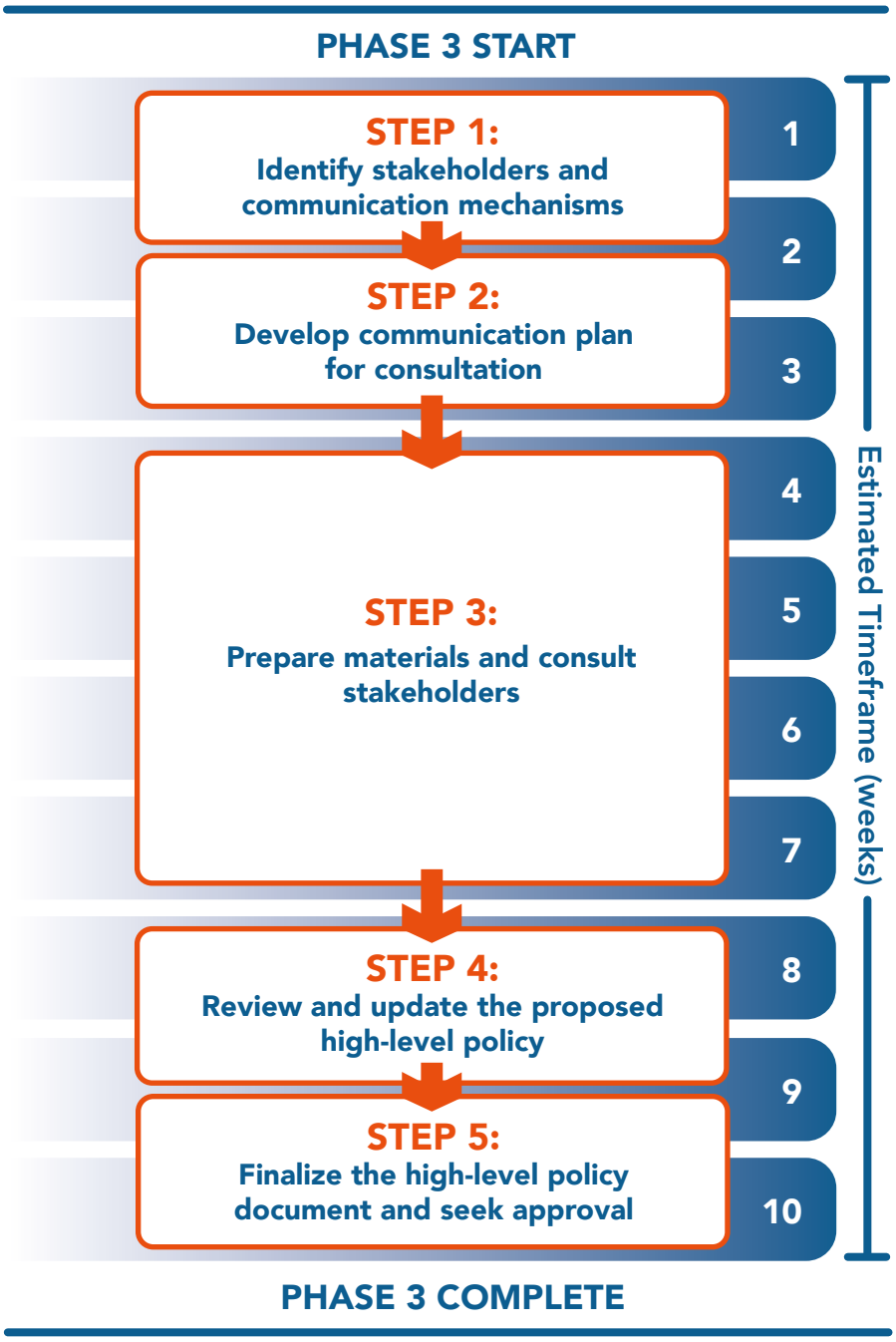


Figure 8 - Steps to complete Phase Three – Consult Stakeholders and Finalize the High-Level Policy

3.1 STEP 1 - Identify Stakeholders and Communication Mechanisms

The national status assessment report may provide useful information to identify stakeholders and communication mechanisms.

Utilising existing communication mechanisms, such as meetings of existing task groups, is efficient, however care should be taken that critical stakeholders that are not included in those mechanisms are not missed.

If an existing task force has been established to provide oversight of the strategy development process, this **task force can be a useful communication mechanism.** Task group members can help to identify stakeholders, provide insight into the best way to communicate with stakeholders, and share information with their relevant agencies and stakeholders during the consultation process.

A mix of communication mechanisms, such as **face to face meetings, dedicated seminars and webinars,** and the use of industry champions, are likely to be needed to reach the diverse range of biofouling stakeholders.

Industry champions are members of industry that are well informed about the biofouling issue and actively share their knowledge with other industry stakeholders. Government agencies can work with industry champions to reach additional industry stakeholders, such as owners and operators.

Suggested potential stakeholders and communication mechanisms are included in **Table 14**.

Table 14 - Relevant stakeholders and communication mechanisms

Sector/ Issue	Stakeholders	Communication Mechanisms
Invasive Aquatic Species	Local, regional, national policy agencies Not-for-profit organizations Scientists, researchers Consultants	Existing task groups, sectoral committees (may exist for ballast water or quarantine related issues)
International shipping	Shipping agents Shipping representative bodies Ship owners/operators Port State Control Inspectors Shipping policy agencies and regulating authorities	National communique to IMO, Direct communication, Workshops, Shipping notices, Inspections, Fact sheets, Newsletters, Interagency communications, Industry champion
Offshore Sector	Offshore policy agencies and regulating authorities Offshore companies Offshore representative bodies	Interagency communications, Representative bodies, Workshops, Fact sheets, Newsletters, Direct communication, Industry champions
Recreational craft	Recreational craft owners/operators Yachting associations Recreational boating associations Recreational fishing associations Marinas and Harbours Recreational boating policy agencies and regulators	Direct communications, Workshops, Newsletters, Fact sheets, Posters (at marinas), Interagency communications, Industry champions
Commercial fishing ships	Commercial fishing policy agencies/authorities Commercial fishing representative bodies Fishing ship owners/operators Regional fishing commissions and organizations	Interagency communications, Direct communication, Workshops, Fishing fleet notices, Inspections, Fact sheets, Newsletters, Industry champions

Sector/ Issue	Stakeholders	Communication Mechanisms
Aquaculture	Aquaculture farm owners/operators Aquaculture representative bodies Aquaculture policy agencies	Direct communication, Workshops, Permit/License notices, Inspections, Fact sheets, Newsletters, Industry champions
Scientific structures	Universities Scientific organizations	Direct communication, Conferences, Fact sheets
In-water Cleaning	In-water cleaning operators Environmental policy agencies and Invasive species policy agencies (local, regional, national) Water quality policy agencies Sediment policy agencies Port authorities Marinas and harbours	Direct communication, Workshops, Interagency communications

Table 14 - Relevant stakeholders and communication mechanisms (continued)

Tasks	Responsibility	Completed?
1. Review stakeholders identified in the national status assessment.	Strategy development team	
2. Identify relevant pathway-specific stakeholders.	Pathway-specific project team	
3. Identify relevant stakeholders for in-water cleaning.	Strategy development team	
4. Engage with any existing task forces and/ or working groups relating to IAS or biofouling to identify stakeholders and communication mechanisms.	Strategy development team and pathway-specific project team	

Table 15 - Tasks required to identify stakeholders and communication mechanisms

3.2 STEP 2 - Develop Communication Plan for Consultation

The development of a communication plan is essential for effective consultation on the high-level biofouling policy. As biofouling has a wide range of stakeholders and potentially a range of regulating agencies involved, it is important to plan key messages and communication opportunities.

A **communication plan template, and instructions for completing the plan, are included in ANNEX G** to assist in formulating a plan for the consultation.

There is no set length of time for consultation, however **most stakeholders will need at least 3 weeks to review the high-level biofouling policy and submit feedback.** Providing less time will risk the integrity of the consultation process.

Tasks	Responsibility	Completed?
1. Share the communication plan template in ANNEX G with pathway-specific project teams.	Strategy development team	
2. Seek pathway-specific project team input to the communications plan, in particular the key messages and the communication actions relevant to each pathway.	Strategy development team (working with the pathway-specific project teams)	
3. Finalize the communication plan and share with pathway-specific project teams.	Strategy development team	

Table 16 - Tasks required to develop a communication plan

3.3 STEP 3 - Prepare Materials and Consult Stakeholders

When consulting stakeholders on the policy, it may be useful to have supporting materials including:

- **Fact sheets** that highlight key messages – these might be pathway-specific and/or for the whole policy,
- **FAQs** – anticipate frequently asked questions and prepare written answers, in a single document. Some FAQs to anticipate, depending on the policy choices made, might include 'How will the mandatory requirement be enforced?', 'Will there be penalties for non-compliance', or 'How will you ensure biofouling measures are implemented if the guidance is voluntary',
- **Stakeholder specific questions** – it may be useful to develop set questions for different stakeholders to target their feedback on areas that may require their input, and
- **Website updates** with links to the high-level biofouling policy and supporting materials.

Once all materials are completed and made available to stakeholders, consultation can commence in accordance with the communications plan.

Tasks	Responsibility	Completed?
1. Develop supporting materials and update website.	Pathway-specific project team and strategy development team	
2. Consult stakeholders in accordance with the communications plan. Clearly articulate to all stakeholders the dates of the consultation period and when feedback is due.	Pathway-specific project team and strategy development team	
3. Record all feedback on the policy received and prepare responses, where relevant. Responses may be provided verbally or in writing, depending on the existing relationship with the stakeholder.	Pathway-specific project team and strategy development team	

Table 17 - Tasks required to prepare communication materials and consult stakeholders

3.4 STEP 4 - Review and Update Proposed High-Level Policy (if needed)

Once all feedback has been recorded and responded to, it will be important to **review the proposed high-level biofouling policy and make any necessary updates.** This may only be necessary if there is:

- Overwhelming stakeholder objection, with legitimate reasons, to a particular policy aspect, and there are viable alternatives that still meet the overarching policy goals, or
- Alternative options provided by stakeholders that have not previously been considered.

If changes of any significance are made to the proposed high-level biofouling policy as a result of the stakeholder consultation, it will be necessary to repeat the approval process.

Tasks	Responsibility	Completed?
1. Review proposed high-level biofouling policy in light of feedback received.	Pathway-specific project team and strategy development team	
2. Update high-level biofouling policy as needed.	Pathway-specific project team and strategy development team	

Table 18 - Tasks required to review and update policy

3.5 STEP 5 – Finalize the High-Level Policy Document and Seek Approval

The high-level biofouling policy should be **finalized by the strategy development team.**

As the high-level policy is likely to include pathway-specific measures, the high-level policy should be **approved by the pathway-specific decision makers.**

After all pathway-specific decision makers have approved the document, the **approval of the overall decision maker should be sought.**

Tasks	Responsibility	Completed?
1. Finalize the high-level biofouling policy document.	Strategy development team	
2. Seek approval on high-level biofouling policy from pathway-specific decision makers.	Pathway-specific project team	
3. Seek approval on high-level biofouling policy from overall decision maker.	Strategy development team	

Table 19 - Tasks required to finalize the policy and seek approval

4 Phase Four – Develop the High-Level Action Plan

This Phase Four (Develop the high-level action plan) involves **identifying the actions** required to implement the high-level biofouling policy and will be one component of the strategy.

High level actions should be identified for developing and implementing the:
- Biofouling management measure for each pathway (either **voluntary guidelines** or **mandatory requirements**), and
- Arrangements to manage risks associated with **in-water cleaning** (if relevant).

An indication of **implementation timing** for each pathway should be included in the high-level action plan.

The steps required to complete Phase Four are summarised in **Figure 9** below.

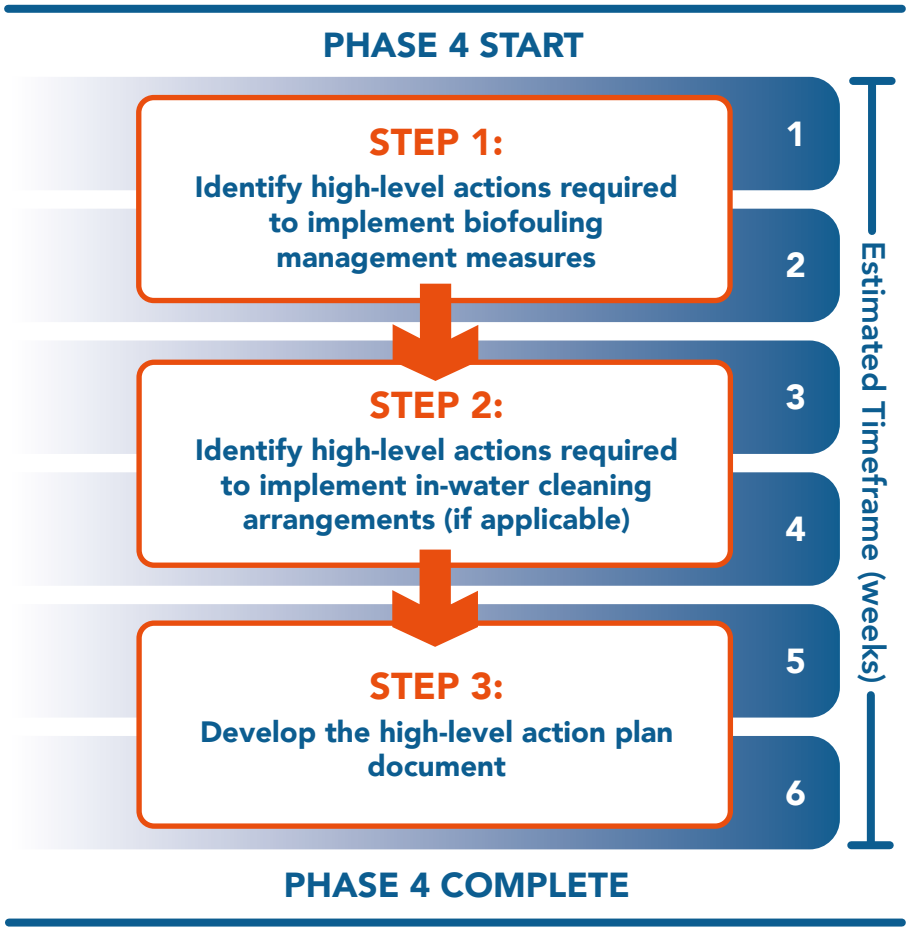


Figure 9 - Steps to complete Phase Four - Develop the High-Level Action Plan

4.1 STEP 1 – Identify High-Level Actions Required to Implement Biofouling Management Measures

The high-level biofouling policy includes, for each pathway, the nature of the biofouling management measures to be implemented. These are either:
- **Voluntary guidelines,** or
- **Mandatory requirements.**

The actions required to implement these, and associated timing, will **vary depending on the national context, current legislation, government processes and critical gaps** identified in the national status assessment.

Generally, **voluntary guidelines will be much faster to implement than mandatory requirements**, as there is no need to develop or amend detailed policy and

legislation, and therefore there is unlikely to be a need for high-level government approval.

It should be anticipated that developing and implementing voluntary guidelines may take a minimum of 6 months, whilst mandatory requirements may take a minimum of 3 years.

The processes that may be required to prepare for implementation of voluntary and mandatory measures were listed in section 2.3 **(Table 7)**.

The **high-level actions required to implement voluntary guidelines** may include:

- **Finalising clear, comprehensive and easy to understand guidelines**
- **Planning communication and education activities** to distribute the guidelines
- **Preparing to implement** the voluntary guidelines.

The **time required to complete this process** may depend on factors such as:

Are new guidelines required to ensure they are pathway-specific and relevant in the national context?	Preparation of new guidelines will require significantly more time to ensure they are comprehensive and practical.
Are there sufficient personnel available to undertake communication and education activities to maximise uptake of the guidelines?	Sufficient personnel dedicated to communication and education will be critical to successful implementation of voluntary guidelines.
Is there any training required for officers who will be engaging directly with industry?	Even though the measure may be voluntary, officers will still be required to engage with members of industry. This may be remotely or during on-board visits. Officers should be equipped with the appropriate information, training and personal protective equipment for their interactions with industry.

The **high-level actions required to develop and implement mandatory biofouling requirements** may include:

- **Detailed policy development** to define the requirement
- Development of **detailed compliance and enforcement policies** and decision-making arrangements
- **Stakeholder consultation** on the detailed policies
- Assessment of the **feasibility** of implementing the detailed policies
- **Gaining government approval** to implement the mandatory requirements
- Making **legislative changes**
- Preparing **information technology systems** and databases to support implementation
- Acquiring **specialised equipment**
- **Training** policy and operational staff to answer enquiries, undertake inspections, use and maintain equipment, and make decisions
- Determining how to **monitor the effectiveness** of the mandatory requirement.

The **time required to complete this process may be highly variable,** and may depend on factors such as:

Did the high-level policy include mandatory pre-arrival reporting?	Additional systems and/or personnel will be required to analyse pre-arrival information. Additional time may be required to develop systems and train personnel.
Did the high-level policy determine that existing inspectors, in the same agency, will be used?	If inspectors are in a different agency, an agreement with that agency may be needed to include biofouling in inspections, streamline decision-making and ensure access to inspection outcomes.
Did the high-level policy determine that in-water inspections will be included in the inspection regime?	Time may be required to determine what will trigger an in-water inspection, acquire the necessary equipment, and train personnel to use and maintain the equipment.
Is there existing legislation that can be amended?	Amending existing legislation may take less time than preparing entirely new legislation and may have a more streamlined approval process.
What is the process in the country for government approvals for new mandatory requirements?	Some may require evidence that the impact on stakeholders of complying with the new requirement does not exceed the benefit of the requirement.
Is there an existing IAS monitoring programme?	An existing monitoring system for IAS may be able to be utilised or adapted to monitor the effectiveness of the policy, reducing the time and resources required to develop a new monitoring system.
Are learnings from other countries developing or implementing mandatory requirements relevant?	Collaboration with another country may reduce the time required to develop the detailed policy and contribute to international consistency.

Tasks	Responsibility	Completed?
1. Seek advice from national and international experts regarding development of pathway-specific biofouling management measures.	Pathway-specific project team	
2. Review the high-level biofouling policy and consider the nature and key policy elements of the biofouling management measure for the pathway.	Pathway-specific project team	
3. Review the national status assessment and consider the national context and status of existing guidelines, legislation and systems.	Pathway-specific project team	
4. Use the national status assessment to identify potential legislative options and systems to implement and enforce a mandatory biofouling requirement (if relevant).	Pathway-specific project team	
5. Use the guidance in this section to identify high-level actions to develop and implement biofouling management measures for the pathway.	Pathway-specific project team	
6. Determine the strategic priority, who is responsible, and the approximate timing for each action.	Pathway-specific project team	

Table 20 - Tasks required to identify high-level actions to implement biofouling management measures

4.2 STEP 2 – Identify High-Level Actions Required to Implement In-Water Cleaning Arrangements

If the high-level biofouling policy includes an intention to manage the environmental risks associated with in-water cleaning (IWC), high-level actions for developing and implementing IWC arrangements should be included in the high-level action plan.

Ships and structures in all relevant pathways may wish to IWC.

As a result, it will be important that **IWC policies are consistent across all agencies and pathways.**

To ensure this is the case, a single agency, most likely the lead IAS policy agency, should be responsible for developing and implementing the IWC arrangements, in consultation with all other relevant agencies.

The strategy development team may be best placed to identify high-level actions required to develop and implement IWC arrangements.

To effectively implement IWC arrangements to manage environmental risks, it will be necessary to have:

- A **standard of environmental performance** that an IWC activity should achieve, and
- A mechanism for **enforcing compliance with the standard,** and how IWC operators must demonstrate compliance with the standard.

This work may be complex with multiple stakeholders and decision-makers (from national and local agencies and port authorities).

The **high-level actions required to develop and implement IWC arrangements may include:**

- **Gaining a detailed knowledge of the environmental risks and the measures** that mitigate the risks
- Developing an **IWC environmental performance standard**
- Developing an **approval system for IWC activities,** with associated compliance and enforcement arrangements
- **Consulting stakeholders** on the IWC standard and approval system
- **Assessing the feasibility** of implementing the IWC standard and approval system
- Gaining **government approval** to implement the IWC approval system
- Making any required **legislative changes**
- **Training** policy and operational staff to inspect and/or audit IWC activities and make decisions.

A minimum of 2 years should be anticipated to prepare for implementation of IWC arrangements, however, this may depend on factors such as:

Are there existing water and/or sediment quality standards that must be met?	Identifying any existing standards or requirements for water quality and sediment may inform the development of an IWC standard.
Is there existing research or standards (domestic and/or international) that can contribute to the development of an IWC standard?	Utilising existing research into measures that will mitigate the environmental risks associated with IWC will reduce the amount of time required to develop the IWC standard.
Are there multiple stakeholders involved in IWC decision-making?	National and local agencies, as well as port authorities, may have a role in deciding whether an IWC activity should go ahead. Identifying all decision-making stakeholders early, and formally agreeing to a streamlined decision-making process, will aid in the development of the approval system for IWC activities.
Is there existing legislation that can be utilised or amended to incorporate an approval system for IWC?	Amending existing legislation may take less time than preparing entirely new legislation and may have a more streamlined approval process.

Tasks	Responsibility	Completed?
1. Seek advice from national and international experts regarding the work required to develop an environmental IWC standard.	Strategy development team	
2. Review the national status assessment to identify potential legislative options to enforce an IWC standard.	Strategy development team	
3. Use the guidance in this section to identify high-level actions to develop and implement IWC arrangements.	Strategy development team	
4.Determine the strategic priority, who is responsible, and the approximate timing for each action.	Strategy development team	

Table 21 - Tasks required to identify high-level actions to implement in-water cleaning arrangements

4.3 STEP 3 - Develop the High-Level Action Plan Document

Once all actions to implement the high-level policy have been determined, it is recommended to capture these actions in an "action plan" document. A template is provided in **ANNEX H.** The **high-level action plan template included in ANNEX H** is simple and straightforward. There are four columns:

- **Action** – detail the action required, based on guidance provided in this chapter,
- **Strategic Importance** – designate the priority of each action,
- **Responsibility** – assign responsibility for the action to an officer or agency, depending on the action, and
- **Timing** – estimate the timing required to complete the action, for tracking purposes.

The strategy importance of each action reflects the impact of not doing the action on the implementation of the high-level biofouling policy. If the outcome of not

completing the action is that the policy cannot be implemented, the action is of high strategic importance. However, if the policy implementation can go ahead without completing the action with minimal impact, then the action is of low strategic importance.

Whilst determining the timing associated with actions at this stage is likely to be an estimate, the high-level action plan should include actual dates (months/years) to aid in tracking.

All agencies contributing to the high-level action plan (pathway-specific agencies and the lead IAS agency) should use the template and follow the guidance in this chapter to ensure the plan is cohesive.

Tasks	Responsibility	Completed?
1. Distribute the action plan template and instructions to pathway-specific project teams.	Strategy development team	
2. Complete the action plan template for the pathway and send the completed template to the strategy development team.	Pathway-specific project teams	
3. Combine all elements and finalize the high-level action plan.	Strategy development team	

Table 22 - Tasks required to develop the high-level action plan document

5 Phase Five – Prepare and Endorse a National Biofouling Strategy

Phase Five involves drafting the national biofouling strategy. The **strategy template is included in ANNEX I.**

The strategy brings together the high-level biofouling policy and high-level action plan.

Phase Five involves a number of steps, summarised in **Figure 10** below. It should be noted that the time it takes to gain government endorsement may vary significantly.

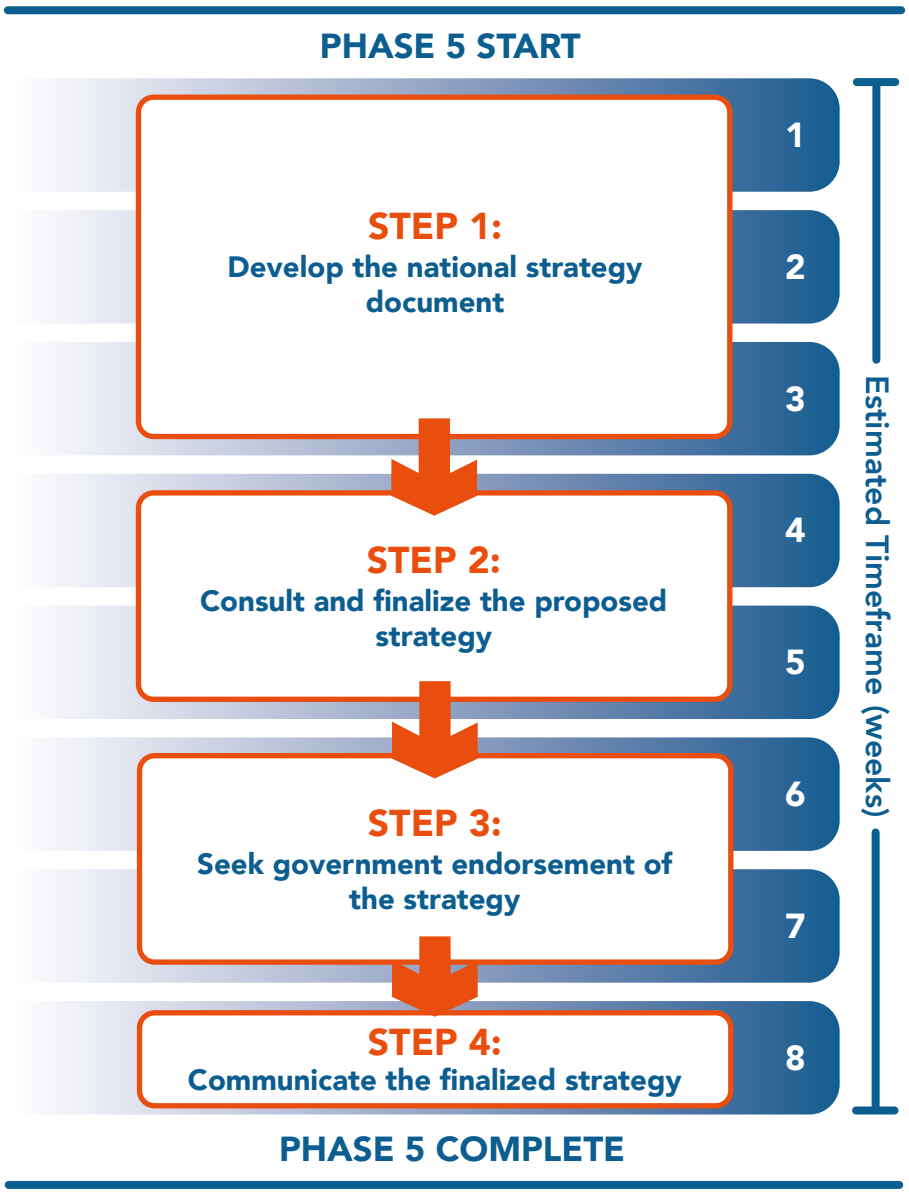


Figure 10 - Steps to complete Phase Five - Prepare and Endorse a National Biofouling Strategy

5.1 STEP 1 – Develop the Proposed National Strategy Document

The strategy document will incorporate a summary of the high-level biofouling policy and high-level action plan, with both the policy and action plan documents attached to the strategy.

The strategy development team should use the **National Biofouling Strategy Template and follow the instructions available in ANNEX I,** to draft the strategy. There is a need to identify when and how implementation of the strategy will be reviewed and tracked.

Tasks	Responsibility	Completed?
1. Use the high-level biofouling policy and high-level action plan, and the **strategy template at ANNEX I,** to draft the strategy.	Strategy development team	

Table 23 - Tasks required to develop the proposed national strategy document

5.2 STEP 2 - Consult Stakeholders and Review the Proposed Strategy

Consulting and reviewing the strategy involves similar processes as those used to consult on, and finalize, the high-level biofouling policy, described in CHAPTER 3.

The strategy development team should lead this work.

Tasks	Responsibility	Completed?
1. Seek endorsement of the proposed strategy by all relevant government agencies, including pathway-specific decision makers.	Strategy development team	
2. Consult stakeholders on the proposed strategy.	Strategy development team (with support from the pathway-specific project teams)	
3. Review the strategy in light of stakeholder feedback, and make any necessary amendments.	Strategy development team	
4. Seek approval from the overall decision-maker to progress the strategy for government approval.	Strategy development team	

Table 24 - Tasks required to consult stakeholders on the proposed national strategy document

5.3 STEP 3 - Seek Government Endorsement of the Strategy

The overall decision-maker should **progress the proposed strategy to government decision-makers** for endorsement.

Tasks	Responsibility	Completed?
1. Seek government endorsement of the national biofouling strategy.	Overall decision maker	

Table 25 - Tasks required to gain government endorsement and finalize the strategy

Government endorsement finalizes the strategy and commits the government to taking the actions identified in it.

5.4 STEP 4 - Communicate the Finalized Strategy

The strategy development team should **share the finalized strategy widely with all relevant stakeholders.**

This demonstrates **transparency** and **a clear commitment** to progressing the actions in the high-level action plan.

Stakeholders, existing working groups and communication channels should all be used to distribute the finalized strategy, in addition to making the strategy available on websites.

The strategy should also be shared with the international community, to promote international consistency and support others developing a national biofouling strategy.

Tasks	Responsibility	Completed?
1. Distribute the finalized strategy to all relevant stakeholders.	Strategy development team	

Table 26 - Tasks required to communicate the finalized strategy

6 Post-Strategy Work: Preparing for Implementation

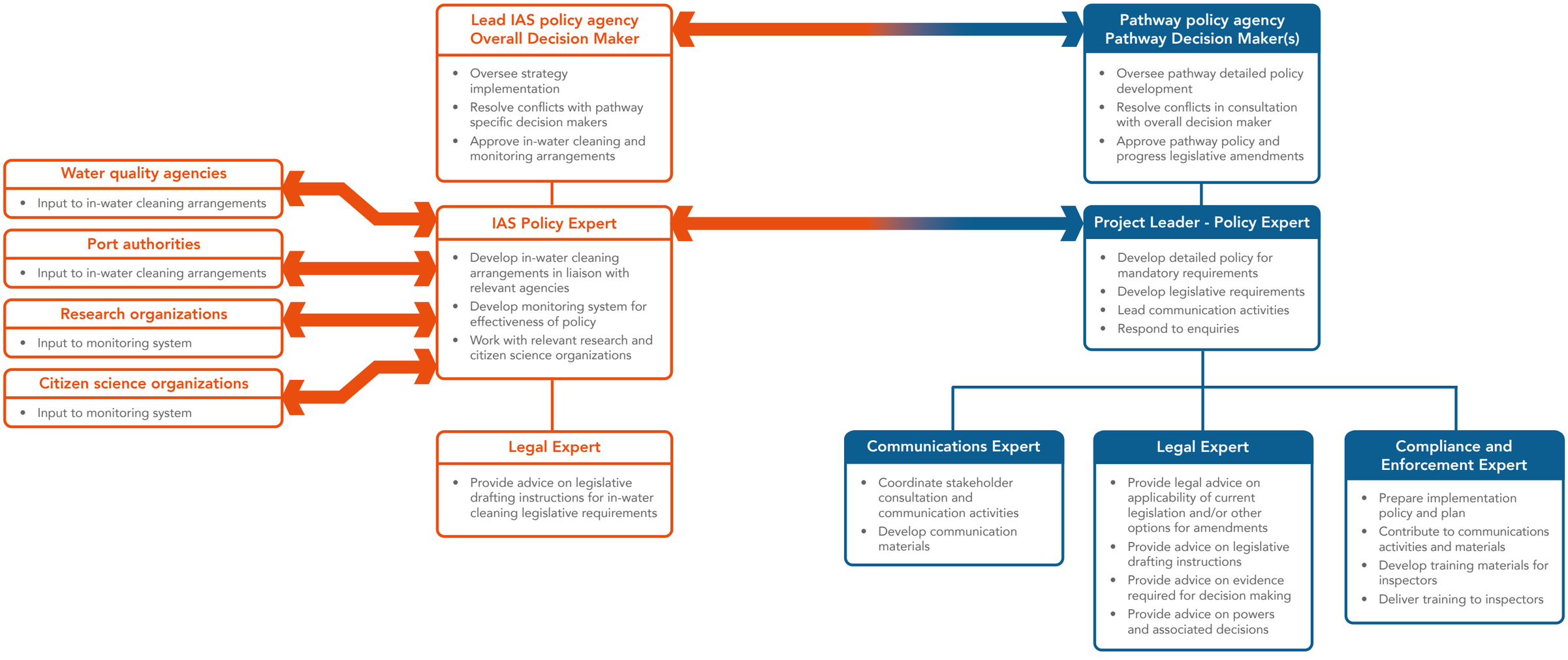
Completing the strategy is a major milestone, but in order to implement biofouling management measures, there is still work to be done.

The amount of work required depends on the high-level biofouling policy and high-level action plan. It may be necessary to:

- **Finalise and prepare to implement voluntary guidelines** (if relevant) (section 6.1),
- **Further develop the mandatory biofouling requirements** (if relevant) (section 6.2),
- **Further develop the IWC arrangements** (if relevant) (section 6.3),
- Determine how to **monitor the effectiveness of the biofouling management measures** (section 6.4), and
- **Further assess the feasibility** of implementing voluntary and mandatory measures, IWC arrangements and monitoring (section 6.5).

It may be necessary to establish new roles and governance arrangements for this phase of work. **Figure 11** provides an example of **roles and governance structure for post-strategy work** if mandatory requirements and IWC arrangements will be implemented.

Figure 11 – Suggested roles and governance structure for post strategy work with mandatory requirements and in-water cleaning arrangements



6.1 Finalize and Prepare to Implement Voluntary Guidelines (if relevant)

The time needed and process for finalizing and preparing to implement voluntary guidelines was listed in section 2.3 **(Table 7).**

The key considerations when finalizing and preparing to implement voluntary guidelines include:

1) Is additional work required to develop pathway-specific guidelines?

The high-level biofouling policy may have already determined the key elements or the exact guidelines that will be implemented. If a decision has been made to use already existing guideline(s) the work is minimal. If a decision has been made to develop new guidelines, the pathway-specific project team must **finalize the guidelines.** This may require the:

- Review of existing guidelines (IMO Guidelines, guidelines released in other countries) (section 2.4),
- Amendment of existing guidelines, or
- Preparation of new guidelines specific to the pathway.

2) How will guidelines be communicated to maximise uptake?

A **comprehensive communication and education plan is essential** to maximise the uptake of voluntary guidelines.

Preparing a plan, similar to that developed to consult stakeholders in Phase 3 (section 3.2), ensures that all affected stakeholders are aware of the guidelines.

The plan may include an **initial period of intensive communication and education activities,** targeting all stakeholder groups through multiple communication mechanisms.

The plan may also include **ongoing communication and education activities,** so that owners and operators maintain their awareness of the voluntary guidelines and build proactive biofouling management into their operational practices.

3) What is needed to prepare to implement voluntary guidelines?

With the guidelines and communication and education plan finalized, it may be necessary to:

- Develop and **prepare communications materials** for distribution,
- **Develop and deliver training** to relevant officers, and
- **Assess the feasibility** of implementation of the arrangements (how to undertake a feasibility assessment is explained in section 6.5).

6.2 Further Development of the Mandatory Requirements (if relevant)

The key considerations for developing mandatory biofouling requirements are:

- How will **compliance** with the requirement be checked and **enforced** (section 6.2.1)?
- What is needed to gain **government approval** to implement the mandatory requirement (section 6.2.2)?
- What **legislative changes** may be needed to implement the mandatory requirement (section 6.2.3)? and
- What is needed to **prepare for implementation** (section 6.2.4)?

This may require detailed policy development and consideration of options.

Officers tasked to develop the mandatory biofouling requirement should seek advice from international experts. Experts from other countries that are developing or implementing biofouling requirements can provide useful insights into options and lessons learnt. Working with international experts will also promote international consistency.

6.2.1 Determining how compliance will be checked and enforced

The high-level biofouling policy identified whether pre-arrival reporting will be mandatory, who will undertake inspections and whether in-water inspections will be included in the inspection regime. These particular aspects were decided early to help determine the detailed compliance and enforcement arrangements.

Developing **detailed compliance and enforcement arrangements** includes determining a number of complex policy issues, such as:

When the mandatory requirement will be implemented, and whether there will be a lead-in time to allow industry to prepare	More information: ANNEX J
(If pre-arrival reporting is required) What a pre-arrival report must contain, how the pre-arrival report will be collected and when, and how the information will be used and stored	ANNEX K
What the detailed inspection policies are, including the purpose of inspections, how inspections will be targeted, how often they'll be conducted, how decisions will be made and what training inspectors will require	ANNEX L
(If in-water inspections are to be conducted) When, how and where in-water inspections will be conducted.	ANNEX M

6.2.2 Gaining government approval to implement the mandatory requirement

The process to gain government approval to progress the implementation of mandatory biofouling requirements will differ in each country, but may include:

- Preparing an **assessment of the impact of proposed new regulations** in contrast to the perceived benefits of the regulation, and
- Seeking formal approval through briefing to government.

An assessment of impact may take varying forms. **Examples of biofouling related impact assessments undertaken internationally** and a **template for an impact assessment are included in ANNEX N.**

Briefing to seek formal government approval should include:
- Key elements of the mandatory requirement,
- Key elements of the compliance and enforcement arrangements, and
- An overview of stakeholder feedback.

With government approval to proceed, legislative amendments can be prepared.

6.2.3 Drafting and making legislative changes to implement the mandatory requirement

It may also be necessary to develop a legislative framework to guide the drafting of any required legislative amendments.

The legislative requirements will vary depending on the policy choices (for example if pre-arrival reporting will be required), however some **key elements that need to be included in policy and legislation,** in line with the recommendations in this guide, **are described in ANNEX O.**

The process of implementing legislative changes may include:
- Drafting instructions for what is required in the legislation,
- Formal consultation period,
- Approval of the legislation, and
- Media/communications highlighting the passing of the legislative amendments.

6.2.4 Preparing to implement the mandatory requirement

It will be necessary to prepare the agency implementing the mandatory requirement AND the affected industry stakeholders for implementation.

To prepare industry stakeholders, an **education and communication campaign** may be needed, including:
- Sector-specific workshops,
- Presentations at conferences and industry meetings,
- Production of webinars and fact sheets,
- Inclusion of details of the mandatory requirement in industry newsletters, magazines and other written media, such as industry notices,
- Targeted in person communications with industry representatives, such as industry organizations, undertaking site visits, contacting shipping agents, attending boat shows and marinas, and ports.

Officers should record all their communication and education activities, including the stakeholders that were engaged and what their response was.

To prepare the agency implementing the mandatory requirement, there may be a number of **implementation projects,** including, but not limited to:
- Development of systems and databases to store data and/or record the outcomes of inspections,
- Development and delivery of compliance and enforcement training,
- Training policy officers to respond to enquiries, and
- Developing compliance agreements with other agencies for inspections (if relevant).

There should also be an assessment of the feasibility of implementing the measure. **The process for undertaking a feasibility assessment is explained in section 6.5.**

6.3 Further Development of In-Water Cleaning Arrangements

The actions required to further develop and prepare to implement IWC arrangements was listed in section 4.2).

The key considerations for developing in-water cleaning arrangements include:

- What is an appropriate **IWC environmental performance standard** (section 6.3.1)?
- How will **compliance** with the IWC standard be checked and enforced (section 6.3.2)? and
- What **legislative changes** may be needed to implement IWC arrangements (section 6.3.3)?

This may require detailed policy development and consideration of options.

Officers tasked to develop the IWC arrangements should seek advice from international experts. Experts from other countries that are developing or implementing IWC arrangements can provide useful insights into options and lessons learnt.

Working with international experts will also **promote international consistency.**

6.3.1 Developing an IWC environmental performance standard

Development of a standard may involve determining appropriate levels for:

Filtration	For example, use of a 10-micron filter in the IWC system
Capture	For example, no debris is released, no plumes are evident during or after cleaning
Efficacy	For example, the IWC activity should remove 90% of macrofouling.

To identify appropriate levels, input from relevant experts is needed to ensure that the levels that are set are realistic and achievable, and provide **confidence that no potential IAS, and only acceptable levels of chemical contaminants, are released** during the IWC activity.

Experts may include **marine scientists with knowledge of propagule sizes** for potential IAS species, and water quality experts with knowledge of acceptable levels of contaminants for the marine environment.

It may also be possible to **leverage off existing work on IWC standards** being undertaken in other countries, such as Australia, New Zealand and the United States.

Working collaboratively with other countries will reduce the time taken to develop the IWC standard and contribute to international consistency in the management of IWC activities.

6.3.2 Determining how compliance with the IWC standard will be checked and enforced

To ensure IWC activities are conducted in compliance with the IWC standard, it may be necessary to:

1) Develop a system to approve IWC activities:

Which government authority/ agency will be the **decision-maker** regarding IWC activities?	Establish a decision-making framework and engagement strategy with other relevant government and port stakeholders that play a role in IWC decision-making to ensure: • Decisions are streamlined, and • Decisions take into account the concerns of all relevant authorities/agencies.
Who will be approved to IWC?	Owners/operators for individual IWC activities, OR IWC providers for multiple IWC activities.
What **conditions** will apply to the approval?	Conditions may include: • IWC in accordance with the IWC standard, • IWC in certain locations only, • The IWC method must be suitable for the anti-fouling coating and level of fouling on the submerged surface, and • Evidence must be collected before/during and after the IWC activity to demonstrate compliance.
Determine **what evidence** must be collected	Evidence may include: • Water and sediment quality testing close to and away from IWC sites to detect contaminants, • Before, during and after photographs and video to demonstrate the efficacy of the IWC and identify the release of any debris or plumes in the water column, • Periodical testing for bioaccumulation of contaminants in sediments and/or sedentary organisms near IWC locations, and • Periodical surveillance for IAS near IWC locations.

2) Determine how and when evidence will be checked

If resources allow, inspectors attend each IWC activity, OR auditors periodically review evidence collected.

3) Determine what systems and training are required

Systems and personnel may be required to:

- Collect and store reports of intentions to IWC,
- Assess applications to IWC,
- Inspect or audit IWC activities and/or providers,
- Make decisions if non-compliance with the IWC approval is suspected.

6.3.3 Drafting and making legislative changes to implement IWC arrangements

It may be necessary to **include elements of an IWC approval system in legislation** to ensure that conditions can be enforced and there are appropriate penalties for non-compliance.

Utilising or amending existing legislation to incorporate the approval system will save time.

The process of implementing legislative changes may include:
- Drafting instructions for what is required in the legislation,
- Formal consultation period,
- Approval of the legislation, and
- Media/communications relating to the passing of the legislative amendments.

ANNEX O provides an example of a legislative framework to implement IWC arrangements.

6.3.4 Preparing to implement IWC arrangements

It will be necessary to ensure officers have the appropriate systems, training and equipment to implement the IWC arrangements. It will also be necessary to ensure industry are aware of and understand any new requirements associated with IWC.

To prepare industry stakeholders, an **education and communication campaign** may be needed.

To prepare the agency implementing the IWC arrangements, there may be a number of **implementation projects,** including, but not limited to:
- Development of systems and databases to store data and record the outcomes of inspections and/or audits
- Development and delivery of inspection or audit training, and
- Training policy officers to respond to enquiries.

There should also be an assessment of the feasibility of implementing the IWC arrangements.

The process for undertaking a feasibility assessment is explained in section 6.5.

The process for further developing, and preparing to implement, mandatory biofouling requirements was listed in section 2.3 (**Table 7**), and is shown in **Figure 12**.

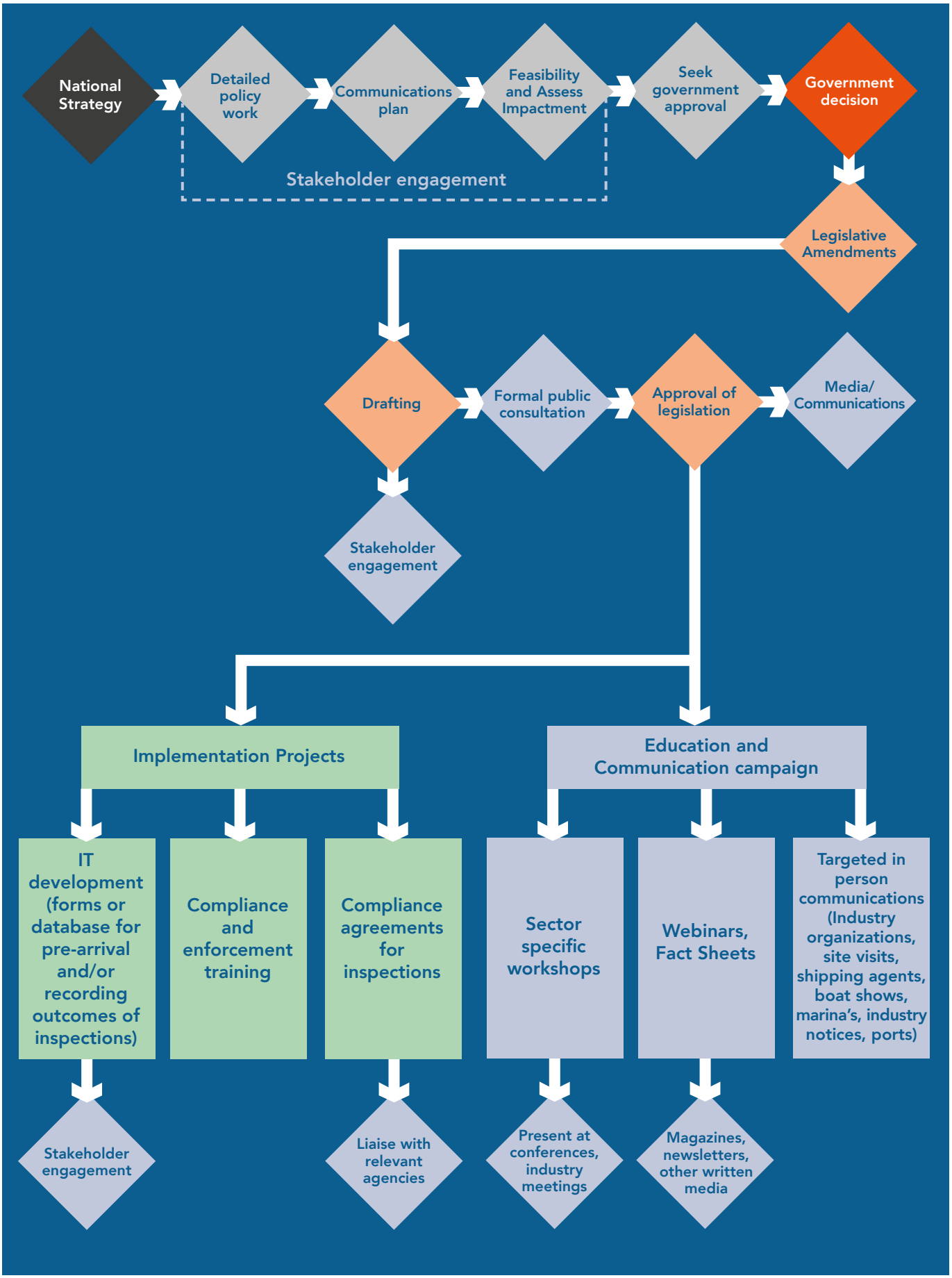


Figure 12 – Process chart for developing mandatory biofouling requirements

6.4 How to Monitor the Effectiveness of Biofouling Management Measures

The implementation of biofouling management measures should be monitored to determine if the approach is working.

Monitoring completes the policy feedback loop (**Figure 13**, below) and provides an opportunity to **continually improve and adapt the policy** to ensure it does not become outdated or fail to meet the overarching policy goals.

Developing a monitoring plan ensures that monitoring activities are prioritised and adequately resourced. To develop a monitoring plan, the options for monitoring should be considered.

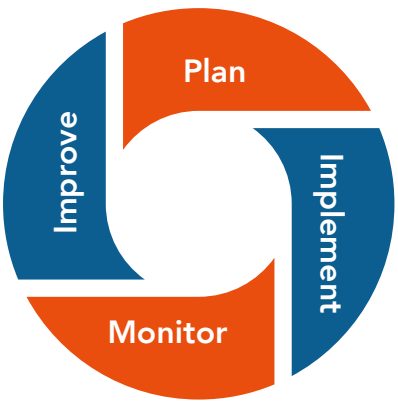
Options include:

1) Gathering information on the biofouling management practices employed by ship and structure owners/operators and other relevant stakeholders, such as port operators and IWC providers

This information can indicate if implementation of the policy has been effective. Mechanisms to gather information include:

Questionnaires	Repeating questionnaires periodically can detect changes in behaviour and inform whether the biofouling management measure and its associated activities (communication, education, compliance and enforcement – if relevant), are effective.
Inspections	Inspections can be used to distribute questionnaires or directly ask owners/operators about implementation of the biofouling measure.
Research	If resources allow, studies that combine questionnaires with underwater surveys of submerged surfaces can contribute to understanding the relationship between biofouling management actions and actual levels of biofouling. This requires the ability to undertake in-water inspections and may require voluntary industry participation, or a legislative power to require in-water inspections for information collection purposes.

Figure 13 - Example of a policy feedback loop



2) Comprehensive and repeated surveillance can detect new IAS in the marine environment.

Whilst new introductions cannot necessarily be directly attributed to biofouling, changes in the IAS status of an area frequented by vessels or structures may indicate that the biofouling management measure is not effective. Surveillance mechanisms include:

Active Surveillance	Conducted by scientists, using multiple sampling techniques (visual surveys, grabs, plankton samples, molecular techniques). Thorough and accurate, but can be expensive and time consuming due to the need to accurately identify organisms. Research organizations, universities, local governments and port authorities may already conduct active surveillance in port environments. It may be possible to leverage off existing work to reduce costs.
Passive surveillance	Information collected by users of the marine environment (otherwise known as citizen scientists). These members of the community keep a look out for, and report, sightings of IAS. Engaging with community groups that are active in the marine environment, such as dive clubs, and providing them with ways to identify and report IAS, can be a good way to get many eyes looking for IAS at low or no cost. Reports can be used to target active surveillance if resources allow. [39]

These options have differing resource needs, so it will be important to consider the options for each and **undertake a feasibility assessment** to ensure that the agency implementing the monitoring plan has sufficient officers and resources to do so.

The process for undertaking a feasibility assessment is explained in section 6.5.

A **monitoring plan** should be developed that identifies:
- Which monitoring option(s) will be used,
- Who will conduct the monitoring,
- How often the monitoring will be undertaken,
- What resources are required to undertake the monitoring and subsequent data analysis, and
- How the monitoring data will be used.

6.5 How to Assess the Feasibility of Implementing Measures

Implementing voluntary and mandatory biofouling management measures requires **personnel and resources.** Similarly, implementing IWC arrangements and a monitoring programme will also require personnel, and potentially specific equipment.

In order to **plan for successful implementation,** it is necessary to review whether the agency responsible for implementing the measure, arrangement or monitoring program has the **capacity and capabilities** required to do so. This is referred to as a **feasibility assessment.**

[39] An example of a successful citizen science programme is Redmap, where citizen scientist reports are used to track changes in the spatial distribution of species.

The purpose of a feasibility assessment is to:

- Calculate the staffing and resources needed to implement the policy
- Determine whether current staffing/resources are available in the agency, and if not
- Identify funding sources to fill the staffing/resources gap.

The feasibility assessment should be used by agency decision makers to determine whether to implement the policy or, if the staffing and resources, or funding, are not available, whether compromises or other policy options should be considered that require fewer resources.

The feasibility assessment should assess each activity that will be required to implement the biofouling management measure individually. For each activity, the assessment should consider:

- The **resources needed** (description of the staff and resources needed to complete the implementation activity),
- **Who is responsible** for providing the staff or resource (which agency/division/section)
- The **strategic importance** of the activity and associated resources *(can the policy be implemented without this staff or resource?)*,
- Whether there are **existing resources/staff** that can be used for the activity, or whether there is a gap that must be filled
- If there is a **gap,** what will be the cost to fill the gap (the financial implications).

A feasibility assessment template is provided in ANNEX P.

Examples of activities that may require ongoing staffing and resources are:

Ongoing activities requiring staffing/resources to implement voluntary biofouling guidelines

- Distribute voluntary guidelines and conduct communication and education activities (inspectors or communications officers), and
- Respond to enquiries (policy officers).

Ongoing activities requiring staffing/resources to implement voluntary biofouling guidelines

- Distribute information about the requirement and conduct communication and education activities (inspectors or communications officers),
- Respond to enquiries (policy officers),
- Collect, assess and store pre-arrival information (if relevant) (policy officers),
- Target and plan vessel/structure inspections (compliance officers),
- Undertake on-board inspections (inspectors - the number needed will depend on the number of arrivals and how inspections are targeted),
- Undertake in-water inspections (underwater photo or video equipment, equipment operators) (if relevant),
- Make compliance and enforcement related decisions (senior manager), and
- Ongoing refresher training for inspectors and equipment users (training officers).

Ongoing activities requiring staffing/resources to implement in-water cleaning (IWC) arrangements

- Assess applications to IWC (policy officers),
- Conduct audits of IWC activities and/or providers (inspectors/auditors), and
- Make compliance and enforcement related decisions (senior manager).

Ongoing activities requiring staffing/resources to monitor the effectiveness of biofouling management measures

Undertake, or manage contractors to:

- Develop and conduct surveys of stakeholders,
- Undertake surveillance for IAS in the marine environment, and
- Store and analyse data.

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Annex A

High-Level Biofouling Policy Template

Section	Instructions	Where to find more information in this guide
PART 1: OVERARCHING POLICY GOALS		
Overarching policy goals	Define the national vision, guiding principles and overall outcome. Describe who was consulted in the development of the overarching policy goals. *If international consistency is included as a guiding principle:* Outline the communication mechanisms, forums, regional agreements or partners that will be used to ensure international and regional alignment. The review of the IMO Biofouling Guidelines should be noted to provide context and justification for reviewing the strategy and retaining flexibility in policy choices, so as to continue to align with the IMO Biofouling Guidelines if amended. *If there are existing biofouling policies:* Outline how existing policies will be amended to be consistent with the overarching policy goals.	CHAPTER 1 Section 1.2 CHAPTER 2 Section 2.1
PART 2: TRANSFER PATHWAYS		
Part 2, Section 1 – Description of relevant pathways		
Overview of nationally relevant biofouling transfer pathways	List each primary and secondary transfer pathway identified in the national status assessment that was found to be relevant in the national context. Summarize the prioritization process undertaken in Phase Two. Provide a prioritized list of transfer pathways and justification for the prioritization.	National Status Assessment CHAPTER 2 Section 2.2

Section	Instructions		Where to find more information in this guide
Part 2, Section 2 – Pathway-specific high-level biofouling policy *(repeat this section for all primary and secondary transfer pathways identified as relevant in the national context)*			
[Pathway] background in the national context	Give a brief overview of the transfer pathway (e.g. international shipping), including its risk profile as identified in the national status assessment.		National Status Assessment
Nature of biofouling management measures	Explain whether voluntary guidelines or mandatory requirements will be implemented for the pathway. Provide justification for the decision.		CHAPTER 2 Section 2.3
Key Policy Elements	Voluntary guidelines (delete if not relevant)	Identify any existing resources or guidelines that will inform (or form the basis of) guidelines that will be distributed. Include relevant guidelines as an attachment. State whether any new guidelines, or new parts to guidelines, need to be identified or developed.	CHAPTER 2 Section 2.4
	Mandatory requirements (delete if not relevant)	Identify which ships/structures the mandatory requirement will apply to, and when Define what the mandatory requirement will be (e.g. ships/structures have an appropriate BFMP and BFRB to demonstrate that they present an acceptable biofouling risk) Include who will undertake inspections (existing inspectors or new, dedicated inspectors) and the agency that employs (or will employ) the inspectors. Include whether pre-arrival reporting will be included in the mandatory requirement. An intention to require pre-arrival reporting but delay implementation of this should also be noted. Include whether in-water inspections will be included in the inspection regime. An intention to include in-water inspections but delay implementation of this should also be noted.	CHAPTER 2 Section 2.4
PART 3: IN-WATER CLEANING			
In-water cleaning	Include whether the environmental risks associated with in-water cleaning will be managed. Note the agencies and stakeholders engaged during the decision-making process.		CHAPTER 2 Section 2.5
REFERENCES			
Include all references used to develop the high-level biofouling policy.			
ATTACHMENTS			
Attach voluntary guidelines that may inform or be used as a basis for voluntary guidelines for specific pathways (if relevant).			

Annex B

Further Analysis of High-Level Policy Overall Outcome Possibilities

Overall Outcome	Advantages	Disadvantages	Information Sources
A - Minimize the amount of biofouling entering the jurisdiction on ships and submerged structures. This approach requires owners and operators of ships and submerged structures to implement best practice biofouling management to minimize biofouling.	Research indicates that minimizing biofouling will reduce the invasion risk of IAS (Hayes et al 2019). Promotes a proactive approach to biofouling management so that biofouling is managed in all circumstances, rather than reactive treatment or cleaning only when a species of concern is thought to be present. Promotes international consistency. Potential to provide industry with compliance certainty if mandatory requirements are implemented.	Some level of risk remains of entry of IAS via biofouling. Risk reduction to zero is impossible. Regulatory impact will be dependent on other policy choices.	Inglis *et al.*, 2010 Hayes *et al*, 2019 International Maritime Organization, 2011 (as may be amended) Ministry for Primary Industries. 2018 (a) Australian Government, 2019 California State Lands Commission, 2017

Overall Outcome	Advantages	Disadvantages	Information Sources
B - Minimize the number of IAS entering the jurisdiction on ships and submerged structures. This approach requires knowledge of the current status of IAS in the jurisdiction and which species of IAS are of concern. This approach also requires taxonomic expertise, equipment and capability to identify these species in situ (underwater, on submerged surfaces, on ship hulls and in niche areas on ships). A sophisticated risk assessment to enable targeting of ships for in-water inspection may be needed.	This approach may enable leveraging off existing species-based import conditions and/or legislation. May provide greater confidence to governments that IAS of concern are not entering jurisdiction.	It is not possible to accurately predict the identity of future IAS and their impacts, making a list difficult to create and maintain. Each jurisdiction will likely have a different list (e.g. in Australia, each state has a list – for example Western Australia and Queensland - and there are several national lists), meaning there is no opportunity for regional or international consistency. Species not on the list may just as easily become IAS in a new environment given the right conditions. Requires knowledge of the IAS status of ports in the country and internationally. This is costly and expensive and must be undertaken regularly to maintain the data currency. It costs New Zealand NZD 170,000 per port to undertake this work, with a regular team who are now familiar with the species and environment (Hayes et al, 2019). Requires knowledge of the presence/absence of IAS on ships and submerged structures, or the ability to accurately predict or model this. To undertake surveys of ships or submerged structures requires good visibility, divers or remote-control vehicles and taxonomic expertise. Underwater surveys are needed of the entire hull and niche areas which are time consuming, difficult and dangerous to access. Taxonomic expertise is expensive, slow and technically challenging, especially as the taxonomy of many marine organisms is still unknown. To model risk is complex, requires substantial information about port IAS status, the ship or structure and its operational profile and voyage history, and sophisticated models to consistently compute this information. The regulatory impact of this option is estimated to be high (see the Australian 2019 Regulation Impact Statement, Australian Government, 2019).	Australian Government, 2015 Australian Government, 2019 Bell et al, 2011 Hayes *et al*, 2019

Annex C

Determine an Appropriate BFMP and BFRB

What is an appropriate Biofouling Management Plan (BFMP) and Record Book (BFRB)?

In line with the IMO Biofouling Guidelines and recommendations made to the review of those guidelines, BFMP and BFRB should be:

- Ship or structure specific, and
- Accountable (i.e. include the timing and triggers for management actions, with wording such as 'as needed' avoided).

There are some important elements that should be included in all BFMP and BFRB to ensure they are effective, and demonstrate proactive biofouling management. These include:

- Hull/submerged surface locations susceptible to biofouling
- Details of the anti-fouling systems and operational practices or treatments used to minimise biofouling,
- Biofouling management practices for all niche areas[40],
- The anti-fouling coating service life for all areas applied,
- Management actions planned to minimise biofouling accumulation during the second half of the anti-fouling coating service life,
- Planned inspections, repairs, maintenance and renewal of anti-fouling systems,
- Details of the recommended operating conditions suitable for the chosen anti-fouling systems and operational practices,
- Details relevant for the safety of the crew, and
- Details of the documentation required to verify any practices, actions and treatments recorded in the BFRB (for example, expectations for inspection reports).

BFMP and BFRB Templates

The IMO Biofouling Guidelines includes a template for a BFMP and a BFRB. In addition, IMarEST and IPPIC produced a BFMP template in 2016[41] and the New Zealand Government produced guidance on what to include in a BFMP in 2018[42]. With changes expected in the IMO Biofouling Guidelines BFMP and BFRB templates, it is advisable to remain flexible in relation to the template of the BFMP and BFRB, as long as the important elements are included.

Equivalent Documentation

Whilst the intent of the mandatory requirement is to drive the development of BFMP and BFRB for all relevant ships or structures, including an option to demonstrate equivalent biofouling management in the legislation can provide industry with flexibility to innovate. This is advisable, particularly in the early years of implementation, as industry adapts to the requirements and templates and standards for BFMP and BFRB remain a subject of discussion at the IMO.

[40] The IMO Biofouling Guidelines contains a comprehensive list of niche areas

[41] International Maritime Organization, 2016

[42] Ministry of Primary Industries, New Zealand Government, 2018 (d)

Policy or Legislation?

The mandatory requirement to require an appropriate BFMP and BFRB must be in some form of legislation that is enforceable to create the powers needed to check for compliance.

It may also be necessary to define what is 'appropriate' in the legislation. Rather than including a specific definition in the legislation, it may be preferable to refer either to:

- International standards (such as the IMO Biofouling Guidelines), or
- Subordinate legislation, such as regulations or policies, that are more easily changed if needed.

Input to the review of the IMO Biofouling Guidelines[43] highlighted the need to improve guidance on BFMPs and BFRBs so that they are ship specific and ensure actions are implemented effectively. Changes to the guidance and templates for BFMP and BFRB in the IMO Biofouling Guidelines should be expected.

[43] International Maritime Organization (a-g), 2020

Annex D

Options for the Mandatory Requirement

Three options are available for the mandatory biofouling requirement, as described in section 2.4. These are:

A. Require ships or structures entering the jurisdiction to have an appropriate **Biofouling Management Plan (BFMP) and Biofouling Record Book (BFRB)**, OR
B. Require ships or structures entering the jurisdiction to present an **acceptable biofouling risk** and demonstrate this by having an appropriate BFMP and BFRB, OR
C. Require ships or structures entering the jurisdiction to meet a **level of fouling requirement** and demonstrate this by having an appropriate BFMP and BFRB.

Table 27 below provides a comparison of these options in relation to the compliance and enforcement activities that can be undertaken and the additional policy work required for each option.

Activities possible:	Option A (Require BFMP and BFRB)	Option B (Acceptable biofouling risk)	Option C (Acceptable level of fouling)
Require an appropriate BFMP and BFRB	☑	☑	☑
Undertake a biofouling risk assessment (if BFMP and BFRB non-compliant)	No	☑	☑
Require biofouling risk to be mitigated (if deemed high risk)	No	☑	☑
Additional policy work required:			
Application (which ships or structures the mandatory requirement will apply to, and when the mandatory requirement will apply)	☑	☑	☑
Define 'appropriate' BFMP and BFRB (ANNEX C)	☑	☑	☑
Define 'acceptable biofouling risk' (ANNEX E)	No	☑	No
Determine 'acceptable level of fouling' (ANNEX F)	No	No	☑
Determine how level of fouling will be measured (in-water inspections, or an alternate proxy measure based on documentation)	No	No	☑
Develop risk assessment and decision-making framework (ANNEX E, ANNEX L)	No	☑	☑

Table 27 - Comparison of mandatory biofouling requirement options

Annex E

Determine Acceptable Biofouling Risk

Acceptable Biofouling Risk

As described in section 2.4, the recommended mandatory requirement is *Option B: Require ships or structures entering the jurisdiction to present an acceptable biofouling risk and demonstrate this by having an appropriate BFMP and BFRB.*

If this option is to be implemented, a process to determine what is an acceptable biofouling risk must be developed.

To determine what an acceptable biofouling risk is, it is necessary to:

- Define biofouling risk, and
- Develop a method to assess biofouling risk.

Biofouling Risk Definition

A broad biofouling risk definition refers to the **likelihood of introduction, establishment and spread of IAS via biofouling, and the potential impact of this on human, animal or plant health, the environment or the economy.**

The biofouling risk definition should refer to both the introduction and spread of an IAS to ensure that primary and secondary transfer pathways can be assessed for biofouling risk.

As the impacts of any particular IAS in a new environment cannot be predicted, the biofouling risk definition should only refer to the potential impact, not the actual impact.

Assessing Risk

Under *Option B*, the mandatory requirement includes that a ship or structure must have an appropriate BFMP and BFRB to represent an acceptable biofouling risk.

For ships or structures without an appropriate BFMP and BFRB, it may be necessary to use other information to assess biofouling risk.

Based on the biofouling risk definition and the overarching policy goals, it can be assumed that more biofouling on a submerged surface represents a higher biofouling risk.

The biofouling risk assessment should aim to estimate the amount of biofouling on a submerged surface for ships or structures that do not have an appropriate BFMP and BFRB.

Put simply, the more opportunity that biofouling organisms have to settle on a submerged surface, the more biofouling will accumulate and the greater the amount of biofouling will be.

Without detailed images of the submerged structure, it is not possible to precisely estimate the amount of biofouling. However, an indication of biofouling risk can be achieved by assessing biofouling risk factors, such as:

- **Anti-fouling coating service life** – coatings in the second half of their service life tend to be less effective, presenting biofouling organisms with an increased opportunity to settle,
- **Time spent stationary** – time spent stationary or at low speeds is generally associated with an increase in biofouling accumulation as there is a lack of hydrodynamic forces making it easier for organisms to attach to the surface, and some anti-fouling coatings require movement for self-polishing to release anti-fouling components,

Assessing Risk - continued

- **Time since last cleaned** – recent cleaning can be an indicator that biofouling organisms have not had an opportunity to settle and accumulate on the submerged surface, if the clean is thorough and did not damage the coating,
- **Time since last inspected** – a recent inspection report that demonstrates only microfouling is present can provide evidence that there is limited biofouling accumulation.

In addition to these factors to estimate the amount of biofouling, the risk of introduction, establishment and spread of IAS from biofouling is also influenced by how long the submerged surface will remain in the jurisdiction. This **duration of stay** should be taken into account in a biofouling risk assessment, with long stays (generally considered longer than 3 weeks) considered higher risk.

Biofouling Risk Assessment Method

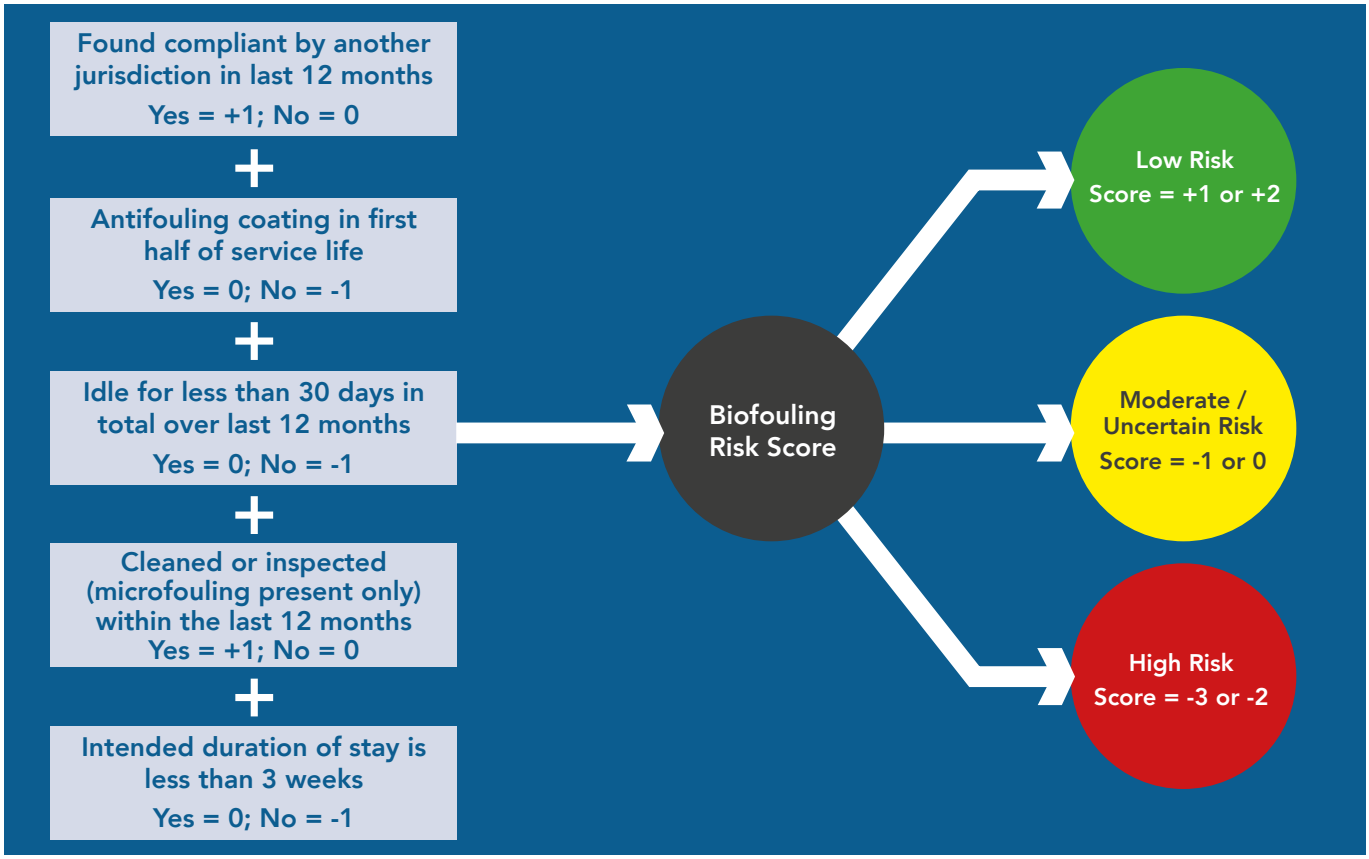
It is possible to estimate the biofouling risk of a ship or structure that does not have an appropriate BFMP and BFRB using the biofouling risk factors. The example provided in **Figure 14** uses a points system.

Points are added if there is a reduced likelihood of biofouling accumulation.

Points are taken away if there is an increased likelihood of biofouling accumulation or release of biofouling organisms.

This example risk assessment also takes into account whether the ship or structure has recently been found compliant by another jurisdiction with equivalent mandatory requirements, which can be a useful way to speed up border clearances. This may require the development of reciprocal arrangements to share information.

Figure 14 - Example biofouling risk assessment scoring and interpretation



Annex F

Determine an Acceptable Level of Fouling (if relevant)

Acceptable Level of Fouling (if relevant)

As described in section 2.4, another option for the mandatory requirement is *Option C: Require ships or structures entering the jurisdiction to meet a level of fouling requirement and demonstrate this by having an appropriate BFMP and BFRB.*

If this option is to be implemented, an acceptable level of fouling (or threshold) must be determined. To do this, it is necessary to:

- Choose a method for quantifying the level of fouling,
- Decide if the acceptable level of fouling will be dependent on other factors, such as how long a ship or structure will be staying in the jurisdiction, and
- Decide what the acceptable level (or levels) of fouling will be.

Due to the voluntary nature of the IMO Biofouling Guidelines, acceptable level of fouling is not addressed. It is likely that following the review of the guidelines some reference to level of fouling may be added, although it is likely that this reference will be to a level of fouling that should trigger cleaning or management actions[44]. The implementation of a level of fouling that must be met is likely to remain out of scope in any revision of the IMO Biofouling Guidelines.

Methods for quantifying level of fouling

There are several methods available to quantify level of fouling:

- Percent cover,
- Fouling rating scale (developed by the United States Navy[45]), and
- Pictorial standard for underwater evaluation of fouling degree on ship hulls (developed by NACE[46]).

All methods require images of the submerged surfaces, which can be obtained either by divers or remote operated cameras. It may be time consuming to capture images of the entire submerged surface. If time is limited, it will be necessary to obtain a representative sample of images, including all biofouling hot spots such as niche areas.

Level of fouling and other factors

The acceptable level of fouling may be dependent on other factors, in particular how long the ship or structure intends to stay in the jurisdiction. If the ship or structure intends a short stay (less than 3 weeks), a more lenient level of fouling may be acceptable. However, it may also be difficult to ensure compliance with the standard, especially if itineraries change.

It is also important to consider how ships or structures will be expected to demonstrate compliance with different standards. If the requirement includes that an appropriate BFMP and BFRB are needed to demonstrate compliance with the level of fouling, will there be a stricter requirement where an appropriate BFMP and BFRB are not enough? And if so, how will those ships or structures demonstrate compliance?

Examples of more stringent requirements may be provision of evidence of a recent clean, or inspection that demonstrates the level of fouling has been met.

[44] International Maritime Organization, 2021

[45] Naval Sea Systems Command (NAVSEA), 2006.

[46] NACE - National Association of Corrosion Engineers. Note that this publication must be purchased.

[47] Bell *et al.*, 2011

[48] Georgiades and Kluza, 2014; Georgiades and Kluza, 2017; Georgiades *et al.*, 2020

[49] New Zealand Government Ministry of Primary Industries, 2018 (a)

Decide the acceptable level of fouling

There has been significant research effort into the identification of acceptable levels of fouling, particularly in New Zealand. The New Zealand risk analysis[47] found a strong association of macrofouling organisms with the introduction of IAS. Based on this, the difficulty of identifying organisms *in situ*, and the need to rapidly clear ships at the border, the analysis recommended that all macrofouling be considered a risk.

Further work identified a need to recognise the difficulties of managing biofouling in niche areas, and identified more lenient limits for ships on short stays (less than 3 weeks)[48].

The New Zealand Biofouling Craft Risk Management Standard[49] includes thresholds that reflect this work and allow only microfouling on long stay ships, and some macrofouling in niche areas on short stay ships.

Without internationally agreed guidance on acceptable levels of fouling, it is possible that different countries will establish different levels. This is not in line with the guiding principle to seek international consistency, and as a result, caution should be applied if an acceptable level of fouling will be defined.

Annex G

Communication Plan Template

Instructions for completing the communication plan template:

Define the objective of the communication plan

The objective is to consult effectively with all relevant stakeholders on the high-level biofouling policy and seek their feedback on the policy, in particular:

- Will implementing the policy impact the stakeholder? If so, how?
- Does the stakeholder think that the policy is feasible and practical?
- Are there alternative options that the stakeholder thinks have not been considered?

Identify key messages that should be delivered to stakeholders

The key messages will relate specifically to the high-level biofouling policy and should contain key elements of the policy, for example:

- The overarching policy goals of the high-level biofouling policy are ….
- The biofouling measure for *[pathway]* will be *[mandatory requirements OR voluntary guidelines]*
- Key policy elements for the biofouling measure for *[pathway]* include
- The environmental risks associated with in-water cleaning *[will/will not]* be managed

Identify stakeholders and/or the audience for communication activities

This should be an overview of all stakeholder groups that must be included. In the case of this consultation, list the stakeholders for all pathways as well as IAS stakeholders more broadly, including all government departments, industry, pathway members (for example recreational boaters), research organizations, in-water cleaning providers, ports, marinas and harbours.

Develop a communications action plan, including the following components:

Target Audience / Communication Mechanisms

Stakeholders and communication mechanisms should have been identified in Step 1. These should be used to complete the target audience and how (channels, tactics, actions) columns of the template.

Timing / Frequency

Different communication channels may be used at different times during the consultation period. During a 3-week consultation period, it may be useful to plan the timing, for example:

- Day 1 - Release the high-level biofouling policy on the web and via direct communications (emails),
- Week 1 – Use social media and newsletters to advertise the consultation period is open and encourage feedback; conduct a webinar and advertise it broadly; meet with stakeholders in person or virtually,
- Week 2 – Follow up with key stakeholders directly (in person, phone, email); re-advertise using social media; hold a seminar; send a survey to stakeholders requesting specific feedback,
- Week 3 – Remind all stakeholders and use social media to highlight the closing date for submissions.

Objective

There may be a different objective for the consultation for different stakeholders. For some stakeholders, such as government stakeholders, it may be to **inform** them of intentions so that, if there are any related policies in their agencies, they can ensure consistency and coordinate this. However, for other stakeholders, such as key industry stakeholders, the objective will be to **seek feedback** on the high-level biofouling policy. For some stakeholders, only part of the policy may relate to them. It is useful to highlight the objective for each stakeholder so that direct communications can focus on those issues. Other objectives may be to **educate, build awareness or change behaviour.**

Responsibility

It is important to designate who is responsible for each action in the plan. Some communications will be best led by the strategy development team, or overall decision maker, whilst others will be best handled by the pathway-specific project team(s) and decision makers. Identifying who is responsible in the plan ensures that officers can plan their work during the consultation period.

Measure of Success

It is good to include how it will be determined if the communication was effective. In the case of social media, it may be measured by the number of responses, likes or 'hits' that the posts get. For a webinar, it may be the number of attendees and questions asked. Recording this detail will make it easier to report on the success of consultation efforts to decision makers who will be asked to approve the strategy.

Status

Including the status of the action provides a way of tracking activities. This makes the plan a living document. The plan should be referred back to as needed to ensure activities are getting done.

Communication Plan Template

Objectives

What you are trying to achieve

Key Messages

High-level overarching messages that link to your objectives. You can refine key messages in your action plan for the different audiences if needed.

Stakeholders / Audience

Understand who you are communicating to and why (inform, educate, build awareness, create change – it may be different for different stakeholders)

Communications Action Plan

Target Audience (Who)	Communication Mechanism(s) (channels, tactics, actions)	Timing / Frequency	Objective	Responsibility	Measure of Success	Status

Annex H

High-Level Action Plan Template

High-level actions required to implement the *[country]* high-level biofouling policy.

Action	Strategic Importance	Responsibility	Timing
Identify actions based on the guidance provided in CHAPTER 4.	Assign priority based on a scale of importance to implementation. High priority = the policy cannot be implemented without this action. Moderate priority = the policy can be implemented but compromises will be required. Low priority = policy implementation can go ahead without this action with minimal impact.	Assign responsibility for each action. Pathway-specific actions should be the responsibility of those agencies with policy responsibility for the pathway.	Refer to the guidance in CHAPTER 4.
Section 1 – Actions to develop and implement biofouling management measures ***[Insert pathway name] – [Insert nature of biofouling management measure – voluntary guidelines or mandatory requirements] –*** repeat this section for each relevant pathway			
Section 2 - Actions to develop and implement arrangements to manage the environmental risks ssociated with in-water cleaning – delete if not relevant based on high-level biofouling policy			

Annex I

National Biofouling Strategy Template

EXECUTIVE SUMMARY

The executive summary should provide an overview of the strategy development process and the key elements of the strategy. It should be assumed that some readers will only read the executive summary, so it is important that this section includes the nature of the biofouling management measures to be implemented for each relevant pathway.

Include:

- Summary of the strategy development process,
- Overview of the high-level biofouling policy,
- Overview of the high-level actions and expected timing for implementation, and
- Outcomes of stakeholder consultation.

CONTRIBUTORS

There will have been a lot of agencies and stakeholders that have contributed to the development of the strategy, including the high-level biofouling policy and the high-level action plan. These contributors should be acknowledged in the strategy.

List all entities that contributed to the development of the strategy (including those that contributed to the development of the high-level biofouling policy, high-level action plan and strategy drafting).

PART 1: INTRODUCTION

The introduction needs to address why there is a need for a strategy and the scope of the strategy, which is a description of which biofouling transfer pathways are relevant in the national context and therefore included in the strategy.

This part should also provide a guide to the contents of the strategy.

Why do we need a strategy?	Overview of the outcomes of the national status assessment, in particular the assessment that determined one or more biofouling management controls were needed to mitigate the risk posed by biofouling.
Scope and elements of the strategy	Identify the biofouling transfer pathways included in the strategy. Describe the structure of the strategy.

PART 2: HIGH-LEVEL BIOFOULING POLICY SUMMARY	More information in this guide:
The high-level biofouling policy does not need to be repeated in full in the strategy itself. The policy should be included as an attachment to the strategy. Part 2 should contain an overview of key elements of the policy.	
Include a summary of the high-level biofouling policy, including the: • Overarching policy goals, • The nature and key elements of pathway-specific biofouling management measures, • Intention to manage the risks associated with in-water cleaning and how (if relevant).	**CHAPTER 2**

PART 3: STAKEHOLDER INPUT	More information in this guide:
Include: • A summary of the outcomes of stakeholder consultation on the high-level biofouling policy, • Any adjustments made to the policy as a result of stakeholder feedback, and • A comprehensive list of stakeholders relevant to implementing the strategy.	CHAPTER 3
PART 4: HIGH-LEVEL ACTION PLAN SUMMARY	**More information in this guide:**
The high-level action plan itself should be attached to the strategy. Include a summary of the high-level actions required to implement the high-level biofouling policy, including estimated timing for implementation of biofouling management measures for each pathway and in-water cleaning arrangements (if relevant).	CHAPTER 4
PART 5: REVIEWING THE STRATEGY AND TRACKING IMPLEMENTATION	
It is advisable to set a timeframe after which the strategy will be reviewed. A reasonable timeframe may be five years, or it might be linked to the high-level action plan. This part should state when the review will occur, and who is responsible for the review. Tracking implementation of the strategy will ensure progress is made towards implementation of the biofouling management measures. Who will track implementation, and any coordination arrangements to support tracking (such as reporting to decision-makers), should be included in this part.	
ANNEX	
High-Level Biofouling Policy Document High-Level Action Plan Document	

Annex J

Determine an Appropriate Implementation Timeline

Timeline to implement mandatory requirements

Determining appropriate implementation timelines for mandatory biofouling requirements is critical. New Zealand and California both had long lead-in times prior to implementation of mandatory biofouling requirements, which was important for education and outreach about the upcoming regulations[50]. Both governments spent a number of years developing and consulting on their proposed biofouling mandatory requirements, and phased-in their regulations, albeit in slightly different ways.

New Zealand first consulted on approaches to manage biofouling in 2010, after years of research and data collection. New Zealand's biofouling regulations were adopted in 2014, and had a 4-year lead-in period during which compliance was voluntary. New Zealand retained the power to take actions to mitigate unacceptable biofouling risks during this time, however, the lead-in period was dedicated to extensive communications. On May 15, 2018, the requirements in New Zealand's Craft Risk Management Standard (Biofouling) became mandatory for all ships arriving in New Zealand[51].

California formally began developing mandatory biofouling requirements with a technical advisory group in 2010. After years of data collection and stakeholder consultation, California's mandatory biofouling requirements were implemented on January 1, 2018. California's regulations, which only apply to ships 300 gross tons and above that are capable of carrying ballast water, were phased-in so that ships were only required to comply after completion of the first regularly scheduled dry docking (or delivery for newly constructed ships) on or after January 1, 2018.

Both approaches took into account that the majority of ships will undertake biofouling management during dry docking. As such, this is the ideal time to develop a Biofouling Management Plan and Biofouling Record Book.

Industry needs time to prepare to comply and the agency implementing the requirement also needs time to gather the resources required for implementation. A phased-in approach that allows for this is advisable.

This might involve:

- A period of voluntary compliance,
- Compliance required after dry docking (or new builds) after the implementation date,
- Compliance actions limited to warnings and no penalties issued for an introductory period, and/or
- A delayed implementation date after the mandatory requirement is adopted.

[50] Scianni *et al.*, in press;

[51] Georgiades *et al.*, 2020

Annex K

Determine Detailed Pre-Arrival Reporting Policy

Pre-arrival Reporting (if pre-arrival reporting will be required)

If the high-level biofouling policy includes that pre-arrival reporting will be required, it will be necessary to determine:

- How the information provided pre-arrival will be used,
- What the pre-arrival report must contain,
- How the pre-arrival report will be collected, and when, and
- How the information will be stored.

Unless there is an existing capability and authority to collect pre-arrival information, it may be desirable to delay implementation of mandatory pre-arrival reporting. This provides additional time to scope and develop the systems needed.

Voluntary pre-arrival reporting of biofouling information could be encouraged during this time. This promotes best practice and facilitates education and communication.

Using information reported pre-arrival

Collecting biofouling information pre-arrival can provide useful information on the implementation of biofouling management measures on a ship or structure.

This information can be used to do a risk assessment. The risk assessment would need to incorporate the biofouling indicators, such as those used in the example risk assessment in Figure 14 - Example biofouling risk assessment scoring and interpretation - as well as whether or not a ship/structure had an appropriate BFMP and BFRB.

Based on the risk assessment, the agency implementing the mandatory biofouling requirement can target ships or structures for inspection. For example, the agency might target 100% of high-risk ships/structures, 20% of moderate/uncertain risk ships/structures, and 5% of low-risk ships.

The target rates will influence the number of inspections that will be expected to be performed, so it is important to retain flexibility in the target rates so that adjustments can be made. As an initial guide, during the first year of implementation of the mandatory requirements in New Zealand, 79% of arriving ships were low risk, 18% were moderate risk and 4% were high risk.

Pre-arrival report contents

If a pre-arrival report is to be used to undertake an initial risk assessment, it will be necessary to collect relevant information on biofouling risk factors, including:

- Does the ship/structure have an appropriate BFMP/BFRB?
- Has the ship/structure been found compliant in another jurisdiction with mandatory biofouling requirements in the last 12 months?
- Is the ship/structure's anti-fouling coating in the first half of its service life?
- Has the ship/structure been idle for less than 30 days in total in over the last 12 months?
- Has the ship/structure been cleaned in the last 12 months? If so, was the clean thorough (all areas cleaned and all macrofouling removed)?

Pre-arrival report contents - continued

- Has the ship/structure been inspected in the last 12 months? If so, was the inspection thorough and did the inspection identify only microfouling present?
- Is the intended duration of stay less than 3 weeks?

Alternatively, ship/structures may be required to submit their BFMP and BFRB prior to arrival for assessment.

How will pre-arrival reporting information be collected, and when

In order to collect pre-arrival information, the agency implementing the mandatory requirement must have:

- The legal power to require information pre-arrival,
- A manual or automated (database) system to collect and analyse information,
- Officers available (including out of hours) to analyse and log information submitted.

Any systems used to submit and receive pre-arrival reports must allow for the submission of reports from ships/structures with poor connectivity.

Systems must also take into consideration any relevant privacy requirements associated with collecting and sharing the information.

Ships/structures without the ability to submit pre-arrival reports should also be considered. Different systems may be required for different pathways, ships or structures.

Ships/structures may be given a time window (for example 1 to 5 days) prior to arrival in which the report must be submitted, allowing sufficient time for the review and assessment of the information.

Alternatively, the requirement may only obligate ships/structures to submit one report per year. This reduces the resource needs to assess and monitor incoming reports, but still provides information to target arrivals for inspection.

How pre-arrival reporting information will be stored

Storing pre-arrival information may require development of a database that is searchable and linked to the risk assessment and targeting system. If not, this will need to be performed manually.

Annex L

Determine Detailed Inspection Policies

Inspections Purpose

Inspections are needed to:

- **Educate** ship owners and operators,
- **Assess compliance** with the requirement, and
- Determine if any **mitigation actions** are required to manage unacceptable biofouling.

To do this, inspectors may be required to:

- **Share information** about biofouling and IAS, the mandatory requirement and how it applies to the ship or structure
- **Assess the biofouling documentation** (BFMP and BFRB, or evidence that demonstrates equivalent management),
- **Assess the biofouling risk** if the documentation is found not to meet the requirement, and
- **Make decisions** regarding mitigation of risk based on the outcomes of the risk assessment, taking into account the **compliance actions** and **penalties** available.

Inspection Timing and Targeting

To estimate the number of inspections that will be required, it is important to consider how often ships or structures will be inspected. This includes deciding whether to set a desired inspection rate and/or inspection frequency.

Inspection rate and frequency

Inspection rate refers to the proportion of arrivals that will be inspected. It may be useful to set an inspection rate in the policy to aid in estimating the number of expected inspections. Where possible, the **rate should be flexible to adapt to real-life arrival numbers rather than predicted statistics.**

The rate may be a percentage of all arrivals, or, if pre-arrival reporting is available, different rates may apply to different risk categories.

For example, the policy might include an inspection rate of 100% of high-risk arrivals, 20% of moderate risk arrivals, and 5% of low-risk arrivals.

Inspection frequency refers to the number of times any individual ship/structure will be inspected. Biofouling management is not undertaken on a single journey and proactive biofouling management is part of a long-term plan (the BFMP).

As a result, it may be appropriate to set a policy that ships will be inspected no more than once per calendar year, unless flagged for follow up as a result of non-compliance.

Inspection Targeting

How inspections are targeted is closely linked to who will be undertaking the inspections. This decision was made in the high-level biofouling policy. This may be:

- Existing inspectors, already undertaking ship or structure inspections for other purposes (such as quarantine, safety or security), or
- Dedicated biofouling inspectors.

Inspection Targeting - continued

Utilising existing inspectors – options for targeting

If biofouling will be added to an existing inspection regime, there may not be an opportunity to influence the targeting of inspections based on biofouling. However, there is likely to be a link between a ship's compliance with other mandatory requirements (such as IMO Conventions) and mandatory biofouling requirements.

It is likely that, if a ship does not comply with other mandatory requirements, it may also not comply with mandatory biofouling requirements.

Dedicated biofouling inspectors – options for targeting

There may be several options for targeting biofouling inspections when dedicated biofouling inspectors are used. These include:

- Targeting based on a pre-arrival report, or
- Targeting based on total wetted surface area.

Pre-arrival reporting can provide the information needed to undertake an initial risk assessment to prioritise arriving ships for inspection. This can be an effective way to allocate inspection resources. In addition to the example risk assessment included earlier in Figure 14, a pre-arrival risk assessment would incorporate whether or not the ship has an appropriate BFMP and BFRB.

It may not be possible to assess whether the BFMP and BFRB is appropriate prior to arrival, but a declaration made by the owner/operator that they do have an appropriate BFMP and BFRB may provide sufficient information. This requires a penalty to be associated with incorrect declarations and inspection of some low-risk ships.

Total wetted surface area can be used as a proxy for the amount of biofouling on a ship. Recent work has developed a model that also takes into account niche areas on ships[52]. Using a model such as this may provide a risk-based approach to target biofouling inspections without the need to require pre-arrival reporting. This model only requires knowledge of the type and size (gross tons) of a ship or structure.

Inspection Decision-Making

The ability of an inspector to make decisions regarding mitigation of risk will depend on the mandatory requirement itself.

If the recommended option (Option B – require ships/structures to present an acceptable biofouling risk) or Option C (require ships to meet a level of fouling) are implemented, there is basis for undertaking a risk assessment and making decisions regarding risk mitigation.

However, if Option A (require an appropriate BFMP and BFRB) is implemented, then there is no basis for assessing risk. In this case, compliance actions may not be taken, however penalties can still be applied if a ship/structure does not have an appropriate BFMP and BFRB.

An inspector may be required to make a decision (or make a recommendation to a decision-maker) whether risk mitigation actions are needed for non-compliant ships or structures, and/or whether penalties should be applied.

[52] Ceballos-Osuna *et al.*, 2021

Inspection Decision-Making - continued

In addition to the outcomes of the documentary and risk assessment, the decision should take into account:

- The **compliance action options** available,
- The **compliance history of the ship,** and
- The **availability of biofouling management options,** such as in-water inspections and cleaning.

An example flow chart to guide decision-making in relation to the use of compliance actions and penalties is included in **Figure 15.**

This includes using different ranked officers to make decisions, particularly where the decision may have a significant impact on the owner/operator.

Compliance Actions

If a ship is found non-compliant with the mandatory biofouling requirement and presents an unacceptable biofouling risk, there should be compliance actions available to the inspector or decision-maker to mitigate the risk.

Compliance actions should be built into the legislation to provide the power to require an owner/operator to undertake mitigation actions.

Compliance actions to mitigate risk might include:

- Warnings – if included in legislation, a warning is a formal action that should be provided in writing, and has a consequence for the ship/structure's next visit, i.e. inspection of that ship/structure will be prioritised next visit and if found non-compliant again, further action will be taken, and
- Directions – directions can be used to require a ship or structure to move to a certain place or at a certain time. This may be to move to a certain place for an in-water inspection (if available), to move outside the jurisdiction after a certain time (providing a time-limitation on the visit) or to move outside the jurisdiction immediately upon arrival.

Warnings provide owners/operators with an opportunity to meet the mandatory biofouling requirement.

These are similar to the 60-day grace period used in California's implementation of mandatory biofouling requirements, where non-compliant ships are re-inspected on their next arrival after 60 days, at which time they are expected to comply. This provides an education opportunity and motivates owners/operators to develop appropriate BFMP and BFRB.

Issuing a direction to an owner/operator to clean or treat biofouling on a ship/structure is not recommended, because:

- A direction to clean places liability on the regulating agency, and
- An owner/operator should be given the opportunity to provide evidence that the biofouling risk has been mitigated, either by providing an inspection report or cleaning voluntarily.

Movement directions can have a significant impact on the itinerary of a ship/structure.

Due to the significant consequences of a direction to move on the itinerary of a ship or structure, and the subsequent economic and logistical impact, it is possible the direction will be challenged in court. Legal advice should be sought on the types of evidence that will be required to use each direction, particularly if the direction will refuse entry to the country.

Penalties

Penalties provide an incentive to comply. Any penalties associated with non-compliance with the mandatory requirement should be included in the legislation.

Types of penalties might include:

- Education (not exactly a penalty, but providing education will inform owner/operators of the requirements and promote compliance),
- Financial or civil penalties – associated with a particular aspect of the mandatory requirement, may be issued in the form of a fine or infringement notice, or
- Criminal offence – associated with a particular aspect of the mandatory requirement, anyone found non-compliant in that aspect may be charged with that offence.

Inspector Training

Biofouling may be unfamiliar to many inspectors, so the regulating agency should develop a dedicated training programme prior to implementation of mandatory biofouling requirements. The training program might include:

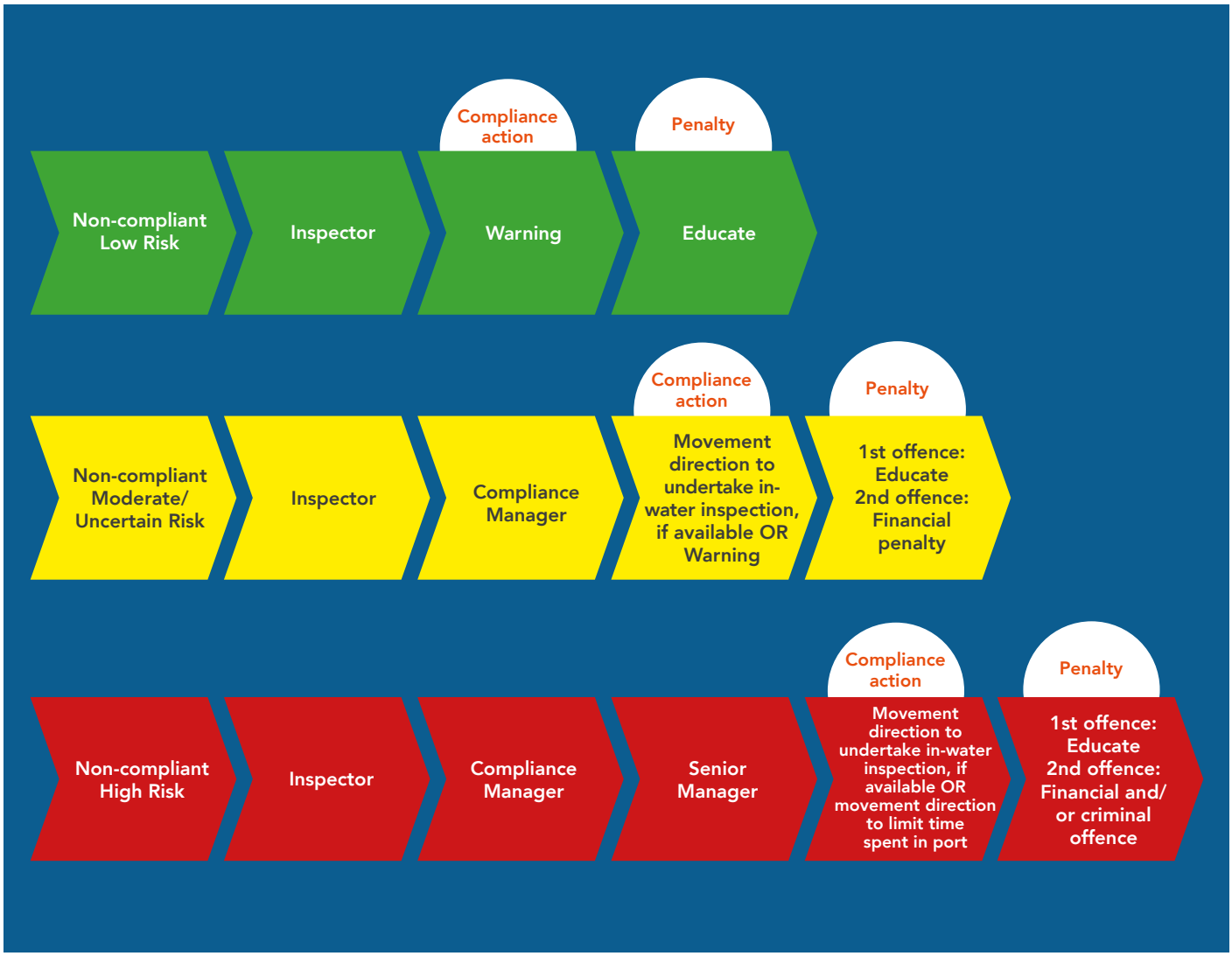
- How to board ships/structures and how to communicate with ship/structure operators (for new inspectors),
- Details of the mandatory requirement, compliance actions, penalties, and decision-making procedures, and
- What to look for during an inspection, and specific questions to ask.

This should be supplemented with regular refresher training.

To support the training programme, agencies may benefit from establishing a network of biofouling advisors based in different locations. Advisors are biofouling inspectors with more training, greater knowledge and/or more experience.

Biofouling advisors can be called on by less experienced inspectors for advice during an inspection, and may also form an important part of the decision-making flow. This will also promote consistency in inspections across ports and regions.

Figure 15 - Example flow chart for compliance action and penalty decision-making for non-compliant ships



Annex M

Determine Detailed In-Water Inspection Policy

In-water inspection preparation (if in-water inspections are included)

In-water inspections have obvious advantages in assessing biofouling risk, however they are not simple.

Logistically, port access is required and it may be necessary for a ship or structure to pause operations in order to facilitate an in-water inspection.

If that is the case, the question of undue delay may arise. The potential cost of a delay to operations in most marine industries is substantial so **a decision to undertake an in-water inspection as part of a biofouling compliance regime is a serious one.**

There is a risk that the owner/operator will challenge the decision. This means having confidence in the risk assessment conducted during a documentary inspection and the decision-making process.

There are several aspects that must be considered in order to implement in-water inspections, including:

- Equipment and Operators,
- Images Required, and
- Timing.

If the capability does not already exist to undertake in-water inspections, it may be desirable to delay implementation of in-water inspections. This would allow time to build the capacity, capabilities and resources to undertake in-water inspections, together with gathering information from arriving ships and structures to further inform the need for in-water inspections in relation to decision making. It will also allow time for international development of acceptable hull inspection procedures for measurement of biofouling, in line with the current recommendations in the review of the IMO Biofouling Guidelines.

Equipment and Operators

In-water inspections require appropriate equipment and trained operators to be available at short notice, in all locations where an in-water inspection may be required.

In-water inspections can be carried out by a remote-operated vehicle (ROV) or diver with a video camera. Either way, equipment and expertise are required to both take the video and analyse it.

Advancements in ROV technology have led to more appropriate and lower cost options being available for port-side underwater video, however the logistics of transporting this equipment to and from the site and the cost of having enough ROVs to be available at all relevant ports should be considered.

ROV operators and/or divers may be from within the agency or contracted.

There are safety considerations for operating in a port and under ships/structures. A safety protocol should be developed to ensure the safety of all operations and training must be provided to all operators and divers on a regular basis. As in-water inspections may be infrequent, regular refresher training will be essential to maintaining a safe approach.

Images

The quality of photo and video footage is important when using in-water inspection in decision-making.

Port environments often have poor visibility, making it difficult to get good quality video footage that can be easily analysed.

Strong currents and/or surface waves may impact the ability of operators and divers to obtain quality photos and video footage. There may be times when the environmental conditions are not suitable to undertake in-water inspections, and a contingency should be built into the decision-making framework for when this occurs.

Analysing video footage is also important.

The ability to quickly analyse the footage and gain an understanding of the level of fouling is essential to be able to use in-water inspections effectively.

Any delay in analysis may delay the ship or structure further, or the ship/structure may move on, making it too late to effectively mitigate any risk.

Time limitations

The ability of the operators or divers to capture video of the entire hull and niche areas is dependent on the size of the ship/structure due to the time it takes and the logistics of reaching all areas.

Videoing an entire hull in one day may be unrealistic for large ship/structures.

Operators and divers may need to select representative portions of the hull and target accessible niche areas in order to give an indication of the level of fouling. This would likely need to be done on a per ship/structure basis and will require knowledge of the ship or structure's niche areas and hull.

Whilst choosing representative portions of the hull should be random, it should also be done in such a way that there is confidence that an accurate picture of the level of biofouling has been obtained.

Annex N

Biofouling Impact Assessments

Examples of International Biofouling Impact Assessments

There are several examples of biofouling impact assessments. Most recently, Australia released a Regulation Impact Assessment (RIS) in 2019[53]. The RIS provided regulatory burden estimates of three different options for biofouling management in Australia. The costs assumed that a certain percentage of ships already complied with biofouling requirements in New Zealand, California and Western Australia, so the cost burden was limited to those unique ships entering Australia that had not visited one of those locations in their last 10 ports of call. The RIS estimated that the regulatory burden to the commercial sector of the preferred, IMO Biofouling Guidelines consistent option, would be approximately AUD 10,519,000 over a 10-year timeframe. The RIS estimated a zero-dollar impact to the recreational sector, as it assumed BFMP would be produced by owners/operators of recreational ships. It estimated this would take a total of 2805 hours.

California's analysis of regulatory impact and cost/benefit for implementation is incorporated into the **Notice of Proposed Regulatory Action and the Initial Statement of Reasons**[54]. These describe the benefits of the regulation, which include minimizing the introduction of IAS and decreased greenhouse gas emissions. The costs to both industry and regulator are described, including that for pre-arrival reporting, the regulatory burden of which was actually decreased through the regulation by reducing the number of forms (related to ballast water as well as biofouling) and the frequency that they had to be submitted.

This was also a benefit to the regulator. The assessment identified regulatory impacts on ship owners and operators (record keeping, reporting and general maintenance). It was also noted that negligible impact on local shipping agents was anticipated, and that there was potential for job creation at dry docks (through longer, more thorough dry docking), anti-fouling coating manufacturers (through demand for higher quality) and in-water cleaning and treatment service providers (through potential increase in demand). A summary of the regulatory burden costing estimates in both the Australian RIS and the Californian analysis are in **Table 28 - Comparison of regulatory burden costings from publicly available documentation of regulatory impact analysis for Australia and California.**

The 2012 New Zealand cost-benefit analysis (CBA) of proposed biofouling requirements took into account costs to government and industry, including border processing costs, such as submitting biofouling declarations, undertaking investigations and issuing warnings, compliance costs and action costs for non-compliant ships[55]. The CBA found that the costs associated with implementation for the first 10 years would be approximately NZD 17,200,000 if voluntary standards were implemented in California and Australia; or NZD 10,000,000 if mandatory standards were implemented in California and Australia.

Overall, the CBA found that benefits would outweigh the costs at all times, and over a 50-year period benefits would increase to between NZD 520 to NZD 865 million, depending on regulatory stances taken in Australia and California. The CBA analysis includes estimates of the impact of compliance on a range of ship types, noting that the cost of compliance is likely associated with additional treatment of niche areas. Based on the calculation used, that an additional 25% of time during dry dock will be needed to apply that treatment, the cost of compliance would range from NZD 10,000 to NZD 15,000 per ship per year, depending on ship type. The CBA anticipated that the regulatory burden of pre-arrival reporting would be negligible.

[53] Australian Government, 2019

[54] California State Lands Commission, 2016 (a) and (b)

[55] Branson, 2012

Table 28 - Comparison of regulatory burden costings from publicly available documentation of regulatory impact analysis for Australia and California

Sources: Australian Biofouling Management Requirements for International Vessel Arrivals – Regulation Impact Statement (Australian Government, 2019); California State Lands Commission Notice of Proposed Regulatory Action and Initial Statement of Reasons (California State Lands Commission, 2016 (a) and (b)).

Burden/Activity	Australia[56]	California[57]
Pre-arrival risk assessment	Estimated regulatory burden of submitting pre-arrival forms was AUD 15 per ship report (a total of AUD 261,000 for 17,386 ship entries each year).	No additional costs to industry (already submitting ballast water forms, regulation actually decreased number of forms).
Preparing a Biofouling Management Plan and Record Book	AUD 0 for recreational craft; Average AUD 1052 per plan for commercial ships	Range from USD 0 to USD 4000 per ship
Additional in-water inspections (proactive – not for compliance purposes)	Estimated at AUD 7000 per inspection (anticipated less than 0.1% of ships to inspect in Australia). Estimated 95% of impacted ships would add biofouling to scheduled in-water surveys in Singapore – approx. 2 additional hours per inspection; additional AUD 667 per inspection every 2.5 years.	In-water inspections USD 2500 to USD 6500 per inspection.
Additional in-water hull cleaning (proactive – not for compliance purposes)	Not estimated.	In-water cleaning at USD 10,000 - USD 42,000 per ship.
Additional in-water niche area cleaning (proactive – not for compliance purposes)	Not estimated.	Costs variable and difficult to estimate. Example included - propeller polishing USD 2000 to USD 5000 per cleaning event.
Additional biofouling management of niche areas (proactive – not for compliance purposes)	Estimated cost of marine growth prevention system (MGPS) AUD 10,000 (noted only 2% of ships likely to install MGPS per year).	MGPS USD 100,000 to USD 1,000,000 per vessel (noted at least half the ships operating in California already had MGPS)

[56] Note: the Australian RIS estimated that only 1/3 of unique ship entries would be impacted (2/3 would have entered NZ, California or Western Australia in last 10 port visits and therefore already have met biofouling requirement for another purpose)

[57] Note: the Californian assessment estimated that the majority of ship would already be implementing best practice biofouling management. The assessment calculated the impact on a small minority of ship only (this was not quantified).

Impact Assessment Template and Instructions

An impact assessment should **identify and estimate the financial burden on industry** of complying with the mandatory requirement.

The assessment does not include the cost of non-compliance with the mandatory requirement.

The assessment also does not include activities that the operator/owner would undertake as part of routine ship/structure maintenance, for example application and maintenance of anti-fouling coatings for the purposes of maintaining fuel efficiency, dry docking or routine inspection and cleaning of niche areas that serve an operational purpose (for example cooling systems that must be cleaned to maintain their operation ability).

To complete the below template, it is necessary to identify all the components of the mandatory requirement that will require industry to change their behaviour and complete actions that may have a financial cost.

The financial cost needs to take into account the potential number of ships or structures (or owners) impacted and the cost of the activity.

It will be necessary to consider the location where activities, such as inspection and cleaning, will be undertaken. If there are dry dock and in-water inspection and cleaning facilities available within the country, then the costs associated with these activities in country should be incorporated.

If these services are limited, and it is anticipated that most ships will undertake biofouling maintenance in other jurisdictions, it is important to consider where they might most commonly seek these services and the costs associated with those services in those locations.

Template for a Biofouling Regulation Impact Assessment

This assessment identifies the potential regulatory impact on industry of complying with the mandatory biofouling requirement for *[insert pathway name]*.

Description of impact/burden	Who will be impacted	Financial cost of impact
Identify aspects of the mandatory requirement that will impact or create a burden for industry.	Identify who will be impacted, including how many owners/operators or ships/structures.	Calculate the cost of undertaking the activity required to comply with the mandatory biofouling requirement. For example, if the cost of preparing an appropriate BFMP and BFRB for a commercial ship is calculated at $1050 per ship, and there are 4500 unique ship arrivals each year, then the financial cost of the requirement to have an appropriate BFMP and BFRB for commercial ships would be $4,725,000. The assessment should note how often this cost will be incurred – in the case of a BFMP and BFRB, the cost may only be incurred once, with a smaller cost of updating the plan and record book every 5 years.

Annex O

Example Legislative Framework

Example Legislative Framework for Mandatory Biofouling Requirements

Element	Where	What	Penalties
Application of the mandatory requirement	Legislation and policy	Legislation must include a description of which ships and/or structures the requirements apply to and the boundaries of the regulatory jurisdiction. As some pathways may apply biofouling requirements in different ways, such as conditions attached to permits or licenses, how this is achieved for each sector should be contained in policy.	N/a
(If implementing mandatory requirement Option B – requiring arrivals to present an acceptable biofouling risk) Definition of biofouling risk	Legislation and policy	The legislation should define biofouling risk, for example[58]: Biofouling risk means: (a) the likelihood of a disease or pest: (i) entering the jurisdiction; or (ii) establishing or spreading in the jurisdiction; and (b) the potential for any of the following: (i) the disease or pest to cause harm to human, animal or plant health; (ii) the disease or pest to cause harm to the environment; (iii) economic consequences associated with the entry, establishment or spread of the disease or pest. How this risk is assessed should be included in policy.	N/a
Requirement to have an appropriate BFMP and BFRB	Legislation and policy	The legislation should include a requirement to have an appropriate BFMP and BFRB. It may also be desirable to include in the legislation an opportunity to demonstrate equivalence. If implementing mandatory requirement Option B – requiring arrivals to present an acceptable biofouling risk – the legislation should include that, in order to not represent an unacceptable biofouling risk, a ship must have an appropriate BFMP and BFRB. The policy should include what an appropriate BFMP and BFRB is.	Infringement notice, civil and criminal penalties (for not having an appropriate BFMP and BFRB). Administrative penalties (e.g. increased inspection rate) (for having a BFMP and BFRB but they are not appropriate)

[58] Biofouling risk as described here is modified from the definition in the Australian Biosecurity Act 2015 (Australian Government, 2015b)

Element	Where	What	Penalties
Documentary inspection	Legislation	Legislation must include powers for inspectors to require documentation to be produced and questions to be answered in order to assess compliance with the mandatory requirement and (if needed) assess the biofouling risk.	Civil and criminal (for not providing information or not answering questions)
Assessment of risk – securing the ship	Legislation	Legislation must include powers for inspectors to require a ship to be secured for the purposes of assessing the biofouling risk either in a particular way or for a particular length of time.	Civil and criminal (for not securing the ship as directed)
Assessment of risk – inspection	Legislation	Legislation must include powers for inspectors to physically inspect a ship to assess the biofouling risk. If in-water inspection is included in the policy, legislation should also include powers for inspectors to arrange for another person with appropriate skills and expertise so that contracted divers/operators may perform the in-water inspection if necessary.	Civil and criminal (for refusing inspection)
Assessment of risk – movement of ship/structure	Legislation	It may be necessary for the ship to be moved to a different port or area within the port to enable either a documentary or (if included in the policy) an in-water inspection. If so, legislation should include powers for inspectors to direct a ship to move to another place within the jurisdiction. The powers should include the ability to direct the owner/ operator not to interfere with the ship.	Civil and criminal (for refusing direction)
Managing moderate risk	Legislation	If a ship has not complied with the requirement (i.e. does not have an appropriate BFMP and BFRB) but the assessment of risk indicates that the ship does not pose an unacceptable risk at this time, the legislation should include a warning to facilitate future compliance.	Time Relevant Warning (for non-compliance)
Managing unacceptable risk – movement of ship/structure	Legislation	If a ship has not complied with the requirement (i.e. does not have an appropriate BFMP and BFRB) and an inspector suspects, on reasonable grounds at the completion of the assessment of risk, that the ship poses an unacceptable risk, the legislation must include powers to mitigate the risk. Legislation must include powers for inspectors to direct an owner/operator to move a ship inside the jurisdiction in order to mitigate the biofouling risk. Powers should also be included to direct a ship to move outside the jurisdiction to mitigate the risk, however as a result of the implications of this direction, it is recommended that a high-level official only be delegated this power.	Civil and criminal (for refusing direction)

Example Legislative Framework for In-Water Cleaning Arrangements

Element	Where	What	Penalties
In-water cleaning – notification of intention	Legislation	If a ship or structure intends to undertake in-water cleaning in the jurisdiction, the legislation should include that prior notification (for example, 24 to 96 hours prior to commencement of the activity) must be given to either the port authority or the IWC implementing agency. The notification should include the intended timing and location for the IWC activity and the IWC provider to be used.	Warning and civil penalties (for failure to notify)
In-water cleaning – requirement to be an approved IWC provider	Legislation	IWC providers must be approved by the IWC implementing agency and be included in a list of approved operators.	Civil and criminal (for undertaking an IWC activity without being on the list)
In-water cleaning – requirement to perform IWC activities in accordance with approval and any associated conditions	Legislation	IWC providers must conduct IWC activities in accordance with their approval and any associated conditions, which may include, but not be limited to: • Evidence that must be gathered before an IWC activity (level of fouling on the submerged surface, the type of anti-fouling coating to be cleaned, water and sediment quality measurements in the surrounding marine environment), • Evidence that must be gathered during an IWC activity (demonstration of capture of debris, no visual plumes, water and sediment quality measures close to, and away from, the IWC site), • Evidence that must be gathered after an IWC activity (level of fouling on the submerged surface, records of any damage to anti-fouling coatings, water and sediment quality measurements close to, and away from, the IWC site), and • Surveillance that must be undertaken on an ongoing basis (IAS in-water surveys, testing of bioaccumulating organisms such as oysters and mussels).	Civil and criminal (for undertaking an IWC activity not in accordance with approval and conditions)

Annex P

Feasibility Assessment Template

This assessment identifies the resources required to implement *[insert one: voluntary guidelines, mandatory requirements, in-water cleaning arrangements OR monitoring plan] [for voluntary guidelines or mandatory requirements, insert pathway name]*

Implementation Activity	Resources required	Responsibility	Strategic Importance	Existing Staffing/ Resources	Gap / Financial Implication
Identify implementation activities (CHAPTER 6, section 6.5)	Identify resource needs.	Assign the division or section of the agency responsible for providing the resources.	Assign priority based on a scale of importance to implementation. High/Medium/ Low.	Identify existing resources/ staffing available.	Identify the gap in staffing and/or resources and calculate the approximate cost to fill the gap.

More information:

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