

Invasive Non- native Species Pathway Action Plan: Boat-based Fishing in Wales



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APEM Ltd. and Natural Resources Wales

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Crynodeb gweithredol

- Mae rhywogaethau estron goresgynol yn rhywogaethau o blanhigion, anifeiliaid neu bathogenau nad ydynt i'w cael yn naturiol mewn ardal ond sydd wedi cael eu symud yno, gan weithgareddau dynol (naill ai'n ddamweiniol neu'n fwriadol) ac sy'n achosi effeithiau amgylcheddol, cymdeithasol neu economaidd sylweddol. Rhai o effeithiau rhywogaethau estron goresgynol yw eu bod yn cystadlu'n llwyddiannus â rhywogaethau brodorol am fwyd a gofod, eu bod yn newid cynefinoedd, lledaenu clefydau ac achosi costau uniongyrchol ac anuniongyrchol i economïau lleol a chenedlaethol.
- Mae symudiad (h.y. cyflwyno a lledaenu) rhywogaethau estron goresgynol yn cael ei hwyluso gan drywyddau a gweithgareddau dynol o'r enw "[Llwybrau](#)", er enghraifft, morgludo, defnyddio cychod hamdden a dyframaethu.
- Mae pysgota o gychod yn cael ei gydnabod fel un o'r llwybrau ble caiff rhywogaethau estron goresgynol eu cyflwyno a'u lledaenu, gyda photensial i weithgareddau pysgota symud anifeiliaid (ar ffurf wyau, larfâu, anifeiliaid ifanc ac oedolion) a gwymon (fel darnau neu sborau).
- Gall rhywogaethau estron goresgynol gael eu cyflwyno a'u lledaenu trwy gael eu maglu neu lynu wrth offer, cyfarpar pysgota, dillad a deunyddiau amsugol fel rhwydi, cael eu taflu fel sgil-ddalfa wrth gael eu prosesu yn ystod cludiant, biolygredd ar gyrff cychod ac offer/cyfarpar, a phan gânt eu defnyddio fel abwyd.
 - Fel arfer ceisir mynd i'r afael â lleihau effaith rhywogaethau estron goresgynol drwy gyfrwng ymdrechion i atal eu lledaeniad ar lefel y 'llwybr'.
 - Mae deddfwriaeth a pholisi yn ymwneud â chyflwyno a lledaenu rhywogaethau estron goresgynol yn bodoli yng Nghymru.
 - Mae amcanion y Cynllun Gweithredu Llwybr (PAP) hwn fel a ganlyn:
 - Amlinellu'r risgiau bioddiogelwch o ran rhywogaethau estron goresgynol sy'n gysylltiedig â'r llwybr pysgota o gychod.
 - Nodi rhywogaethau estron goresgynol morol allweddol sy'n gysylltiedig â'r llwybr pysgota o gychod.
 - Darparu cyfres o [gampau gweithredu graddadwy](#) i randdeiliaid amgylchedd morol Cymru y gellid eu rhoi ar waith ble mae pysgota o gychod yn digwydd.
- Rhanddeiliaid yw'r rhai sy'n defnyddio, yn elwa o, neu sy'n gyfrifol am (e.e. rheoli, amddiffyn neu reoleiddio) yr amgylchedd morol. Yma, mae hyn yn cynnwys awdurdodau perthnasol a chyrff statudol, harbwrfestri, a'r rhai sy'n ymwneud â'r gweithrediadau pysgota o gychod a restrir isod.
- Mae'r PAP hwn yn berthnasol i weithgareddau pysgota morol a wneir o gwch at ddibenion masnachol (e.e. pysgota â rhwyd treillio) a hamdden (e.e. twristiaeth pysgota). Y bwriad yw y bydd yn berthnasol i bysgota o gychod ar draws holl ardaloedd morol Cymru (ar gyfer cychod wedi'u cofrestru yng Nghymru), gan gynnwys, ond heb fod yn gyfyngedig i'r canlynol:
 - Pysgota â phot neu drap
 - Pysgota â gêr wedi'i dynnu
 - Pysgota â rhwyd
 - Pysgota â gwialen a lein

- Mae'r PAP hwn yn amlinellu saith cydran ffocws bioddigolwch ar gyfer y llwybr pysgota o gychod o fewn ardaloedd morol Cymru:
 1. [Deall rolau a chyfrifoldebau cyfreithiol](#)
 2. [Hyrwyddo gwybodaeth ac arweiniad ar rywogaethau estron goresgynnol a bioddigolwch](#)
 3. [Codi ymwybyddiaeth](#)
 4. [Prosesau a gweithdrefnau bioddigolwch](#)
 5. [Cyfleusterau bioddigolwch](#)
 6. [Gwylidwriaeth ac adrodd](#)
 7. [Gweithio ar y cyd](#)
- Y bwriad yw i'r cynllun hwn gael ei ddefnyddio i gefnogi'r [Cynlluniau Gweithredu Rhywogaethau \(SAP\)](#) a'r [Cynlluniau Gweithredu Bioddigolwch \(BAP\)](#) cysylltiedig.

Executive summary

- [Invasive non-native species](#) (INNS) are plants, animals or pathogens that do not naturally occur in an area but have been moved there, by human activities (either accidentally or deliberately) and cause significant environmental, social and economic impacts. The impacts of INNS include outcompeting native species for food and space, altering habitats, spreading disease and incurring direct and indirect costs for local and national economies.
- The movement (i.e. the introduction and spread) of INNS is facilitated by human mediated routes and activities called “[pathways](#)”, for example, shipping, recreational boating and aquaculture.
- Boat-based fishing is recognised as a pathway for the introduction and spread of INNS, with potential for fishing activity to move both animals (as eggs and in their larval, juvenile and adult life stages) and seaweed (as fragments or spores).
- INNS can be introduced and spread through being entangled/ attached to equipment, fishing gear, clothing and absorbent materials such as nets, being discarded as bycatch when processing underway, biofouling of boat hulls and equipment /gear, and through the use of INNS as bait.
- Reducing the impact of INNS is commonly approached through efforts to prevent their spread at the pathway level.
- Legislation and policy related to the introduction and spread of INNS exists, covering both general activities and activities specific to boat-based fishing.
- The objectives of this Pathway Action Plan (PAP) are to:
 - Outline the INNS biosecurity risks associated with the boat-based fishing pathway.
 - Identify key marine INNS associated with the boat-based fishing pathway.
 - Provide stakeholders of the Welsh marine environment with a [series of scalable actions](#) that could be implemented where boat-based fishing occurs.
- Stakeholders are those that use, benefit from or are responsible for (e.g. managing, protecting or regulating) the marine environment. Here, this includes relevant authorities and statutory bodies, harbourmasters, and those involved in the boat-based fishing operations listed below.
- This PAP is applicable to marine fishing activities undertaken from a boat for both commercial purposes (e.g., trawling) and recreational purposes (e.g., fishing tourism). It is intended to be applicable to boat-based fishing across all Welsh marine areas (for Welsh-registered boats), including, but not limited to:
 - Pot and trap fishing
 - Towed gear fishing
 - Net fishing
 - Rod and line fishing
- This PAP outlines seven components of biosecurity focus for the boat-based fishing pathway within Welsh marine areas.
 1. [Understanding roles and legal responsibilities](#)
 2. [Information and guidance on INNS and biosecurity](#)
 3. [Raising awareness](#)
 4. [Biosecurity processes and procedures](#)
 5. [Biosecurity facilities](#)
 6. [Monitoring and reporting](#)
 7. [Collaborative working](#)

- This PAP is intended to be used in support of the associated [Species Action Plans \(SAPS\)](#), and [Biosecurity Action Plans \(BAPS\)](#).

Preface

Safeguarding Wales's marine environment and native biodiversity requires robust biosecurity measures to prevent the spread and impact of invasive non-native species (INNS). The guidance in this Pathway Action Plan outlines actions and guidance to support stakeholders with their biosecurity efforts, with the aim of making Welsh marine boat-based fishing more sustainable.

It is acknowledged that no single activity is solely responsible for the spread of INNS and all users of the marine environment are encouraged to take the time to understand more about this threat and how they can contribute to tackling it.

Stakeholders are encouraged to share this plan, the guidance within it, the actions that they choose to undertake and to raise awareness of biosecurity. Collective effort is ideal, but individual actions are equally vital. Proactive steps by stakeholders, even when taken independently, strengthen national INNS biosecurity and help to protect our marine environment — every action counts.

The significance of this issue is recognised by Natural Resources Wales, who commissioned, and will manage this plan under a [wider framework of INNS biosecurity planning](#).

Background

What are Invasive Non-Native Species (INNS)?

Non-native species (NNS) are plants, animals or pathogens that do not naturally occur in an area but have been moved there, by human activities (either accidentally or deliberately). NNS are also sometimes referred to as “alien species”, “non-indigenous species” or “exotic species”. Most NNS do not cause issues within the area where they have been introduced. However, 10-12% cause significant environmental, social or economic impacts. These are known as Invasive Non-Native Species (INNS) and, in Wales, include the American slipper limpet, carpet sea squirt and Japanese wireweed, among many others. The impacts of INNS include threats to biodiversity, habitat alteration, fouling underwater structures (including boat hulls, navigational aids and piers) and the introduction of diseases. The impacts of INNS (in all environments including marine) are estimated to cost the British economy £4 billion per year, of which, £499 million per year is attributed to impacts in Wales (see the [2023 Eschen paper](#)).

Marine INNS are resilient and often capable of surviving harsh and variable conditions, making them particularly challenging to manage. Many species can endure high levels of drying, temperature fluctuations, and low nutrient availability, allowing them to persist in damp conditions for extended periods. For instance, mussels, barnacles and algae can remain viable (i.e., still able to live and/or reproduce) when attached to damp equipment, nets or boat hulls,

even after days or weeks out of the water. The resilience enables them to travel long distances, hitchhiking on fishing gear, recreational boats, or clothing/equipment.

What are pathways?

The mechanisms and routes by which INNS are moved from one location to another by humans are termed “pathways”. This movement of species by humans, accidentally or deliberately, allows INNS to overcome natural barriers that would otherwise prevent them from spreading between their native and non-native ranges, e.g., an ocean. For instance, Pacific oysters, native to Japan, would not be able to reach UK waters through natural spread, but when introduced into UK waters by human activity can survive and establish as the environmental conditions in the UK are compatible with their native range.

Animals can be moved as eggs and in their larval, juvenile and adult life stages. Seaweed can be moved as fragments or spores (their reproductive structures). Larvae can be planktonic (drift with currents, unable to propel themselves against water movement) or free-swimming (can actively move and maintain their position in the water column).

Pathways are broadly classified as two types:

- 1) Pathways of initial introduction: Those which transfer NNS to regions or locations that are geographically separate and isolated from their native range (referred to as “introduction(s)” in this document). An example of this would be the movement of transoceanic boats.
- 2) Pathways of further spread: These facilitate the movement of NNS populations beyond their initial introduction point to a wider area (referred to as “spread” in this document):
 - a. Facilitating the short-range dispersal of an NNS population within a single habitat or location (e.g. paddle boarders spreading a seaweed within a bay), or
 - b. Facilitating regional spread where some small barriers exist (e.g., the movement of recreational boats between two nearby but separate harbours).

The frequency and magnitude of pathways in the marine environment have been increasing since the 1800s with the beginning of rapid globalisation. A significant movement of marine INNS has been through the trans-oceanic voyages and shipping that has long supported growing global economies and international supply chains. For more information on other pathways in the marine environment, please see the other Welsh Pathway Action Plans. Links can be found on the [Wild Seas Wales website](#).

Vectors are the specific, discrete parts of a pathway (i.e. the means within a pathway) that facilitate the movement of INNS from one location to another. Vectors within the boat-based fishing pathway could include INNS fouling the boat hull or being taken up in water-retaining features (e.g., bilge tanks) or the disposal of non-native bycatch. For aquaculture, vectors could include the escape of a cultured INNS from the aquaculture site, INNS hitchhiking on the cultured species or INNS-fouled equipment that is brought to a site. The relationship between pathways and vectors in the marine environment is illustrated in Figure 1.

Natural spread of INNS e.g., larvae distributed along a coastline by tides and currents, may also occur following introductions. However, unlike the spread caused by human activities, natural spread is generally limited by the inherent barriers between locations. Natural spread is generally gradual and organic (i.e. slow outward spread from a point-source of introduction). Although natural spread is more challenging to manage, improved biosecurity procedures, particularly at high-risk/vulnerable sites, can reduce the risk of impact and improve the chances that introductions are detected early.

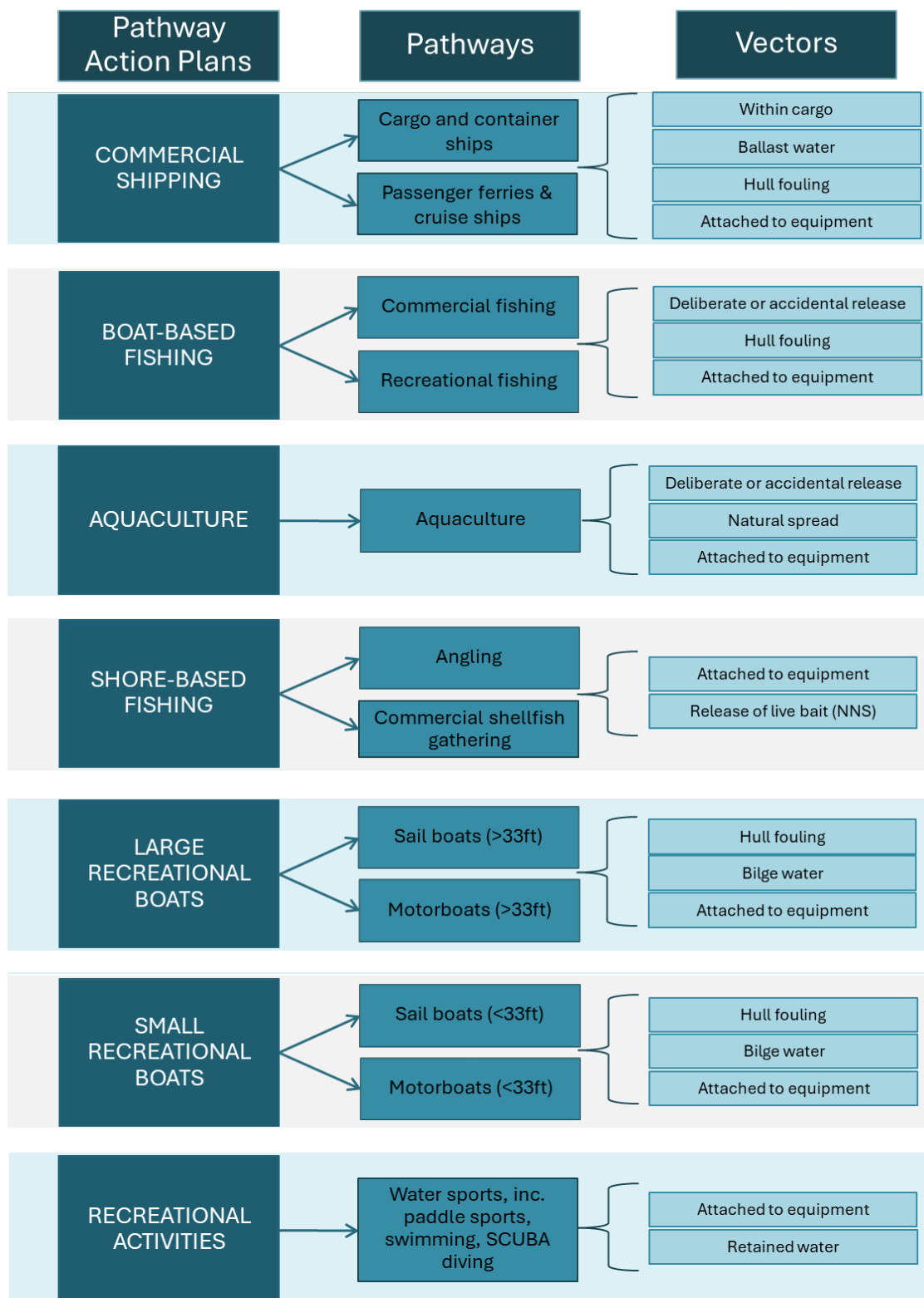


Figure 1: An overview of the Pathway Action Plans that have been developed for Wales, and the vectors associated with the pathways. Note that the list of vectors is not exhaustive.

What is biosecurity?

Biosecurity measures are actions, procedures and behaviours put in place to reduce the risk of INNS introduction and spread into, within and outside of a given area. Biosecurity measures should be realistic, pragmatic and cost-effective. Preventing the introduction and spread of INNS is by far the most effective way to reduce the impact of INNS. Eradication and control of INNS is often not possible in the marine environment and any attempts are more costly, difficult, and time-consuming compared to preventing the arrival and establishment of INNS in the first place. This is especially true in the marine environment, where eradication is near impossible once INNS become established.

A biosecurity framework: what is the context for this Pathway Action Plan?

This Pathway Action Plan forms part of a biosecurity planning framework commissioned and endorsed by Natural Resources Wales. The driver behind the framework is the wider goal of improving the condition of and increasing biodiversity in protected marine sites. Within the marine environment, this goal includes reducing the introduction and spread of INNS. The Species Action Plans (SAPs) and the Pathway Action Plans (PAPs) produced for this framework are intended to provide a basis for biosecurity planning for all marine sites throughout Wales, as well as presenting standalone guidance for pathway management. Figure 2 shows the relationships between each of the action plans.

Pathway Action Plans (PAPs) describe the pathway and list possible actions that could be undertaken to address the risk of the introduction and spread of INNS via that pathway into or around Wales. Links to the other PAPs can be found on the [Wild Seas Wales website](#).

Species Action Plans (SAPs) describe priority INNS and list possible actions that could be undertaken to address the introduction and spread of that species into or around Wales. Links to the SAPs can be found on the [Wild Seas Wales website](#).

Biosecurity Action Plans (BAPs) are site-specific and can be scaled as appropriate. A BAP can be produced for a whole region (i.e. as has been done for the Pembrokeshire Marine, Cardigan Bay, Menai Strait and Conwy Bay and Carmarthen Bay and Estuaries Special Areas of Conservation (SACs)) or for an individual port, harbour or aquaculture site. They will identify the pathways relevant for that site and the species at or near the site that are of concern. The actions listed in the PAPs and SAPs are relevant to all stakeholders (see [Key stakeholders](#)) and should be considered and incorporated into a site's BAP. Due to the wide breadth and scale of the different stakeholder groups, the scope of these actions is equally broad. It is therefore important that individual stakeholders review their activities and use of the site to decide which of the biosecurity actions are applicable and practicable.

Biosecurity To-Do-List trackers have been created to make it easier for stakeholders to log what actions they plan to carry out and track what progress is being made on each action. The need for using to-do-list trackers will be dependent on the scope and scale of the BAP. For example, the BAPs produced for the Welsh SACs cover such large areas that it is necessary to provide individual stakeholders with an additional support tool that makes it easier to log and track their actions. The tracker also enables NRW, as the SAC BAP manager, to effectively

oversee the implementation of biosecurity within each SAC, highlighting progress and pinpointing where further assistance or support may be needed. This approach is also intended to facilitate coordinated monitoring and collaborative efforts to share and enhance biosecurity practices between stakeholders. Biosecurity planning at smaller scales (e.g. an individual port or aquaculture facility) are unlikely to require a BAP and a to-do-list tracker in parallel. Stakeholders can decide which is the most appropriate method for facilitating their biosecurity efforts. It is worth acknowledging that statutory authorities, including NRW, will also be progressing actions under this framework.

We encourage fishing boat owners, managers, skippers and fishermen to consider the benefits of improved biosecurity to both sustainability and profitability of the industry.

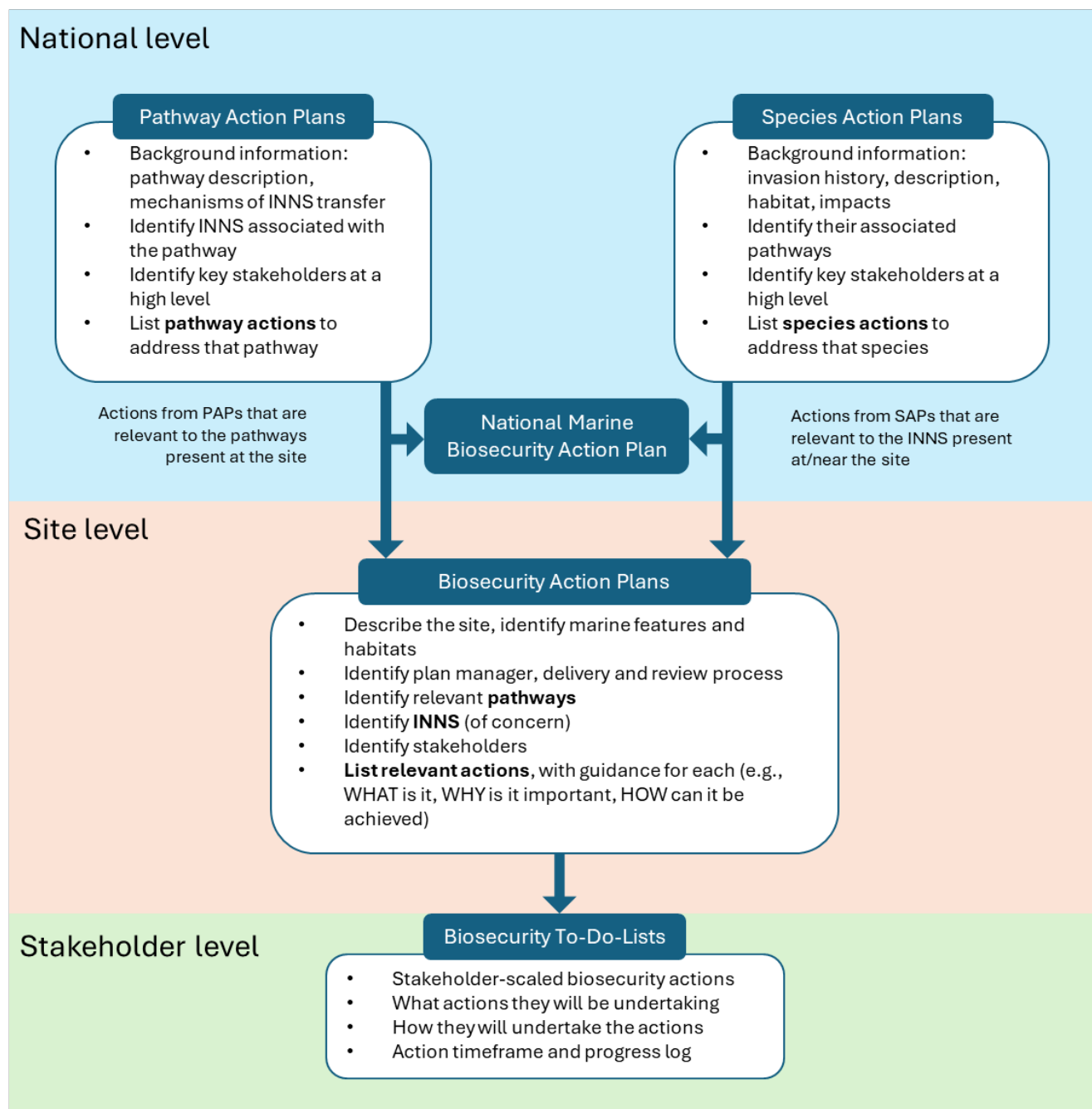


Figure 2. A flowchart showing the relationship between the Pathway Action Plans, Species Action Plans and the Biosecurity Action Plans created for the Natural Resources Wales Biosecurity Planning Project with APEM Ltd.

Scope, aims and objectives

Scope

This Pathway Action Plan (PAP) is intended to be applicable to boat-based fishing activities across all Welsh marine areas (for Welsh-registered boats). This includes recreational and commercial fishing that involve use of a boat, and fishing activities using both privately owned and hired boats. Here, fishing includes, but is not limited to:

- Pot and trap fishing
- Towed gear fishing
- Net fishing
- Rod and line fishing

Although some overlap is expected, this document does not apply to shore-based fishing activities i.e., those that do not require boat use (see the shore-based fishing PAP in [Useful resources](#)).

This document, and the biosecurity measures outlined within it, are intended to be applicable to fishing boat owners and operatives, charter businesses and managers of marinas, harbours and boating organisations using fishing boats (see [Key stakeholders](#) for more information). The actions encompass several dimensions of INNS management for the pathway including:

- Strategies for effective INNS biosecurity
- Strategies to enable early detection and quick reaction to new records
- Coordination of efforts, resource sharing and collaboration
- Research, development and innovation
- National policy and regulatory frameworks

Aim

The overall aim of this PAP is to reduce the risk of the introduction and spread of marine INNS via the boat-based fishing pathway.

This document aims to complement the existing national work on boat-based fishing biosecurity (for further information see [legislation](#)) providing boat-based fishing specific information to aid a pathway-based approach to biosecurity. It also seeks to put forward actions that can be applied at national (Welsh), regional and local levels. The goal is to use existing communications and resources wherever available and adapt them to fit specific requirements. This approach aims to avoid any duplication or unnecessary additional effort. This will facilitate a consistent approach to biosecurity for this pathway across Wales.

Objectives

- Outline the biosecurity risks associated with boat-based fishing.
- Identify marine INNS associated with boat-based fishing.

- Provide a list of clear and practical biosecurity actions to address the pathway. These can subsequently be appropriately scaled and applied to a specific site and its stakeholders.

The boat-based fishing pathway

In the marine environment, boat-based fishing is recognised as a pathway for the introduction and spread of INNS, with potential for boat-based fishing activity to move both animals (as eggs and in their larval, juvenile and adult life stages) and seaweed (as fragments or spores). There are multiple ways, known as vectors, in which INNS can be spread via the boat-based fishing pathway. These include:

- Biofouling on, or entanglement in fishing equipment (e.g., pots, rope, nets etc);
- Biofouling on boat hulls, surfaces and niche areas (e.g., boat propellers, anchors and pipes); and
- Discard of non-native bycatch (e.g., when processing underway).

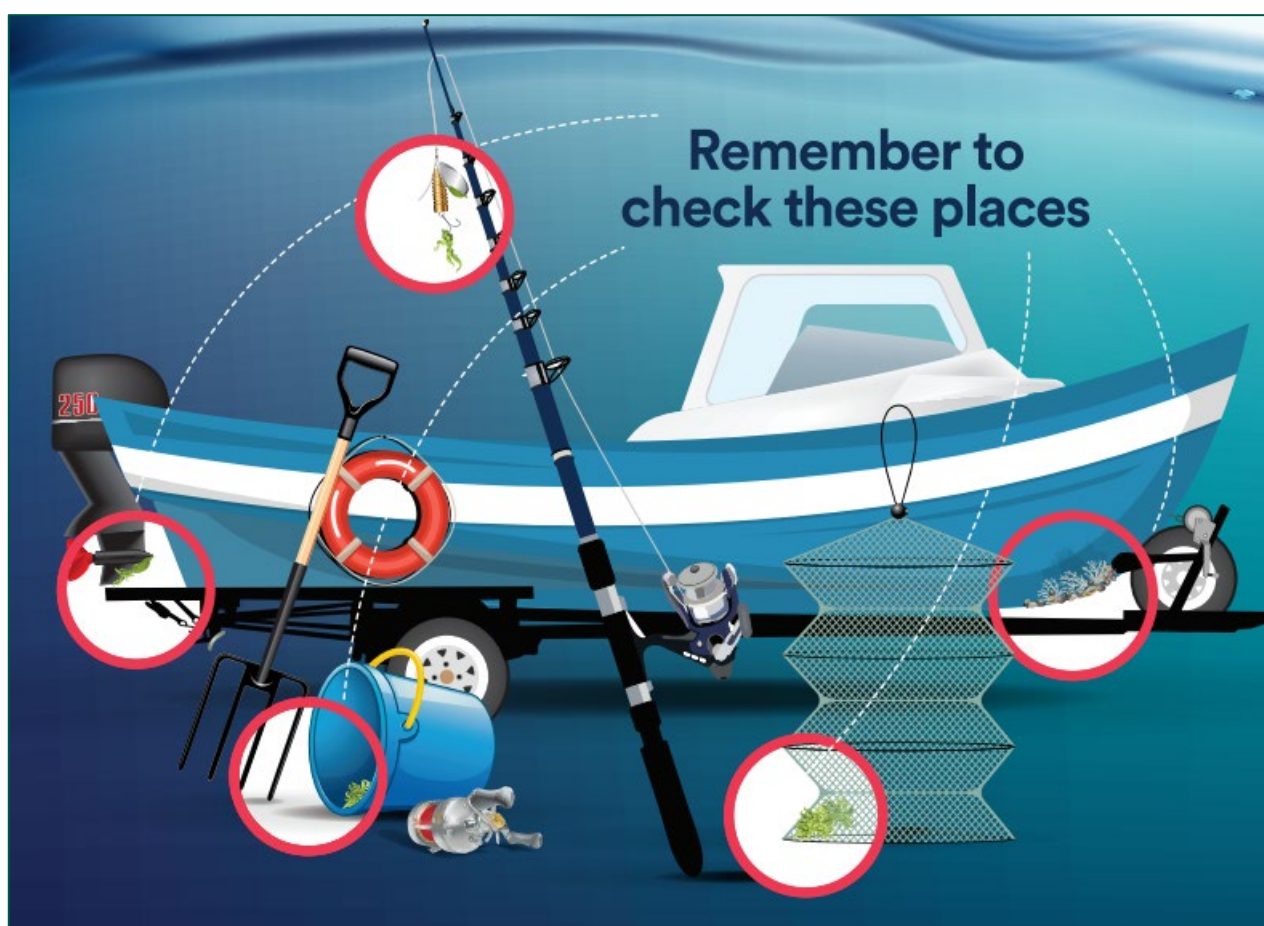


Figure 3. Locations where INNS may stowaway on equipment and boats used for marine fishing. This image is taken from the [GB NNSS guidance for marine anglers](#).

Fishing gear such as nets, pots and traps are often composed of fibrous materials which absorb water and can take hours or days to dry, especially when piled on deck or stowed. Such wet materials with crevices and cavities are ideal for harbouring INNS, including larvae, eggs and spores which are often not visible to the naked eye. Any other wet equipment, including

personal protective equipment (PPE) (e.g., jackets, salopettes, life jackets, gloves) may also have INNS on the surface of the materials, or within water that is absorbed.

Biofouling (or biological fouling) is the accumulation of marine organisms (plants, animals, bacteria and detritus) on underwater surfaces. Hull fouling refers to biofouling on a boat's hull and other surfaces below the waterline. This includes all surfaces and hard to reach areas and crevices that are in contact with the water. In the marine environment, common biofouling organisms include sea squirts, barnacles and sponges.

The first stage of fouling is the formation of a biofilm on the surface, which is a thin layer of microalgae, bacteria and small particles. The presence of this biofilm facilitates the further colonisation of the surface by other marine organisms. It is important to note that the species found on a hull (or other underwater surfaces) are not necessarily INNS, but there are many INNS known to accumulate as biofouling or live among biofouling organisms.

Biofouling can especially accumulate if a boat remains static in the water for a prolonged period of time, for example, moored at a buoy or in a marina for weeks to months. If the boat is then moved or travels to another location without first being cleaned, the species that have accumulated on the boat can then spread to this new location. Even boats with antifouling paints or coatings are at risk of INNS colonisation if left stationary for long periods of time. This is because some INNS (e.g., the red ripple bryozoan, *Watersipora subatra*) are resistant to the toxic effects of antifouling coatings.

If the boat is cleaned in the water (for boats with more than just a biofilm/slime layer) or is lifted and cleaned but the debris is washed back into the water, there is a risk that the organisms in that biofouling community, including any INNS, may survive and be able to establish in that area. The level of hull fouling can be graded/ranked based on the amount and coverage of the fouling visible. Table 1 shows information from a [2006 paper](#) that outlines a ranking system for hull fouling which can be used for reference when undertaking inspections of boats. Similar hull fouling ranking has been employed in other biosecurity inspection programs.

Table 1. Hull fouling ranking from Ashton, G.V., Boos, K., Shucksmith, R. and Cook, E.J., 2006.

Risk assessment of hull fouling as a vector for marine non-natives in Scotland. *Aquatic Invasions*, 1(4), pp.214-218. *biofilm: thin layer of bacteria, microalgae, detritus and other particulates.

Rank	Description	Visual estimate of biofouling cover
0	No visible fouling. Hull entirely clean, no biofilm* on visible submerged parts of the hull.	Nil
1	Slime fouling only. Submerged hull areas partially or entirely covered in biofilm, but absence of any plants or animals.	Nil
2	Light fouling. Hull covered in biofilm and 1-2 very small patches of one type of plant or animal.	1-5% of visible submerged surfaces
3	Considerable fouling. Presence of biofilm, and fouling still patchy, but clearly visible and comprised of either one or more types of plant and/or animal.	6-15% of visible submerged surfaces
4	Extensive fouling. Presence of biofilm and abundant fouling assemblages consisting of more than one type of plant or animal.	16-40% of visible submerged surfaces.
5	Very heavy fouling. Many different types of plant and/or animal covering most of visible hull surfaces.	41-100% of visible submerged surface

Discarding non-native bycatch away from the site it was fished from can facilitate the spread of INNS. For example, it is known that fishers process their catch while underway (to the next fishing site or to their landing port) and discard American slipper limpets (*Crepidula fornicata*) overboard that have been brought up attached to whelks (the target species). Some bycatch INNS may also remain on the boat and be swept overboard into the landing port waters when the boat deck is cleaned. These discarded INNS may be able to establish in the receiving area, or may contain eggs and larvae that survive, grow and eventually establish.

Boat based fishing in Wales

There are many ports and harbours along the coastline of Wales from which small and large fishing boats depart, either to inshore or offshore grounds. Ports and harbours with commercial fishing boats include, but are not restricted to, Conwy Harbour, Amlwch Harbour (Isle of Anglesey), Port of Milford Haven and Saundersfoot Harbour. Fishing boats can also be chartered from most major towns along the coast. Data on fleet landings by port can be viewed on the Welsh Government [DataMapWales](#) platform.

How do INNS impact boat-based fishing operations?

INNS can be a problem for fishing, leading to increased financial costs and reduced productivity. The impacts of INNS on boat-based fishing may be extensive and varied and include the following:

- **Competition for resources:** INNS can compete for space and food with native fishery species and spread disease, resulting in stock mortality, and reducing the abundance of fish that are targeted by fishing boats. The latter impact could result in a loss of business for fishing boat companies or owners. Less obvious impacts of INNS include the environmental transformation of nursery areas (where juveniles are reared). For example, the carpet sea squirt (*Didemnum vexillum*) can smother gravel beds used by fish species such as Atlantic herring (*Clupea harengus*) to spawn, which may impact egg laying (See [NRW Report 454](#)).
- **Entanglement and reduced access:** INNS may also impede fishing activities by increasing levels of bycatch entangled in fishing gear and potentially make fishing grounds less accessible. For instance, the invasive slipper limpet (*Crepidula fornicata*) can comprise large proportions of bycatch in parts of the UK due to the high densities it can achieve in areas historically occupied by oysters. Additionally, Japanese wireweed (*Sargassum muticum*) can become wrapped around fishing gear and can clog up harbours by forming mass aggregations on the surface.



Boat hull heavily fouled with Japanese kelp / Wakame, *Undaria pinnatifida* among other species © NRW.



Lobster pot clogged with Japanese wireweed, *Sargassum muticum* © Andy Riches.

- **Increased drag, obstruction and boat damage:** INNS can attach to hard substrates in high densities, impacting normal usage. For example, on boat hulls, high densities of biofouling can result in increased drag when underway, incurring higher fuel, cleaning and antifouling costs.

- Some INNS, like the Trumpet tubeworm (*Ficopomatus enigmaticus*), can cement themselves to hulls and submerged metal boat parts (e.g., propellers) requiring time-consuming and costly removal. Removing hard fouling species can also cause damage to paints, coatings and the substrate itself. INNS can also impact boat-based fishing by causing obstructions in water intakes on boats or becoming tangled in propellers, for example, with large aggregations of seaweeds like Japanese wireweed and worm wart weed (*Gracilaria vermiculophylla*).
- **Costs and movement restrictions:** Increased cleaning and maintenance of marinas and harbours may be required if there is a high density of INNS. This could result in costs being passed from marina management organisations to boats owners (e.g., in enhanced berthing / mooring fees or memberships). The application and enforcement of clean boat policies in marinas or harbours could also mean that boats not meeting the standards for hull fouling may be refused entry which would restrict movements.



Species that can impact boat-based fishing: Trumpet tubeworm (*Ficopomatus enigmaticus*) on a boat, from the Green Blue.

Relevant INNS for boat-based fishing

The tables below present INNS that are likely to spread via boat-based fishing. Table 2 describes High and Medium risk INNS from the [Welsh Priority Monitoring and Surveillance List](#) (WPMSL) that are known to be present and breeding in Wales. Table 3 describes INNS that are not currently recorded as present in Wales (known as horizon species) but should be monitored for. It is important to identify species that may be on the horizon so that appropriate biosecurity actions can be put in place to prevent their introduction, or surveillance programmes can be implemented to aid timely detection and response. Some species are on the horizon for the UK and some are on the horizon for Wales. These species represent some of the most likely to be transported via boat-based fishing. Note that this is not an exhaustive list, as there are other INNS known to be transported by boat-based fishing that are not listed as High or Medium risk on the WPMSL.

The current distributions of INNS around Wales (and the UK more broadly) can be viewed by searching the database and maps on the [National Biodiversity Network Atlas](#) (NBN Atlas).

An overview of the different lists of INNS that are of interest to Wales can also be found on the [NBN Atlas](#). The current distribution of INNS included on those national lists can be found on the [Wales INNS Portal](#).

Further information and links to resources developed to aid identification of INNS are available below. Further species-specific information is also available from the searchable GB NNSS [Information Portal](#).

Table 2. High and Medium risk INNS established in Wales that are likely to spread via boat-based fishing.

INNS name	Potential impacts	Image	Additional information
American slipper limpet (<i>Crepidula fornicata</i>)	Changes in hydrodynamics, and therefore food and oxygen availability; food and space competition with target species (including prevention of spat settlement); reduction of shellfish larvae (via predation); change in local biodiversity and sediment composition.	 Photo credit: Elizabeth Green [CC BY, via iNaturalist]	Adults could be captured by bottom towed fishing gear; larvae may be in water on fishing gear and equipment, or in bilge water or boat crevices; adults may be caught as bycatch and disposed of at a different location to where they were obtained. Larvae are planktonic for 4-5 weeks (high dispersal risk). Breeding can occur between Feb. and Oct. but peaks in May and June. Spawning seen even at temperatures as low as 7°C. For further information see the GB NNS Information Portal, Risk Assessment and NBN Atlas A link to the Species Action Plan can be found on the Wild Seas Wales website.

INNS name	Potential impacts	Image	Additional information
Carpet sea squirt (<i>Didemnum vexillum</i>)	Major fouling organism on artificial and natural surfaces; potentially decreases local biodiversity due to competition for resources; smothers substrate (including other species) and its acidic surface hinders settlement on it by other species Costly to other sectors, including the aquaculture industry.	 Photo credit: Javier [CC BY, via iNaturalist]	Colonies may be disturbed by bottom-towed fishing gear releasing fragments or larvae; larvae may be in water on fishing gear and equipment, or in bilge water or boat crevices; can grow on surfaces (hulls, propellers, keel, rudder), equipment (fenders, marker buoys) or fishing gear, and transfer if moved; adults can grow over the existing hull fouling community; small fragments can be transported in ballast/bilge water. Larvae are planktonic for a few hours (low dispersal risk). Fragments are viable for up to 30 days (high dispersal risk). Tolerant to temperatures between 2-24°C and salinities >26ppt. Reproduction occurs between 14-20°C. For further information see the GB NNSS Information Portal, Risk Assessment, NBN Atlas and the 2023 alert poster. A link to the Species Action Plan can be found on the Wild Seas Wales website.

INNS name	Potential impacts	Image	Additional information
Chinese mitten crab (<i>Eriocheir sinensis</i>)	Erosion of river / stream banks; affect fisheries by damaging nets, killing netted fish, consuming bait & damaging gear; clog water intake pipes; compete for food & space and predate on native species in freshwater & marine; burrowing activities affect water quality.	 Photo credit: The Food and Environment Research Agency [via GB NNSS]	Adults could be caught by bottom towed fishing gear (in brackish areas); larvae may be in water on fishing gear and equipment, or in bilge water or boat crevices; juveniles may be caught as bycatch and disposed of at a different location to where they were obtained; juveniles may live among hull fouling organisms. Reproduction occurs in brackish/marine waters (15-30 ppt salinity). Larvae are planktonic in the marine environment for up to 2 months (high dispersal risk). For further information see the GB NNSS Information Portal, Risk Assessment and NBN Atlas. A link to the Species Action Plan can be found on the Wild Seas Wales website.

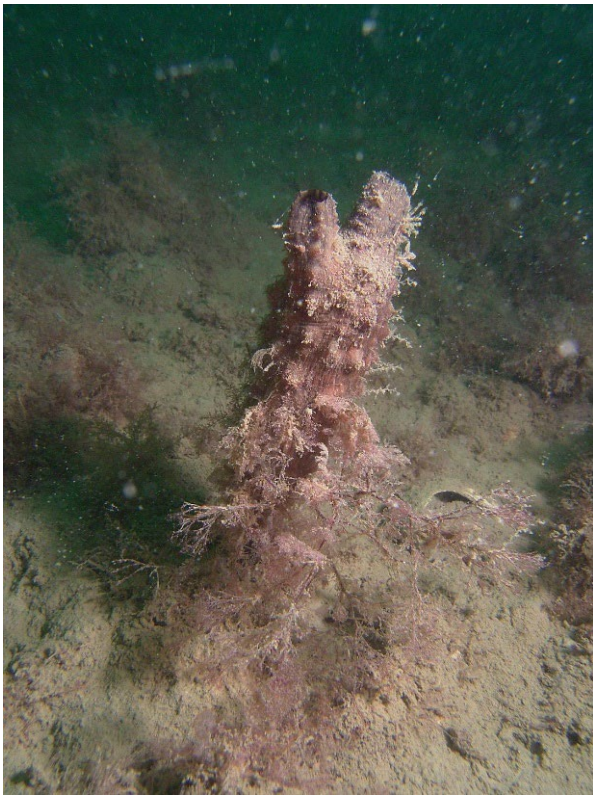
INNS name	Potential impacts	Image	Additional information
Trumpet tubeworm (<i>Ficopomatus enigmaticus</i>)	Major fouling organism on artificial surfaces & is a nuisance in ports & marinas where it clogs pipes & blocks tide-gates; ecosystem engineer; prolific fouler of hulls, niche areas and submerged metal surfaces.	 Photo credit: Cricket Raspet [CC BY, via iNaturalist]	Adults can foul hard to reach areas such as water inlets/outlets; larvae can be carried in bilge water and trapped sediment. Planktonic larval stage 1-3 months (high dispersal risk). Minimum water temperature of 18°C needed for reproduction. Wide salinity tolerance (1.6-55 ppt) but preference for brackish environments. For further information see the GB NNSS Information Portal and NBN Atlas. A link to the Species Action Plan can be found on the Wild Seas Wales website.

INNS name	Potential impacts	Image	Additional information
Devil's tongue weed (<i>Grateloupia turuturu</i>)	Outcompetes native algae and seagrasses, leading to changes in local ecosystems. Rapid growth and dense mats can smother other marine life, reducing biodiversity. Alters habitats by changing the structure of the seafloor, which affects the species that rely on these habitats for food and shelter. Can have cascading effects throughout the marine food web. Negatively affect fisheries and aquaculture operations by the fouling of nets, ropes, and other equipment.	 Photo credit: Elena_Sherehora [CC BY, via iNaturalist]	Mature specimens may be caught in bottom towed fishing gear; spores may be in water on fishing gear and equipment, or in bilge water or boat crevices; can grow on stationary boats (hulls, propellers, keel, rudder) and equipment (fenders, marker buoys) or fishing gear, resulting in their transfer if these objects are moved. Spores can develop at temperatures ranging between 15-20°C. Developed strands have a wide temperature tolerance (4-29°C). For further information see the GB NNSS Information Portal and NBN Atlas.

INNS name	Potential impacts	Image	Additional information
Japanese skeleton shrimp (<i>Caprella mutica</i>)	Likely to displace other native amphipod species & potentially compete with sessile suspension feeders for food.	 Photo credit: Lucinda Lintott [some rights reserved]	There is minimal movement of adults, so they are predominantly moved as 'hitchhikers'. Adults (often < 50 mm) and juveniles attach to other fouling species and artificial substrates; adults and juveniles may be on fishing gear and equipment, or in bilge water or boat crevices. They have a wide temperature tolerance range (-2-28°C) but cannot tolerate low salinities (<18ppt). For further information see GB NNSS Information Portal, Risk Assessment and NBN Atlas.

INNS name	Potential impacts	Image	Additional information
Japanese Kelp / Wakame (<i>Undaria pinnatifida</i>)	It potentially reduces local biodiversity, by outcompeting and displacing native species. Dense forests of this species can foul fishing gear and aquaculture equipment. Its dense growth can also affect the availability of space and resources for commercially valuable species.	 Photo credit: Steve Kerr [CC BY, via iNaturalist]	Mature specimens may be caught in bottom towed fishing gear; spores may be in water on fishing gear and equipment, or in bilge water or boat crevices; can grow on stationary boats (hulls, propellers, keel, rudder) and equipment (fenders, marker buoys) or fishing gear, resulting in their transfer if these objects are moved. Fertilisation can occur between 10-15°C with optimum growth for spores between 15-20°C. Spores can survive in temperatures between -1 and 30°C. Spores can be vegetative and remain viable for up to 2 years under certain conditions. For further information see GB NNSS Information Portal, Risk Assessment and NBN Atlas.

INNS name	Potential impacts	Image	Additional information
Japanese wireweed (<i>Sargassum muticum</i>)	Can interfere with recreational & commercial use of waterways, especially when detached & forming large floating masses; known for fouling fishing gear & boat props, as well as blocking intake pipes of aquaculture facilities; known to alter habitats; impacts to subtidal native assemblages through overgrowing & shading underlying species, with particular concern for seagrasses.	 Photo credit: Susan Marley [CC BY, via iNaturalist]	Mature specimens (which can float) may be caught in bottom towed fishing gear or become entangled around the steering gear of boats; spores may be in water on fishing gear and equipment, or in bilge water or boat crevices; strands can fragment if disturbed (e.g., by propellers). Fragments viable for up to 3 months. Wide tolerances of temperature (10-30°C) and salinity (7-34ppt). For further information see the GB NNSS Information Portal, Risk Assessment and NBN Atlas.

INNS name	Potential impacts	Image	Additional information
Leathery sea squirt (<i>Styela clava</i>)	Can be a major fouling organism on boats, aquaculture & fishing equipment & other artificial structures; potentially decreases local biodiversity through outcompeting native species.	 Photo credit: Chris Wood, Marine Conservation Society [via GB NNSS]	Adults may be entrained by bottom towed fishing gear; larvae may be in water on fishing gear and equipment, or in bilge water or boat crevices; adults can grow on immersed stationary boats (hulls, propellers, keel, rudder) and equipment (fenders, marker buoys) or fishing gear, resulting in their transfer if these objects are moved. They are hermaphroditic (possess both male and female reproductive organs) but not self-fertile. Spawning occurs in water above 15°C and larvae are planktonic for 1-3 days before they settle. For further information see the GB NNSS Information Portal and NBN Atlas.

INNS name	Potential impacts	Image	Additional information
Red ripple bryozoan (<i>Watersipora subatra</i>)	Tolerant of copper and mercury in antifouling paint, thus easily foul boat hulls; replaces similar native species through competition; resistant to most antifouling paints so can establish, thus increasing habitat complexity and facilitating colonisation by other INNS.	 Photo credit: Jacqui Geux [CC BY, via iNaturalist]	Larvae may be in water on fishing gear and equipment, or in bilge water or boat crevices; adults can grow on stationary boats (hulls, propellers, keel, rudder) and equipment (fenders, marker buoys) or fishing gear, resulting in their transfer if these objects are moved. Short free-swimming larval stage (less than 1 day) so natural dispersal risk is low. Wide temperature tolerance (12-28°C) and salinity range (25-49ppt). For further information see the GB NNSS Information Portal and NBN Atlas.

Table 3. Two INNS that are not currently recorded as present or established in Wales (horizon species) but are known to be able to spread via boat-based fishing vectors.

Horizon INNS name	Potential impacts	Image	Additional information
<u>HORIZON SPECIES:</u> Veined rapa whelk (<i>Rapana venosa</i>)	Predator of shellfish including commercially important species, has the potential to decimate bivalve fisheries, with associated economic loss.	 Photo credit: Nikita Gerasin [CC BY, via iNaturalist]	Larvae may be in bilge water. Planktonic larval phase of 24-80 days (high dispersal risk). Successful establishment of reproductive populations seen to occur between 18-26°C. For further information, see the GB NNSS Information Portal, Risk Assessment and the NBN Atlas.

Horizon INNS name	Potential impacts	Image	Additional information
<u>HORIZON SPECIES:</u> Brush clawed shore crab (<i>Hemigrapsus takanoi</i>)	Direct competitor of native shore crabs (in Holland, led to a drastic reduction in the juvenile native common shore crab and replaced the common shore crab in Dunkirk harbour). Predate on newly settled shellfish (e.g., mussel and oyster spat).	 Photo credit: Demian Hiß [CC BY, via iNaturalist]	Larvae and adults may be transported in bilge water. Adults can be moved with hull fouling communities, clinging to other species or hiding in crevices. Natural range expansion following initial introductions occurs when pelagic larvae are dispersed by currents. After hatching, larvae are planktonic for up to a month (depending on temperature). For further information see the GB NNSS Information Portal and NBN Atlas.

INNS, pathways and the law

The following points provide a brief summary of relevant legislation (at time of writing):

- Pathway management and the development of pathway action plans are specifically mentioned under the [EU Regulation \(1143/2014\)](#) on the prevention and management of the introduction and spread of invasive alien species. This regulation was retained in domestic law under the European Union (withdrawal) Act 2018 as the [Invasive Alien Species \(Enforcement and Permitting\) Order 2019](#).
- [The Wildlife and Countryside Act 1981](#) makes it an offence to release or allow to escape into the wild any plant or animal which is not ordinarily resident in Great Britain (i.e. non-native) and is not a regular visitor to Great Britain in a wild state (i.e. migratory).
- [The Marine Strategy Regulations 2010](#) transpose into domestic law the EU Marine Strategy Framework Directive. The Directive aims to reduce human impacts on the marine environment, including INNS. The programme of measures is intended to reduce the introduction and spread of INNS. INNS pathway management helps to deliver the 2010 Regulations.
- [The Water Environment \(Water Framework Directive\) \(England and Wales\) Regulations 2017](#) transpose into domestic law the EU Water Framework Directive. The Directive establishes a framework for national measures to achieve or maintain a good ecological status, including transitional and coastal waters. While INNS are not specifically mentioned within the 2017 Regulations they could affect the ecological status of waterbodies. Pathway management is a key aspect of managing the potential spread of INNS.
- [The Welsh National Marine Plan 2019](#) contains a cross-cutting policy specifically relating to INNS. Under Policy ENV_03, proposals should assess the likely risk of introducing or spreading INNS and put in place reasonable biosecurity measures where necessary to reduce or stop their introduction or spread.

Industry-specific legislation

- Fishing boat licences (don't currently include biosecurity clauses) - [Fishing licence documents for commercial fishing boats | GOV.WALES](#)

Biosecurity to manage the Boat-Based Fishing Pathway

The following sections present information on existing biosecurity within the boat-based fishing sector as well as actions that, if undertaken, would improve biosecurity in this sector and, ultimately, reduce the risk of INNS impacting stakeholders and fishing operations.

Who are the key stakeholders?

Within the context of this PAP, a stakeholder is anyone who uses, benefits from or is responsible for (e.g. managing, protecting or regulating) the marine environment.

Biosecurity for boat-based fishing requires engagement and actions taken at national, regional and local scales by specific stakeholders including, but not limited to individuals, businesses, site managers, statutory bodies, and authorities. To note, the term “authorities” here refers to bodies with powers to introduce, amend and enforce regulations, legislation and policy.

For successful implementation of the actions recommended in this PAP and across the [biosecurity framework](#), stakeholders must work together to engage, support and secure resources where needed.

Examples of relevant stakeholders include:

Authorities

- Government departments, organisations and agencies (e.g., Welsh Government)
- Regulatory bodies (e.g., Natural Resources Wales)
- County councils and local authorities
- National Park Authorities (e.g., Pembrokeshire Coast National Park)

National stakeholders

- Managing bodies for protected sites
- Commercial fisheries associations (e.g., Welsh Fishermen’s Association / Cymdeithas Pysgotwyr Cymru (WFA-CPC))
- Recreational boating governing bodies (e.g., RYA Cymru)
- Environmental charities and Non-Governmental Organisations (NGOs) (e.g., the Marine Biological Society and Wildlife Trusts)
- Major landowners (e.g., the Crown Estate)
- National trade associations (e.g., British Marine)

Local stakeholders

- Fishers and fishing businesses
- Recreational angling chartering businesses and tour operators

- Harbour masters
- Point of sale (e.g., bait and tackle shops, seafood wholesalers)
- Cockle license-holders (who use boats for operations)
- Local fishing clubs and associations
- Individual anglers and fishers (using boats)
- Local environmental groups

Existing biosecurity for boat-based fishing

This PAP, and the [wider biosecurity framework](#) within which the PAP sits, are intended to complement and enhance the existing biosecurity actions that might already be undertaken by the fishing sector. The INNS biosecurity recommendations within this, and other, PAPs and BAPs do not override any the requirements or associated guidance under existing regulations. Resources have been developed as part of the RAPID LIFE [INNS Management Toolkit](#), including marine [best practice guidance](#) for commercial marine operations.

Site-specific biosecurity planning

Site-specific biosecurity action planning is an important tool to help ensure that a thorough and planned approach to biosecurity is taken. The [framework](#) associated with this PAP allows for biosecurity planning to be scaled as deemed appropriate by stakeholders. For instance, stakeholders for sites where boat-based fishing is a pathway, such as marina managers, or harbourmasters, could create site-specific biosecurity plans that take into account boat-based fishing and all other pathways that are relevant to the site. At whatever scale, plans should include:

- A summary of the site background, activities and staff overview (e.g., environmental information, INNS present, site use).
- A broad assessment of the INNS pathways that might be present at the site (i.e., identify the pathways and vectors /determine how INNS might be spread to and from the site).
- Appropriate and proportional biosecurity actions to address the risks identified (see [Site construction and maintenance actions](#)).
 - If there are multiple pathways at the site, consider what other actions there may be to address these risks. These can be found in the other PAPs (see [Useful resources](#)).
 - The [biosecurity components and practical action examples](#) within this PAP provide guidance and example actions which boat-based fishing stakeholders could consider for implementation.
- Plan details (e.g., biosecurity manager/responsible staff, review period).

In addition to the biosecurity to-do-list trackers that form part of the biosecurity framework, the following resources provide additional guidance for producing a site-specific biosecurity plan:

- [Marine Biosecurity Planning \(2015\)](#)
- [Marine Biosecurity Planning – Guidance for Specific Operational/Construction related Activities \(with template\)](#)
- [INNS Management Toolkits](#)

Plans should be regularly evaluated to review the progress, successes, failures and modifications of the actions within them. They should then be updated to reflect these outcomes by, perhaps, amending approaches, altering timescales or allocating additional resources. The plan could also be updated with current information on the distribution of any key INNS or changes to site use. Stakeholders should consider discussing any biosecurity plan with NRW.

The use of antifouling

The application of antifouling paint and copper-containing epoxy coatings can help to reduce the fouling levels on the hull due to their biocidal effects, meaning that most organisms cannot survive on them. However, the efficacy of the paints and coatings decreases over time, and they must be reapplied. The frequency of reapplication depends on a number of factors including the antifoulant used, the frequency of boat usage and chemical variables in the water. Currently (depending on country) there are not strict regulations around application of antifouling paints for recreational boating, and as such, many boats go without this treatment and thus act as pathways for spread of INNS. There are, however, regulations on the chemicals that can be used in antifoulants which is controlled by the Health and Safety Executive (HSE) and the Control of Pesticides Regulations (COPR). A [link to the COPR approved biocidal products can be found here](#).

Check Clean Dry

The [Check, Clean, Dry \(CCD\) campaign](#) is a national campaign in the UK to improve aquatic biosecurity by outlining three key steps to preventing the spread of INNS (see Figure 4). A key approach to angling biosecurity is to promote the procedures that ensure that equipment and PPE is cleaned of organisms and completely dried out between uses. These steps could be applied to much of the fishing gear used on boats.



Figure 4. An extract from the Check, Clean, Dry guidance for marine angling, (Marine angling poster). GB NNSS.

Recommended strategic actions for authorities

Table 4 contains a list of possible strategic actions which could be taken by national authorities. Achievement of these actions support a solid statutory basis for robust management of **all marine INNS pathways in Wales, including the boat-based fishing pathway**. However, it is acknowledged that any statutory changes require extensive and time-consuming legislative assessments and consultation which is at odds with the urgency required for pathway and INNS management at present. It is therefore recommended that these strategic actions act as long-term goals for authorities and that priority is placed on actions that can be undertaken and achieved on shorter timescales by all stakeholders (see [Recommended actions for stakeholders](#)).

Table 4. Recommended strategic actions for authorities to address the introduction and spread of marine INNS via all pathways in Wales. The ID letters PS (Pathway Strategic) denote that the actions are aimed at addressing the management of pathways, differing from the ID letters SS (Species Strategic) in the Species Action Plans (SAPs) that are aimed at addressing the management of species.

ID	Strategic action	Purpose
PS-1	Develop a national (Welsh) position statement for key pathways in the marine environment	The statement (and its guidance) should: • Set out the position of the Welsh Government on pathway management and lay out a national approach for addressing key marine INNS pathways. • Provide a clear objective for all marine stakeholders, supported through guidance and assistance where available. Top-down direction is a critical need for the facilitation of national, regional and local biosecurity planning. • Make it clear that improved biosecurity is the priority; however, also include goals in relation to pathway risk, surveillance and monitoring, and INNS early detection, rapid response and management. • Aim to clearly state what is expected of all stakeholders and provide realistic, measurable and agreed targets. The position should conceptually align with other GB strategies and existing regulation to ensure a consistent approach to pathway management throughout the British Isles. However, it must be grounded within a realistic Welsh focus, taking current limitations into account. To achieve the best outcomes, stakeholders should be consulted in policymaking, and policymakers should support the integration of industry expertise and experience into INNS pathways management strategies.

ID	Strategic action	Purpose
PS-2	Review existing legislation	A review should be undertaken of current legislation in Wales and the wider UK relating to INNS pathways to identify legislative gaps and highlight opportunities to strengthen INNS and biosecurity legislation. The review should identify primary legislation under which INNS management can be enforced (e.g., Wildlife and Countryside Act, 1981). The outcomes of this review could provide evidence, justification, and legislative support for national position statements or for introducing / amending legislation relating to pathways in Wales.
PS-3	Introduce legislation relating to pathways in Wales	The introduction of new legislation (or the amendment of existing legislation) in Wales relating to marine pathways can ensure a consistent and enforceable approach to biosecurity. Authorities should use evidence gathered as part of the review of existing legislation (see PS-2) as justification for new legislation. For example, the adoption of existing international resolutions (e.g., the International Maritime Organisation resolution MEPC.207(62) on biofouling) can facilitate a robust approach to pathway management in line with international standards. Legislation may not be required for, or applicable to all pathways.
PS-4	Review and prioritise resource allocation in support of policy and legislation related to INNS	Enforcement / enactment of existing and new policy and legislation should be considered. Resources, roles and responsibilities should be agreed and assigned to ensure that prioritised policy and legislation is being effectively enacted (e.g., provisions for enforcement officers to carry out inspections). Incentives for following legislation could be outlined in biosecurity-related award schemes or accreditations, which should be investigated, created and/or developed and endorsed by the Welsh Government or Natural Resources Wales. Penalties for offences could include fines or suspension of relevant licences as per The Invasive Alien Species Order 2019 . Importantly, legislative policy needs to be clearly communicated to stakeholders.
PS-5	Identify and prioritise high risk areas/locations for marine INNS introductions and impacts	Pathway and species risk assessments are a valuable tool for identifying and prioritising high-risk locations for marine INNS and more effectively allocating resources. Data gathered from previous reports (e.g., NRW evidence report 459 and NRW evidence report “Marine Protected Areas: Features at risk from marine invasive non-native species” (pending publication) and information from the SAPs and PAPs in the biosecurity framework should be used to inform strategies for species and pathway management and surveillance. It is recognised that data used to inform pathway and species risk assessments is currently limited and further data collection is required.

ID	Strategic action	Purpose
PS-6	Develop a national plan for monitoring marine INNS pathways	A national plan should develop a standardised approach to monitoring marine pathways and implementing monitoring programs in high-risk locations (see PS-5). The procedures within this plan should be applicable and practical at local, regional and national levels with provisions included for necessary resources or support required to undertake actions. The plan could be developed in consultation with stakeholders from all levels. A cost-benefit analysis could also be undertaken to ensure that the implementation of inspections will not damage Welsh businesses.
PS-7	Continue to develop contingency plans for key marine INNS	Contingency plans put forward protocols for situations when a new record of an INNS is made in an area it has not been previously recorded. This can include INNS that are new to Wales and INNS that are found in some regions of Wales but not others. The protocol typically involves contacting relevant authorities and taxonomic experts for positive identification, as well as putting in place rapid actions to contain the spread of the new species. General contingency plans for marine INNS have been developed for England by the GB NNSS and a general INNS contingency plan for Wales is in draft (at time of writing, July 2025).
PS-8	Improve collaboration and links between stakeholders and authorities	Invite stakeholders to participate in existing platforms and/or forums for ongoing communication, collaboration, and knowledge exchange, such as the British Ecological Society Invasion Science Special Interest Group. Platforms like this serve as a hub where researchers, policymakers, government agencies, industry representatives, and wider stakeholders come together to share expertise, data, and resources related to INNS management. Key features should include: 1. Regular meetings and workshops; 2. Agreements for data sharing and data integration; 3. Collaborative research, leveraging the expertise and experience of the industry; 4. Capacity building; and 5. Research and monitoring priorities communicated between stakeholders. Promote the Natural Resources Wales list of high priority evidence needs and research ideas page: Natural Resources Wales / Marine and coastal evidence priorities.

ID	Strategic action	Purpose
PS-9	Improve national data flow	Data flow is fragmented, data administration slow, and existing mechanisms for priority species reports reaching authorities are inconsistent, which may delay management response. Different recording schemes have variable verification and data upload timescales as well as variable data restrictions and some records are lost in the data flow process. Authorities should work with partners including The UK Centre For Ecology & Hydrology, The Marine Biological Association, The National Biodiversity Network and Local Environmental Records Centres to ensure records arrive at the appropriate destination in a timely manner and are accessible to all. This may include continuing work with Defra on their ‘improving marine NIS data access and flow efficiency’ project.

Recommended actions for all stakeholders

The sections below outline seven components of biosecurity focus for the boat-based fishing pathway within Welsh marine areas. Stakeholder-specific guidance, including example actions for each component, is provided to support the development of tailored actions. Stakeholders are encouraged to define their own biosecurity actions, appropriately scaled and proportional to their activities, using the guidance provided.

The biosecurity components in this plan complement those outlined in the SAPs and other PAPs. They can serve as a foundation for creating a new biosecurity plan or modifying and enhancing existing procedures. For each component, high-level 'priority issues' have been identified through discussions with stakeholders. These priority issues inform the initial context for developing tailored actions.

These components are:

1. [Understanding roles and legal responsibilities](#)
2. [Information and guidance on INNS and biosecurity](#)
3. [Raising awareness](#)
4. [Biosecurity processes and procedures](#)
5. [Biosecurity facilities](#)
6. [Monitoring and reporting](#)
7. [Collaborative working](#)

1. Understanding roles and legal responsibilities.

To ensure that all stakeholders are aware of the relevant and current INNS legislation and national policy that relate to boat-based fishing.

PRIORITY ISSUE: There is a lack of clarity within stakeholder groups (for all pathways) regarding the legal requirements for INNS management. Stakeholders require more guidance on how their activities intersect with INNS legislation, and what is required under current policy (if anything) to achieve compliance (i.e. voluntary vs. mandatory actions).

Responsible stakeholder	Guidance for Development of Actions	Example actions
Authorities	Authorities should produce a policy position or statement (see actions PS-1 to PS-4), relevant to existing or new INNS-focused legislation and regulation. This policy(s) should provide stakeholders with an improved understanding of how INNS legislation or regulation affects them. This needs to be communicated via an appropriate information cascade to include all relevant stakeholders. If legislation or regulation exists, but enforcement policy is undefined, it is recommended that stakeholders are still offered advice on this matter.	• Consult with relevant stakeholders on the implementation and feasibility of INNS-focused policy. • Collaborate with the boat-based fishing sector / stakeholders to develop appropriate and achievable policy, without undue impact to Welsh blue growth and individual operators. • Ensure consistency with wider legislation and regulation. • Establish a policy(s) for relevant regulation(s) and release a statement to provide stakeholders with a clear definition of what is expected under the legislation.

Responsible stakeholder	Guidance for Development of Actions	Example actions
National & local stakeholders	Official statements (as above) should be summarised and shared between relevant stakeholders, using plain, accessible language. Information could be included in association newsletters or governing body communications to relevant stakeholders (e.g., WFA-CPC online news) so that all stakeholders are aware of any legal responsibilities with regards to INNS. In cases where an authority-produced statement is unavailable, national and local stakeholders are encouraged to independently review the relevant regulation and provide advice to their members as appropriate. Individual users should adhere to the position statement or advice offered by higher-level stakeholders. If unaffiliated, individuals could take it on themselves to understand the relevant legislation and adjust their own practices where practicable.	• Issue a press-release that summarises current national policy, highlighting the requirements for compliance with the legislation or regulation. • Include an overview of the requirements under legislation and policy in public communications to recreational stakeholders (e.g., in harbour information announcements or club codes of practice). • Adhere to relevant legislation and best practice.

2. Information and guidance on INNS and biosecurity

To ensure that information and guidance on INNS and biosecurity within Welsh marine areas are consistent, high-quality and appropriate for the boat-based fishing pathway.

PRIORITY ISSUE 1: Resources for INNS and biosecurity awareness are abundant but can be fragmented, making it difficult for stakeholders to navigate and identify the most relevant and appropriate information, especially without a prior understanding of biosecurity.

PRIORITY ISSUE 2: Targeted, sector-specific (i.e. pathway specific) biosecurity guidance is limited, resulting in stakeholders being unsure of what to do and when to do it.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	This biosecurity component aims to address information resources on INNS for boat-based fishing stakeholders, ensuring that these resources are appropriate for the pathway. However, it should be noted that the provision of INNS information resources is expected to overlap significantly across all marine PAPs, SAPs and BAPs. Therefore, it is critical that authorities, as well as local and national stakeholders, take a holistic approach by integrating and co-ordinating their biosecurity activities. By doing so, they can ensure a cohesive and unified effort that builds on and enhances existing measures, maximising the effectiveness of INNS management across all marine pathways and action plans. Targeted guidance is needed to help integrate proportional, industry-beneficial and focused biosecurity actions into existing practices. Engaging the industry in consultation during policy-making, co-developing best practice advice, and fostering collaborative efforts to raise INNS awareness in Welsh marine areas are essential steps toward achieving balanced and effective biosecurity improvements. All stakeholders should ensure that resources are appropriate, tailoring specific guides to relevant operations and risk factors.	- Download or request a paper copy of the NRW marine INNS guide. ID sheets for several marine species can be found on the GB NNSS website. An ID guide for marine NNS from Natural England and the MBA can also be found on the GB NNSS website. - Refine guidance to increase relevance for the different end users in the boat-based fishing sector (e.g., individual fishers, businesses or harbourmasters).

Responsible stakeholder	Guidance for Development of Actions	Example actions
Authorities	To improve INNS biosecurity in Welsh marine areas, authorities should consider creating/aligning a national-level marine INNS and biosecurity awareness raising campaign. This should provide common resources and consistent messaging for all marine stakeholders. Key highlights of the campaign could include: • A centralised location for biosecurity and INNS awareness-raising materials. While there is considerable existing material available for this action, ensuring a common repository and "endorsement" of primary materials will help stakeholders maintain consistency. • A defined list of priority INNS of concern. • Publication of INNS alerts when a population is newly established or spreading. • Clear points of contact for stakeholders seeking support and advice. Authorities could consider leading a consultation with other stakeholders on the production/review of a code of practice.	• Identification guides, such as the Welsh and English NRW ID guides (see Useful resources), should be printed and disseminated to as many relevant stakeholders as possible (e.g., local groups, points of sale). The ID guides should be kept up to date, accounting for newly introduced and horizon INNS. • Produce pathway-specific training resources which can be provided to other stakeholders. • Consult with stakeholders on the update / production / endorsement of best practice codes for INNS and biosecurity in boat-based fishing and share widely with relevant stakeholders. • Create an accessible central website to host biosecurity resources and information to make navigation to the most relevant information easier.

Responsible stakeholder	Guidance for Development of Actions	Example actions
National & Local stakeholders	In the absence/interim of the action above, national stakeholders should consider the INNS information and decide whether it is suitable for / relevant to their operating practices. Relevant information that could be integrated into operation-specific material could include: • Key INNS to look out for • Impacts of INNS • Biosecurity best-practice Material could include self-produced resources; however, a lower effort option could review and compile the existing material already in existence. Sources of existing, high-quality INNS biosecurity information include the GB NNSS and the Angling Trust (see Useful resources for links). Information material should prioritise increasing knowledge of relevant INNS (to pathway or region) and key biosecurity messages. Where possible, these resources should be updated and made more relevant to specific groups within the boat-based fishing pathway.	• Review existing biosecurity information and tailor to the boat-based fishing pathway.
Marina managers / harbour masters	Act as a source for the dissemination of the information produced above.	• Review the guidance received and incorporate into procedures where possible. • Consult with other stakeholders to ensure that risk factors are considered appropriately within information resources.

3. Raising awareness

To facilitate and encourage the active sharing of information and guidance, relevant to the boat-based fishing pathway, among all stakeholders within Welsh marine areas.

PRIORITY ISSUE: Some stakeholders operating within Welsh marine areas are not aware of INNS and their impacts, or what biosecurity is. All stakeholders would benefit from more exposure to INNS awareness raising activities. All stakeholders could also facilitate the spread of information and awareness raising about INNS and biosecurity.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	This biosecurity component aims to increase the awareness of INNS biosecurity with boat-based fishing stakeholders. The materials produced under component 2 are intended to provide the consistency and appropriateness of biosecurity information for the pathway. However, it should be noted that raising awareness is expected to overlap significantly across all marine PAPs, SAPs and BAPs. Therefore, it is critical that all stakeholders (including authorities) integrate/coordinate their activities. By doing so, they can ensure a cohesive and unified effort that maximising the effectiveness (and reach) of INNS information-sharing. All stakeholders can have a role in raising awareness of INNS and biosecurity by promoting and disseminating existing information regarding INNS and key biosecurity messages. This could be achieved both digitally (e.g., through social media and relevant websites) and in print (e.g., in harbour offices, newsletters and magazines, tackle shops / point of sale). Information can also be disseminated through fishery managers (e.g., Menai Strait Fishery Order Management Association, The Marine and Fisheries Division of the Welsh Government etc.) where applicable.	- Engage in Invasive Species Week. Use approved or provided biosecurity resources in communications and training. A marine INNS workshop kit comprised of preserved specimens and information sheets can be borrowed from Amgueddfa Cymru (see Useful resources). - Become familiar with existing and newly developed fishing-focused guidance. - Share information resources with other stakeholders as widely as possible. - Provide ad hoc information/facts on INNS to staff, colleagues, members of the public, customers etc.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	There is no requirement for burdensome changes to current activities, but consideration of INNS within outwards facing communications or marketing can benefit the sustainability of all activities within Welsh marine areas. The useful resources within this PAP include links to existing high-quality information sources which can be used as the basis for awareness raising. However, it is hoped that as national awareness increases, fishing stakeholders will expand their knowledge and activities in this area, eventually producing their own tailored resources (where they have not already done so), further amplifying awareness and engagement. Signage may be effective at targeting individual fishers who may be unaffiliated with groups/organisations and, as such, typically harder to reach. Hotspots where signage may be best installed could include at ports and harbours where fishing boats dock or moor-up, or slipways. Information contained within signage can range from general actions and national guidance (e.g., the GB NNSS Check, Clean, Dry campaign), to site specific biosecurity protocols, depending on the intended audience (see Useful resources for links to signage resources). Landowner permission should be considered (if applicable or required). Individual fishers should simply read and abide by any signage. Boat-cleaning guidance should include information on cleaning all underwater surfaces (e.g., hulls, propellers, sea chests and rudders) and removing standing/entrained water from bilges, as well as information on antifouling (e.g., the suitability of different coating types and how they should be maintained).	- Boat-cleaning guidance should be provided and shared widely, with public demonstrations encouraged. - Install biosecurity signage in prominent locations.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All Stakeholders continued	Existing guidance on antifouling and boat cleaning is available from sources like The Green Blue and the GB NNSS RAPID INNS management toolkit guidance on hull fouling. The IMO has also produced guidance for minimising the transfers of INNS as biofouling specifically for recreational craft which describes best practice for antifouling and cleaning. Boat-specific cleaning guidance should also be provided to users at the point of sale or rental. Equipment cleaning guidance (e.g., the GB NNSS Check, Clean, Dry campaign) should be shared by all relevant organisations and staff. For submerged equipment/infrastructure, guidance should include information on cleaning all underwater surfaces (e.g., trestles, pontoons, buoys etc.). Train staff (e.g., deck hands) on biosecurity best-practice, inspection/monitoring methods and INNS reporting. Organise workshops and educational events through local groups for boat-based fishers. These could cover an introduction to INNS, fishing gear and boat cleaning guidance and biosecurity best-practice. Material could be developed in collaboration with boat manufacturers and fishing groups (e.g., the WFA-CPC). Provide customers on chartered boats with training/briefings before boarding a boat to encourage them to implement biosecurity. Training and educational resources are available on the GB NNSS website (GB NNSS Training resources).	See actions above

Responsible stakeholder	Guidance for Development of Actions	Example actions
Authorities	Authorities should ideally be a primary source for INNS and biosecurity information in Wales. Information on available funding and resources for biosecurity should be shared with stakeholders. Messaging should ensure that stakeholders are aware of critical information, such as updates to policies (e.g. in-water cleaning rules) or species records/alerts.	• Issue regular updates/social media posts offering INNS and biosecurity advice. • Continue to engage with stakeholders, with a particular focus on improving communication links with key boat-based fishing stakeholders. • Include links or QR codes to online resources (including ID guides) with communications. Where appropriate, stock/disseminate hard copies of resources.
Marina managers / harbour masters	Fishing events and competitions can be used as an opportunity to undertake awareness-raising actions, spreading INNS information to a wider audience of participants and members of the public. During high-risk events (e.g., competitions, especially those supporting international participants), a short talk or briefing before each event should be given to explain the importance of biosecurity as well as to remind participants to engage with the site biosecurity. Staff or volunteers could be in attendance to raise awareness of INNS and assist with any biosecurity actions required. Event organisers could link with local NGOs (e.g., Wildlife Trusts) to set up INNS information stands and provide attendees with relevant resources (e.g., biosecurity best-practice guidance and INNS guides) such as angling event guidance created by the GB NNSS.	• Incorporate INNS and biosecurity information in pre-event communications and at briefings before events commence. • Include biosecurity statements in event entry conditions / prerequisites for competitions. • Collaborate with NGOs to produce activity specific INNS guidance to use at awareness raising events.

4. Biosecurity processes and procedures

To improve INNS biosecurity procedures being undertaken by stakeholders relevant to the boat-based fishing pathway, ensuring consistency and efficacy.

PRIORITY ISSUE: Although many stakeholders undertake biosecurity procedures (e.g., antifoul application, harbour biosecurity planning and procedures) continuous improvement and inclusion of best practice in standard procedures should be prioritised.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	This biosecurity component is primarily intended to encourage operators within Welsh boat-based fishing to enhance biosecurity procedure for INNS. However, this guidance is also highly relevant to other stakeholders interacting with the marine environment, such as (but not limited to) NRW, Local Authorities, and County Council field or operational teams. At the most basic, INNS biosecurity can be achieved simply through “Check Clean Dry” procedures (see GB NNSS information). At a high level, stakeholders are encouraged to review and update their protocols and practical procedures to ensure that operational biosecurity comprehensively addresses INNS and is consistently applied. Continuous improvement should also be a priority. These updates do not need to be onerous or burdensome. Enhancements can leverage existing best practices or adopt innovative approaches tailored by stakeholders themselves.	• Authorities could provide support to national and local stakeholders for the implementation of improved biosecurity at sites where boat-based fishing is a priority pathway. • Consult and collaborate with the industry to ensure best practice is encouraged and enabled. The onus should be placed on pragmatic changes to procedures which do not negatively impact Welsh blue growth or individual operators. • Regularly review emerging methods and technologies that offer INNS risk reduction.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	<u>Appoint Biosecurity Managers or Champions</u> For operations of varying scales, appointing a biosecurity manager or champion can be beneficial. This individual, equipped with relevant knowledge and a defined responsibility for biosecurity, can oversee and ensure that biosecurity actions are conducted appropriately and effectively for their site, business, or organisation. A biosecurity manager should act as a central point for all INNS queries (e.g., on ID or procedure), enforce biosecurity protocols and facilitate action in response to new INNS detections and issues. The biosecurity manager could be a member of staff already in post and familiar with the site and biosecurity plan. They could be trained in the role and provided with the tools to train other staff members and inform members of the public /customers. The biosecurity manager should act as a point of contact for staff. For a fishing boat or operation, a biosecurity manager should be appointed to oversee fishing gear and boat cleaning and ensure the appropriate use of biosecurity facilities (if available). This should include not discarding INNS overboard while underway. At a harbour (receiving fishing boats), they should ensure that the site itself is cleaned and maintained regularly to address biofouling on infrastructure. Additionally, they should also ensure the appropriate use of site biosecurity facilities (if they are present) and help to ensure that the facility itself is cleaned and maintained regularly.	• Considering appointing a biosecurity manager or champion to act as a central point for INNS related queries. • A stand-alone BAP or to-do-list tracker could be developed for the individual operation - communicate with NRW for support and advice. • Introduce a clean boat policy and communicate this policy widely with relevant stakeholders and authorities. • Ensure innovative approaches and updated best practice is shared within the industry.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	It is recognised that this action may only be a light-touch at the local stakeholder level and not appropriate for individual/unaffiliated boat-based fishers; however, a point of contact for the promotion of biosecurity within local user groups could provide a valuable asset for improving biosecurity at the grassroots level. <u>Research and develop INNS management measures</u> Invest and participate in the development and testing of new methods and technologies to manage INNS. For example, working with a research body / professional.	Consider collaborating with researchers to advance INNS management technologies.
Harbour masters	Harbour masters, site owners and site managers (or any other relevant party) should develop an inspection strategy to target visiting fishing boats, based on their own inspection strategies. This should outline procedures for inspection and to enforce relevant actions (e.g., refusing entry or insisting on immediate removal and cleaning with costs covered by the boat owner/manager). Clean boat policies could be introduced in more regulated sites like harbours and ports. These policies outline a maximum amount of hull fouling that is permitted for a boat entering the site (unless immediately being removed from the water for cleaning) or the maximum amount of hull fouling allowed to accumulate on a boat moored at the site before the boat must be removed and cleaned (in compliance with national boat cleaning requirements). An example of a ranking for hull fouling	- Develop an inspection strategy/checklist for all fishing boats and refuse entry if boats are heavily fouled. - Include a biosecurity statement/clause in club membership / code of practice site agreements. - Initiate a clean boat policy for boats entering harbours and ports. - Disseminate hull fouling resources and cleaning expectations to boat owners in the T&C's for mooring and birthing.

Responsible stakeholder	Guidance for Development of Actions	Example actions
Harbour masters continued	can be seen in table 1. They can be included, for example, in the Terms and Conditions for mooring and berthing. The GB NNSS has produced an example biosecurity clause. The terms of any clean-boat policies and inspection strategies should be publicly accessible and made clear to visiting boats prior to their entry. Simple questions that could be asked to visiting boat prior to a physical inspection of a boat are: ○ When was the boat last taken out of the water? ○ When was the boat hull last cleaned? ○ When was antifouling paint last applied? ○ Where are you travelling from? ○ How long was your boat stationary at its previous mooring? Some marine licensed activities, such as expanding or constructing harbour infrastructure, require the submission of a marine INNS biosecurity risk assessment (see marine licencing guidance). Information about construction and maintenance activities that may be exempt from a marine licence are included below. Applicants, who may include managers/owners of harbours that accommodate fishing boats, should coordinate with authorities to improve the biosecurity considerations within their planning applications, facilitating the future-proofing of biosecurity in their construction and development.	See actions above

Responsible stakeholder	Guidance for Development of Actions	Example actions
Operators	Biosecurity best-practice can be integrated into everyday operations without substantial inconvenience or expense. Some of these practices are common-sense actions that may be undertaken already to prolong the life of boats and equipment, and to reduce the frequency at which costly or onerous maintenance/cleaning needs to be undertaken. The following are examples of good practice for biosecurity: • Remove any artificial substrates (e.g., buoys, fenders, warp) from the water that are not in use to prevent biofouling accumulating. INNS generally grow well on artificial structures and the more of these that are in the environment the more settlement substrate there is for INNS. • Drop moorings to the seabed when not in use (attach a rope riser to allow retrieval) where the riser and chain can be covered in sediment. This smothers any fouling which has accumulated and reduces wear and tear. • Ensure that boats are either used frequently to prevent high levels of biofouling from accumulating or, if the boat cannot be used frequently, remove it from the water / dry-dock it. • If selling or using live bait, ensure that it is a native species to prevent release and spread of INNS. • Ensure that when sorting catch known INNS are either landed or only returned to the location at which they were caught.	• Follow and promote sector-specific best practise biosecurity guidelines. • Remove artificial substrates when not in use to prevent biofouling. • Drop moorings to the seabed when not in use. • Remove boats/dry-dock from the water if they are not being used regularly. • Ensure that any live bait sold/used is native.

Responsible stakeholder	Guidance for Development of Actions	Example actions
Operators continued	The GB NNSS-hosted RAPID INNS Management Toolkit has guidance documents that provide more detailed information on best-practice for the marine environment by sector .	See actions above

5. Biosecurity facilities

The availability of a biosecurity facility (or the supply of appropriate equipment) can help promote effective cleaning, reducing the risk of INNS being transferred to or from a location.

PRIORITY ISSUE: Washdown facilities are critical for enabling the physical cleaning of equipment, clothing and PPE. Enhancing the availability and accessibility of these facilities can substantially improve biosecurity effectiveness.

To note: A review of available washdown facilities within Welsh marine areas was not included in the scope of the biosecurity framework, leaving the overall status of such facilities unknown.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	Stakeholders who manage or own assets (e.g., marina and harbour operators, local authority managed assets where boat-based fishing occurs etc.) should consider the installation of biosecurity facilities. It is acknowledged that biosecurity facilities may be multi-purpose at many locations and that facilities do not need to be overly complicated or technical (e.g., using hot water to clean rather than cold or freshwater rather than seawater). However, it is worth noting that efficacy of a facility is generally proportional to complexity and cost. When planning installations, the following requirements, among other aspects like space and financial resources, should be considered. • The scale of the facility in proportion to the risk posed by the activity • Infrastructure required for the collection and disposal of wastewater and waste material in a biosecure way to prevent INNS re-entering the environment (e.g., water tanks and biological waste bins). • Supply of necessary resources, like water and electricity	• Install a freshwater (and, if possible, a hot water) supply at a site where angling occurs. • Ensure that waste is controlled in a way that minimises the risk to wider habitats. • Use existing washdown facility (following improved protocols that may be outlined in component 4).

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	Some facilities relevant to shore-based fishing include: • Supply of power washers and steam washers to fishers and boat cleaners for use on boats and equipment at a secure location that is bunded. • Fabrication of a bunded area at designated cleaning area / dry dock to capture all waste material and waste water. • Provision of areas to leave fishing gear and boats once removed from the water to dry thoroughly, allowing all plants and animals (i.e., biofouling species) to desiccate. Funding sources may be available to facilitate the purchase, installation and operation of biosecurity facilities. Guidance on the use of equipment at the facilities should be prominently displayed to ensure the correct application of the biosecurity measures. Additional note: It is difficult to provide a one-size-fits-all recommendation for biosecurity facilities without understanding the nuances of a particular site. The GBNSS provides good background information and a biosecurity facility support tool, which offers a useful overview of facilities. Stakeholders should be reminded that biosecurity facilities do not need to be complex and could just represent a minor upgrade to existing facilities.	• Utilise the biosecurity support tool to assist with decision making. • Review and explore the potential to upgrade existing biosecurity facilities.

Responsible stakeholder	Guidance for Development of Actions	Example actions
Port and harbour operators	Ensuring that on-site personnel have access to washdown facilities can improve day-to-day operational biosecurity. Facilities should be intended to assist staff with the implementation of CCD procedures. It is important for operators that offer maintenance services to ensure that any facilities used minimise the risk that INNS waste could be released into the wider environment. The critical consideration should be focused on waste capture and appropriate disposal.	• Review existing/install new facilities and how they are being used. • Ensure waste management and drainage is appropriate to minimise the risk of INNS reaching the environment.

6. Monitoring and reporting

To establish a robust understanding of what INNS are present in Welsh marine areas and facilitate the early detection of introductions and spread.

To ensure that INNS sightings are reported to an appropriate platform and records are included in national databases.

To ensure that up to date species distribution data is available to facilitate rapid responses to new INNS introductions or spread events.

PRIORITY ISSUE: INNS monitoring and surveillance are insufficient in certain regions, with stakeholders often unaware of what to report or where to report sightings. Additionally, data flow is fragmented, data administration slow, and existing mechanisms for priority species reports reaching authorities are inconsistent, which may delay management response.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	This focus area aims to increase the INNS monitoring and surveillance effort by boat-based fishing stakeholders. Stakeholders should take an integrated approach to monitoring (see action PS-6). By doing so, they can ensure a cohesive and unified effort that builds on and enhances existing programmes, maximising the effectiveness of monitoring across all marine pathways and action plans. Stakeholders who own or manage assets (e.g., marina and harbour operators where fishing boats are received etc.) should consider implementing regular monitoring for INNS. Monitoring can either be undertaken and reported by stakeholders individually or could be through a collaborative effort with other stakeholders, for example those in academia.	- Promote and encourage the use of reporting / recording platforms. - Check Welsh biosecurity communications for opportunities to coordinate monitoring and collaborate. - Consider proactive monitoring through citizen science programmes. - Promote opportunities for integrated or collaborative monitoring efforts.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	It is best to use standard procedures for monitoring high-risk INNS. Procedures may be directed from a new national approach or from existing monitoring. The best approach to monitoring for current and horizon INNS is to employ multiple methods in tandem to achieve maximum coverage of habitat and species detection. Some of the monitoring methods that could be employed include: • Rapid Assessment Surveys (optimal for detecting fouling organisms but not for planktonic or soft bottom habitat species); • Settlement plates/panels (panels placed in key areas for a pre-determined amount of time and checked periodically for marine growth or analysed in a lab); and • Environmental DNA (eDNA) (used to ascertain which species are present at a site using the genetic material that can be obtained from an environmental sample such as water). Stakeholders can contact NRW for guidance on monitoring INNS at their site at: invasive.non.native@naturalresourceswales.gov.uk Simple training and guidance should be provided to staff, focusing on recognising priority INNS, or being encouraged to report “unusual” growth or fouling. Confirmed or suspected INNS should be reported. This improves INNS distribution knowledge and the ability to reduce the spread. Information on how and where to report sightings should be included in all biosecurity materials and resources.	See actions above

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders continued	NRW recommend that INNS sightings should be reported to: • iRecord online [www.irecord.org.uk/]; and • iRecord App [available on Google Play].  Potential INNS sightings can also be reported directly to NRW at: invasive.non.native@naturalresourceswales.gov.uk Reporters should take photos and make a note of the sighting location (ideally GPS coordinates). If possible, they should take notes about the surroundings (e.g., substrate type, other species in the area, tidal height). The reporting platform should be mentioned / linked on educational materials, at workshops and in social media engagements (see Component 2). National and regional groups (e.g., the WFA-CPC or MSFOMA) could provide members / relevant people with guidance and reminders for reporting sightings.	See actions above

Responsible stakeholder	Guidance for Development of Actions	Example actions
Authorities	It has been recognised that the reporting of INNS sightings is not as efficient as it could be. Authorities should therefore engage with local groups, citizen science surveying groups (e.g., Seasearch and Shoresearch), Local Environmental Records Centres (LERCs) and non-governmental organisations (NGOs) (e.g., Wildlife Trusts) to set up or improve data-sharing links and ensure that sightings of high-risk species or new incursions of horizon species are passed to the relevant authority and acted on in a timely manner. This could involve establishing a list of National alert species and disseminating this list to all relevant parties (e.g., LERCs and NGOs). A critical analysis of the dataflow for national INNS records should be considered, with the primary aim to improve the consistency, accuracy and timeliness of reports. Making use of the existing reporting channel for commercial fishing operations, "Catch Recording App" by adding INNS as a voluntary addition to make it easier for fishers to log sightings.	• Undertake a critical analysis of the data-flow for national INNS reports. • Ensure that priority INNS reports are flagged with relevant stakeholders (e.g. iRecord species notifications). • Investigate the addition of marine INNS to the commercial fishing "Catch Recording App".
Local stakeholders	INNS sightings should be reported / recorded on the relevant platforms. Fishers might already have a good knowledge of the "normal" plants and animals at their regular sites. Reporting new or unusual species or unexpected fouling/growth can provide valuable information and trigger a quick response.	• Report new/unusual species or growth/fouling to iRecord or NRW.

7. Collaborative working

To improve the collaboration between all stakeholders within Welsh marine areas where boat-based fishing occurs.

To foster open communication, build trust, and align on shared goals to drive effective outcomes.

To cooperate in decision-making and share resources to address challenges and achieve success together.

PRIORITY ISSUE 1: Stakeholders remain uncertain about advancing biosecurity implementation without clear guidance and support from regulators and authorities. Top-down leadership is crucial, complemented by inter-stakeholder collaboration. Mechanisms for sharing information, practical advice, and bespoke guidance tailored to both national and local stakeholder needs must be developed and prioritised.

PRIORITY ISSUE 2: Opportunities for coordinated and collaborative biosecurity can be missed due to limitations in communication, leading to duplicated effort and gaps.

Responsible stakeholder	Guidance for Development of Actions	Example actions
All stakeholders	All stakeholders should work to strengthen communication and collaboration mechanisms, ensuring that practical improvements and best practices are effectively shared and considered within national or regional biosecurity implementation. Open communication channels will facilitate the flow of information from authorities to stakeholders within key sectors (i.e., those whose operations may act as pathways of introduction and spread). Open channels will also facilitate the sharing of information from stakeholders to authorities. For example, carpet sea squirt sightings in new areas.	• Engage in the biosecurity framework for Welsh marine areas in some capacity. • Consider mechanisms for collaboration and integration with other stakeholders and project.

Responsible stakeholder	Guidance for Development of Actions	Example actions
Authorities	Authorities could consider taking a leadership/coordinating role in this process by setting clear frameworks, facilitating dialogue, and ensuring that all voices are heard. Impartial guidance is critical in driving coordinated efforts, updates to national policy, maintaining transparency, and promoting a proportional approach. Authorities should ensure close working and collaboration with relevant authorities (and other stakeholders) in England (e.g., the Environment Agency) and Europe.	• Ongoing stakeholder engagement to keep INNS at the forefront of stakeholders' activities and awareness. • Establish/task an existing working group with coordinating collaborative working. • Engage and coordinate with stakeholders to monitor progress and assess future support needs.

Action scaling: commercial fishing operation example

The following section provides examples of how the biosecurity components and the actions listed above (under “Recommended actions for all stakeholders”) could be scaled for implementation for a commercial fishing operation within a boat- or fleet-specific biosecurity plan (Table 5) and a recreational angling tour company within a company biosecurity plan (Table 6).

Table 5. Example actions for a commercial fishing operation.

Component	Example approach for a commercial fishing operation
1. Understanding roles and legal responsibilities	Engage with relevant local harbours regarding any site-specific biosecurity policies. Make sure to stay up-to-date with (and follow) guidance and regulations for boat cleaning in Wales.
2. Information and guidance on INNS and biosecurity	If guidance/information is received from authorities, see if it is appropriate for inclusion in boat- or operation-specific guidance. Provide feedback on guidance/information if appropriate. Have a waterproof INNS guide onboard if one is provided.
3. Raising awareness	Put up ID images of key INNS at appropriate locations, e.g., galley or catch processing area. Ensure that appropriate INNS and biosecurity signage is visible on the fishing boat. Complete the training courses on biosecurity on the GB NNSS website.
4. Biosecurity processes and procedures	Appoint a crew member as biosecurity manager to co-ordinate the biosecurity actions and help to record INNS. Comply with T&Cs or site requirements as appropriate. Don't discard INNS overboard while underway.
5. Biosecurity facilities	Ensure that antifouling is up-to-date and well maintained. Wash heavily fouled equipment in freshwater and leave it to dry (so that all fouling is dead). Make use of available biosecurity facilities.
6. Monitoring and reporting	Ask the crew (especially those sorting through the catch) to be vigilant for key INNS and flag if they are found. Log any sightings to iRecord (or a designated intermediary) at the end of the day at the same time as making the catch record, and do not return any INNS back to the sea. Try to ensure that any sightings are recorded on the day they are made.

Component	Example approach for a commercial fishing operation
7. Collaborative working	Share information with other stakeholders, attend relevant workshops / events and provide feedback to authorities.

Action scaling: recreational boat-fishing charter business example

Table 6. Example actions for a recreational angling tour company.

Component	Example approach for a recreational fishing charter business
1. Understanding roles and legal responsibilities	Engage with relevant marina / harbour authorities regarding any site-specific biosecurity policies. Make sure to stay informed with (and follow) the latest guidance and regulations for boat cleaning in Wales. Link with charter angling providers to encourage best practice for boat cleaning and general biosecurity.
2. Information and guidance on INNS and biosecurity	Have a waterproof INNS guide onboard if one is provided.
3. Raising awareness	Provide information to customers about INNS and biosecurity when they book on to a fishing trip. Include links to INNS information (e.g., GB NNSS website) on company website. Periodically share posts about INNS and biosecurity on company social media pages. Put up signs in office/shop and on the boat outlining biosecurity procedures (e.g., Check Clean Dry) and key INNS to watch out for (and where to report them). Encourage crew to complete the training on the GB NNSS website. Attend INNS and biosecurity workshops/events when possible.
4. Biosecurity processes and procedures	Appoint a crew member as biosecurity manager to co-ordinate the biosecurity actions, raise awareness with customers and help to record INNS sightings. Have a policy that all bait used on the trips is either a native species or is non-viable (i.e., dead and not carrying any eggs). Comply with T&Cs or site requirements as appropriate.

Component	Example approach for a recreational fishing charter business
5. Biosecurity facilities	Make use of biosecurity facilities. Link with other charter angling providers to encourage a co-ordinated biosecurity effort. When the boat is not in regular use (e.g., off-season) ensure that it is removed from the water, any biofouling is removed (and disposed of appropriately), and the antifouling coating is maintained.
6. Monitoring and reporting	Download the iRecord app onto work phones or encourage crew to download the app on their personal phones. Recommend iRecord to customers for uploading sightings (of INNS as well as their catches). When an INNS is spotted, upload it to iRecord as quickly as possible.
7. Collaborative working	Share information with other stakeholders, attend relevant workshops / events and provide feedback to authorities.

Considerations for site maintenance and construction operations

The following guidance is for consideration by site owners, site operatives and other relevant actors when planning or undertaking minor work at a site.

The [Welsh National Marine Plan](#) contains a cross-cutting policy specifically relating to INNS. Under Policy ENV_03, proposals for inshore and offshore developments in Welsh marine areas should assess the likely risk of introducing or spreading INNS and put in place reasonable biosecurity measures where necessary to reduce or stop their introduction or spread.

Some general operational activities might risk spreading INNS. These include minor works, repairs, maintenance and construction that would not necessarily need a marine licence so there may not be an assessment or an understanding of the risk that the activity might pose in spreading INNS.

Activities, which may fall under Band 1 licencing eligibility, are listed below. It is important to note that the NRW Permitting Service may still be required to consider the appropriateness of the activity before determining the licence application (see [Natural Resources Wales website](#) for more information).

- Repairing, replacing or reasonably improving parts or ancillary equipment attached to existing structures (e.g., bolts, flaps, valves, cathodic protection, access covers, grills, joints, decking on a pier or pontoon, health and safety equipment etc.).
- Installing scaffolding/access towers to facilitate the maintenance of existing structures.
- Replacing render or concrete, including resurfacing slipways (excludes work on coast protection structures, such as sea walls).
- Removal of marine growth and/or guano from any structure (other than from boats).
- Installing ladders at any building or structure.
- Dropping or removing posts for marking channels, shallow water areas, outfalls and groynes.
- Dropping or removing marker buoys.
- Removing discrete pieces of debris associated with construction, demolition, damage or disrepair of a building / structure (using a vehicle or boat).
- Removing litter (using a vehicle or boat).

The movement of material and equipment on or off a site risks inadvertently transferring INNS. INNS (as adults, juveniles, larvae or fragments) could be attached to surfaces, entrained in any water-retaining features/crevices (including in porous materials like concrete), living within sediments or among other species (like fouling communities). If the material or equipment is not thoroughly cleaned (e.g., washed down with freshwater) and dried before moving on or off the site, any INNS that are present would also be moved on or off the site.

Additionally, equipment, parts or materials that have been static in the water for prolonged periods of time can build up fouling which can be dislodged into the water during maintenance, cleaning or replacement. In this way, fouling INNS can be helped to spread to new areas (e.g., fragments of carpet sea squirt, which can form new colonies elsewhere).

Biosecurity is not necessarily considered when undertaking each of the above activities and guidance on how to address the risks of this minor pathway is not as well developed (or specialised) as it is for other pathways in the marine environment (see [Useful resources](#)). As such, it is important to set out general procedures for operatives to follow to reduce the risks of introducing or spreading INNS into, around or out of their site. However, the intention is not to add onerous risk assessments and checks to everyday operations but to ask operatives to be mindful of potential risks and take basic steps to minimise them. The aim of the following guidance is for it to be considered by marina managers, harbourmasters, site owners, site operatives and any others when planning or undertaking minor work at a site.

Activity: Cleaning, maintenance or removal of structures / items in the water

Suggested Biosecurity Actions

- Visually inspect them before disturbing them.
- If they have fouling on them, try to minimise the risk of releasing the species into the water:
- Bring the structure out of the water before carrying out the work and retain the detritus that comes off the item (collect it and dispose of it on land).

Activity: Bringing new infrastructure / equipment and material on site

Suggested Biosecurity Actions

- Ensure it is fully clean and dry before it is deployed.
- If unclear when it arrives, take to a suitable location for cleaning, this should be a contained area of hard-standing with appropriate drainage. Wastewater and waste material should be collected and disposed of in a biosecure way to prevent INNS (including larvae, fragments, etc.) re-entering the environment (e.g. water tanks and biological waste bins).
- If possible, check the source of the item(s) and understand what INNS are present at that site (this can be done by searching the location on the [NBN Atlas](#) (or on [iRecord](#)) which are both open-access and free to use).

Activity: General operational good practice for infrastructure

Suggested Biosecurity Actions

- Where practical, remove man-made structures from the water when they are not in use.
- Temporarily move items out of the preferred growth zone. For example, dropping the mooring chain to the seabed when not in use will smother fouling (in muddy sediments) or prevent new growth.

- Air dry what you can, when you can. Identify opportunities to dry out equipment or infrastructure as often as possible, e.g., drying room/area for kit, PPE etc.
- Expose to fresh water. Make the most of any natural flows of freshwater into your site. Expose INNS to fresh water through immersion or wash down.
- Photograph fouling on buoys / pontoons when they are taken out for maintenance to keep a record of growth and inspect for any new INNS.

Useful resources

- [Angling Trust](#)
 - [GB NNSS Check Clean Dry](#)
 - [GB NNSS Angling PAP](#)
 - [GB NNSS Recreational Boating PAP](#)
 - [The WiSe scheme for charter boating](#)
 - [Health and Safety Executive list of approved biocides](#)
 - [Royal Yachting Association, The Green Blue resources](#)
 - [IMO Glofouling resources](#)
 - [Wales Biodiversity Partnership INNS Group](#)
 - [GESAMP 2024 report on Marine biofouling: Non-Indigenous Species and Management across Sectors](#)
 - [GB NNSS-hosted RAPID LIFE project INNS management toolkits](#)
 - [Natural Resources Wales report on the impacts of marine INNS on MPA features](#)
 - [Welsh marine INNS priority list](#)
 - [Natural Resources Wales marine INNS guide in Welsh](#)
 - [Natural Resources Wales marine INNS guide in English](#)
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- **Full reference to the 2023 report by Eschen:**
 - Eschen, R., Kadzamira, M., Stutz, S., Ogunmodede, A., Djeddour, D., Shaw, R., Pratt, C., Varia, S., Constantine, K. and Williams, F., 2023. An updated assessment of the direct costs of invasive non-native species to the United Kingdom. *Biological Invasions*, **25**, 3265-3276
 - **Links to other Pathway Action Plans (PAPs) and Species Action Plans (SAPs):**

Links to the action plans listed below can be found on the [Wild Seas Wales website](#).

 - American slipper limpet, *Crepidula fornicata* SAP
 - Chinese mitten crab, *Eriocheir sinensis* SAP
 - Carpet sea squirt, *Didemnum vexillum* SAP
 - Trumpet tubeworm, *Ficopomatus enigmaticus* SAP
 - American oyster drill, *Urosalpinx cinerea*, & Japanese oyster drill, *Ocenebrellus inornatus* SAP
 - Recreational Boating (small boats) PAP
 - Recreational Activities PAP

- Commercial Shipping PAP
- Aquaculture PAP
- Shore-based Fishing PAP
- Boat-based Fishing PAP