MARINE BIOSECURITY PLAN

Tamar Estuaries

2018 - 2020

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NATURAL ENGLAND

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What are Invasive Non-Native Species (INNS)?

Invasive Non-Native Species are those that have been transported outside their natural range and that damage our environment, the economy, our health and the way we live.

What is Biosecurity?

Biosecurity means taking steps to make sure that good practices are in place to reduce and minimise the risk of spreading invasive non-native species. A good biosecurity routine is always essential, even if invasive non-natives are not always apparent.[1]

What is a Vector or Pathway?

These are the means by which a species is moved from place to place due to human activity.

Abbreviations and Acronyms

DEFRA	Department for Environment, Food and Rural Affairs
GB NNSS	GB Non-Native Species Secretariat
GES	Good Ecological Status (within WFD) or Good Environmental Status (MSFD)
INNS	Invasive Non-Native Species
MBA	Marine Biological Association of the UK
MSFD	Marine Strategy Framework Directive
NE	Natural England
PML	Plymouth Marine Laboratory
PPMLC	Port of Plymouth Marine Liaison Committee
QHM	Queen's Harbour Master
RAS	Rapid Assessment Survey
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TECF	Tamar Estuaries Consultative Forum
TGB	The Green Blue
WAG	Wembury Voluntary Marine Conservation Area Advisory Group
WFD	Water Framework Directive

[1] GB NNSS https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?pageid=174

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1. Introduction

- **Site Name:** **Tamar Estuaries**
- **Plan Period:** **April 2018 – March 2020**
- **Biosecurity Manager/Officer:** **Tamar Estuaries Consultative Forum**
- **Location of biosecurity logbook:** **Tamar Estuaries Consultative Forum**
- **Plan review date:** **April 2020**

2. Site Description

This plan covers the marine and tidal extents of Plymouth Sound and its associated estuaries of the rivers Tamar, Tavy, Lynher and Plym which comprise a complex suite of marine inlets on the English Channel coast; collectively the rivers drain much of Devon and Cornwall. The Plan's outer boundary extends from Gara Point to Rame Head, but excludes the Yealm estuary which is being included in a separate plan for South Devon.

The Sound is an open bay with a steeply sloping, rocky coastline, with the inner sound sheltered by an artificial breakwater; the Sound and the lower Tamar form a 'ria' – a submerged valley. The Tamar provides the dominant freshwater input with annual flows in the region of $30m^3s^{-1}$. The upper part of the Tamar and Lynher estuaries are characterised by a well-developed estuarine gradient, such that they exhibit one of the finest examples of salinity gradient communities in the UK and contain sedimentary and reef habitats of international marine conservation importance. The broader lower reaches of the rivers form extensive tidal mudflats bordered by saltmarsh communities are of international importance for the large numbers of waterbirds. [2,3]

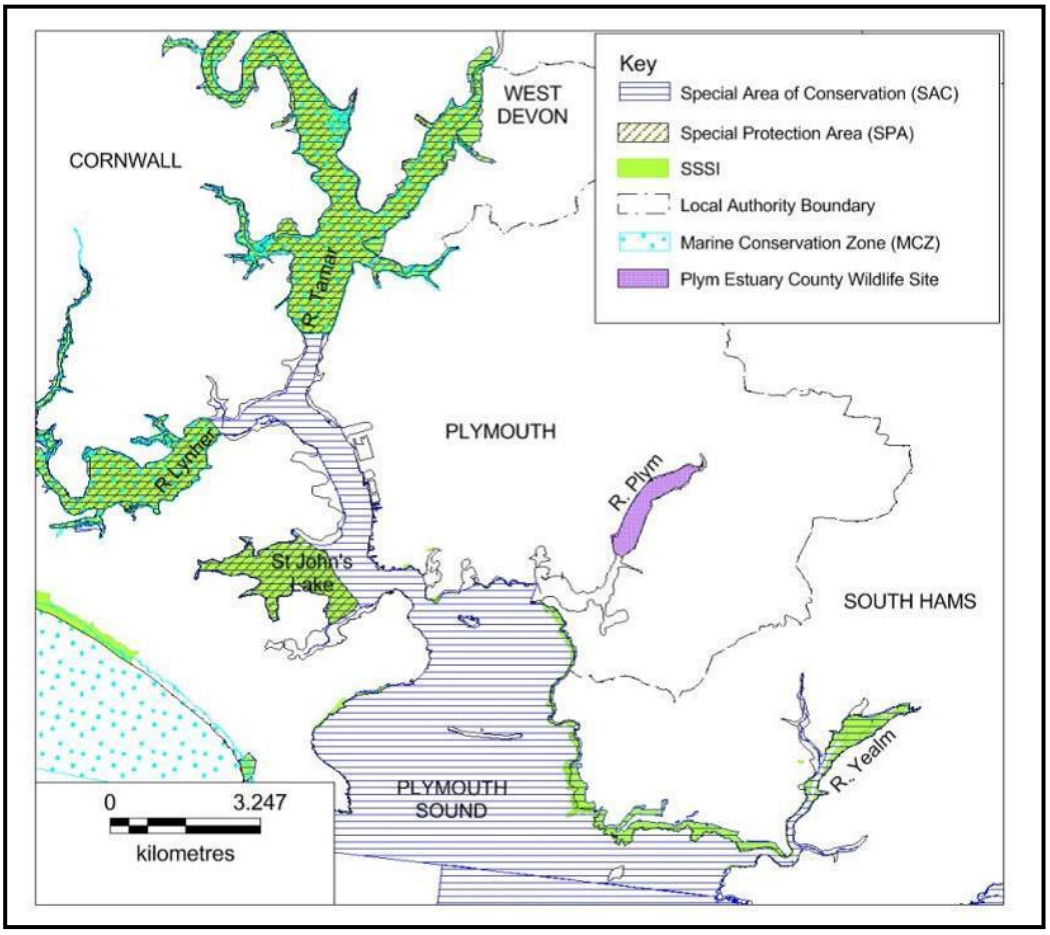
Within these waters is one of the highest concentrations of designated marine protected areas anywhere in England.[4] The waters are designated under European legislation as a Special Area of Conservation and a Special Protection Area (collectively known as a European Marine Site). Parts are also designated as Sites of Special Scientific Interest (SSSI) and a Marine Conservation Zone (MCZ). The nature conservation designations and key marine features of conservation interest are listed below and illustrated in Fig 1.

Table 1: Marine Protected Areas – site designations and features

Designation	Marine Features
Plymouth Sound and Estuaries SAC[5]	Large shallow inlets and bays Estuaries Sandbanks which are slightly covered by seawater all the time Atlantic salt meadows (Glauco – Puccinellietalia maritimae) Reefs Mudflats and sandflats not covered by seawater at low tide Allis Shad Shore dock

[2] Knights, A. M., Firth, L. B., Thompson, R. C., Yunnie, A. L., Hiscock, K., & Hawkins, S. J. (2016). Plymouth—A World Harbour through the ages. *Regional Studies in Marine Science*.
[3] PCC (2014). Waterfront Evidence Base – Informing the Plymouth Plan.
[4] Natural England Designated site details available at: https://designatedsites.naturalengland.org.uk/SiteSearch.aspx
[5] http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0013111

Tamar Estuaries Complex SPA[6]	Avocet Little Egret
Tamar Estuaries MCZ	Intertidal biogenic reefs Intertidal coarse sediment Blue mussel beds Native Oyster Smelt
Start Point to Plymouth Sound and Eddystone SAC[7]	Reefs
Tamar-Tavy Estuary SSSI	Avocet Transitional low marsh vegetation Saltmarsh
Plymouth Sound Shore and Cliffs SSSI	Exposed rocky shores (predominantly extremely exposed to wave action) Moderately exposed rocky shores Shores of mixed substrata (stones and sediment)
St John's Lake SSSI	Black-tailed Godwit Wigeon
Wembury Point SSSI	Reefs Shores of mixed substrata (stones AND sediment)
Wembury Voluntary Marine Conservation Area (VMCA)	



[6] http://jncc.defra.gov.uk/pdf/SPA/UK9010141.pdf
[7] http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030373

Fig 1: Map of designated marine habitats. Note: R. Yealm is covered by a separate biosecurity plan

Natural England carried out a condition assessment of the Plymouth Sound and Estuaries SAC in 2015, this reported that large areas of the Sandbanks, Estuaries and Large Shallow Inlets and Bays are judged to be in unfavourable condition.[8] One of the key factors causing this is 'The increasing amount of INNS, particularly the Slipper limpet, *Crepidula fornicata*; and the Pacific oyster, *Crassostrea gigas*. And the impacts these species are having on the designated habitats within the site.'

A Natura 2000 Site Improvement Plan for Plymouth Sound and Tamar Estuary[9] identifies a number of INNS, including Pacific oyster, *Crassostrea gigas*; Wakame, *Undaria pinnatifida*; and Wire weed, *Sargassum muticum*, which are increasing in density in the area and have the potential to dominate and thus exclude native species. Actions proposed included:

- Identifying the range and distribution of NNS within the site and impact on designated features.
- A management plan and control implementation for Pacific oyster.
- Development of an NNS pathway and biosecurity project for the Plymouth area.

Currently none of the following water bodies' WFD ecological status classifications are recorded as being affected by INNS: Plymouth Sound; Plymouth Tamar; Cotehele Stream; Lower River Lynher; Lower River Plym; Lower River Tamar; Lower River Tavy; Tiddy; Tory Brook.

The maximum tidal range for Devonport is 5.76m, the Tamar has a mean spring tidal range of 4.7m and tidal length of 31km, the Plym has a mean spring tidal range of 4.6m and a tidal length of 6.9km.[10]

[8] Natural England Condition Assessment – Plymouth Sound and Estuaries Special Area of Conservation (2016)
[9] SIP174 Site Improvement Plan – Plymouth Sound and Tamar Estuary available at: http://publications.naturalengland.org.uk/publication/6283453993582592
[10] Uncles, RJ; Stephens, JA; Smith, RE. 2002 The dependence of estuarine turbidity on tidal intrusion length tidal range and residence time. *Continental Shelf Research*, 22 (Nov-13). 1835 - 1856. 10.1016/S0278-4343(02)00041-9

3. Non-native species

Due to its long history as a naval and commercial port and its proximity to the coast of mainland Europe, the Tamar Estuaries area is somewhat of a hot-spot for non-native species (NNS). Table 2 lists 16 NNS which have a significant presence in the area, more information about these species, including their likely impacts, is provided in the separate Species Guide along with a list of a further 29 NNS known to occur in the area. More information can be found on the GB NNSS information portal.[11,12]

Table 2: Top 16 Non-native species present

	Species	Common name	On MSFD list	Occurrence	
				Artificial habitats	Natural habitats
SEA SQUIRTS	*Styela clava*	Leathery sea squirt	✓	✓✓	✓
	Asterocarpa humilis	Compass sea squirt	✓	✓ new 2011	✓ new 2014
	Corella eumyota	Orange-tipped sea squirt		✓✓	✓✓
	Botrylloides violaceus	Orange cloak sea squirt		✓✓✓	✓
	Aplidium cf. *glabrum*			✓✓	✓
BRYOZOANS	*Tricellaria inopinata*	Tufty-buff bryozoan		✓✓✓	✓✓
	Bugula neritina	Ruby bryozoan		✓✓✓	
	Watersipora subatra	Red ripple bryozoan	✓	✓✓✓	✓ new 2015
	Schizoporella japonica	Orange ripple bryozoan	✓	✓ new 2012	elsewhere in UK
MOLLUSCS	*Crassostrea gigas*	Pacific oyster	✓	✓✓	✓✓✓
	Crepidula fornicata	Slipper limpet	✓	✓	✓✓✓
BARNACLES	*Austrominius modestus*	Darwin's barnacle		✓✓✓	✓✓✓
ALGAE	*Undaria pinnatifida*	Wakame	✓	✓✓✓	✓✓
	Sargassum muticum	Wireweed	✓	✓	✓✓✓
	Grateloupia turuturu	Devil's tongue weed	✓	✓✓✓new 2012	✓✓new 2012
	Caulacanthus okamurae	Pom-pom weed		✓ new 2014	✓✓✓ new 2014

Note: Occurences: ✓ = Rare/Occasional ✓✓ = Frequent/Common ✓✓✓ = Abundant/Superabundant

Horizon scanning – high risk species to look out for

Due to the high levels of maritime traffic including international and cross-channel traffic the area is extremely vulnerable to the arrival of a number of other NNS. Those species that present a particularly high risk of arrival and impact are *Didemnum vexillum*, Carpet sea squirt; *Eriocheir sinensis*, Chinese mitten crab; *Hemigrapsus spp.*, Asian shore crabs; and *Homarus americanus,* the American lobster. More information on these species is provided in the separate Species Guide along with a list of a further 18 potential invaders.

[11] MACLEOD, A., COOK, E.J., HUGHES, D. & ALLEN, C. 2016. *Investigating the Impacts of Marine Invasive Non-Native Species*. A report by Scottish Association for Marine Science Research Services Ltd for Natural England & Natural Resources Wales, pp. 59. Natural England Commissioned Reports, Number223.
[12] GB NNNSS Information Portal www.nonnativespecies.org/factsheet/index.cfm

4. Use of the Area

Plymouth is a busy port which includes one of England's two naval bases, a commercial port handling over two million tonnes of goods a year, an international ferry terminal, and one of the busiest marine leisure centres in the UK. In 2016 nearly 65,000 vessel movements were recorded within the port limits of which at least half were defence related. Thus the Tamar Estuaries area is subject to high levels of local, national European and international marine traffic or activity making it highly vulnerable to invasion by NNS or indeed of exporting NNS already present to other areas.[13]

The 'Dockyard Port of Plymouth' includes the two main elements of:

- The Royal Navy and Ministry of Defence (MoD) facilities, including Devonport Dockyards and other facilities; and
- Commercial port activities including primarily Millbay (operated by Associated British Ports), Sutton Harbour and Cattewater Harbour Authority. Cattewater sees the bulk of commercial movements with vessels going to and from Cattedown Wharves, Victoria Wharf and Pomphlett Wharf.

Naval activities

The largest naval base in Western Europe, HMNB Devonport covers more than 650 acres, and includes 15 dry docks, four miles of waterfront, 25 tidal berths and five basins, and accommodating 5,000 naval vessel movements per year. It is also the base port for many naval vessels including frigates, submarines hydrographic survey ships and amphibious assault ships. HMNB Devonport conducts surface ship refitting and is the only location in the UK equipped to carry out nuclear submarine refuelling, and refits. Many MoD related services are now provided through major contractors such as Babcock Marine and Serco.

The Ministry of Defence also controls most of the waters of Plymouth Sound and the Tamar Estuaries under the Port of Plymouth Order through the Queen's Harbour Master.

Commercial activities

Plymouth has considerable commercial port activities and is generally classified as a regional port that focuses on short-sea shipping. Commercial ship arrivals in 2016 were around 1400, a figure typical for the last 20 years. The port is relatively small with limited access and this is reflected in the size of vessel using it; the majority of vessels arriving in Plymouth being less than 5,000 deadweight tonnes (dwt), with the exception of tanker traffic (see below).

The marine industries sector encompasses a diverse variety of businesses/employers including fishing, freight, an international ferry service, boat building and ship/boat refits and repairs including for international customers and facilities for recreational activities.

The city is important for commercial fishing with 488 registered fishing vessels which in 2016 landed over 11,300 tonnes (value £15million) of fish representing the third highest tonnage of fish landings of any English port.[14]

Plymouth handled 2.2 million tonnes of freight in 2015, 44% of which was transported to or from a foreign country.

The international ferry terminal is operated by ABP with Brittany Ferries providing services to Roscoff, France and Santander, Spain. In 2015 449,000 sea passengers were carried, the majority to France.

[13] Data provided by QHM.

[14] MMO (2017). UK Sea Fisheries Statistics 2016 available at : https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2016

The Cattewater hosts 4 privately owned cargo terminals. The oil tanker facility at Cattedown supports the supply chain for oil distribution in the Southwest handling over 1 million tonnes of refined oil products annually. The largest ship is around 16,000 tonnes and there are around 240 tanker port calls per year.

There are six substantial marinas within Plymouth and three smaller ones. There are two in Torpoint and one in Millbrook with over 2,000 boats, plus another 2,000 on moorings within the estuary. There are also a number of small pontoons and piers spread throughout the area. The waters of Plymouth Sound and its estuaries form a major sailing centre with 20 yacht clubs, including two of the most prestigious in England, containing over 4,000 boats moored on the waters. 2017 had over 700 sailing events ranging from club dinghy racing, national and international events and (biennially) the end of the Rolex Fastnet Yacht race which attracts up to 400 yachts, including internationally traveling super yachts.

There are also a large number of commercial providers of watersports activities such as kayaking, charter boat fishing and diving.

Particularly large employers in Plymouth's marine industries sector include Princess Yachts International, Babcock Marine, and Interfish.

Proposed future developments include a cruise liner terminal and dedicated cruise liner berthing facilities at Millbay and improved water transport links throughout the area.

Recreational activities

The Tamar Estuaries is a very popular area for recreational activities such as sailing, boating, kayaking, rowing, paddle boarding, sea angling, diving, jet skiing, swimming, wind-surfing, shore and river fishing. It is important to understand that even equipment which is removed from the water after use such as kayaks can transfer NNS to another area unless the equipment is properly cleaned and dried between uses. There are at least 16 public slipways and many more privately owned which provide access to the estuaries for recreational users.

PCC through the TECF are currently carrying out research into types and levels of water-based recreational activities within the area, this will result in activity heat maps for the area, which could inform the biosecurity planning.

5. Significant Risks

An examination of the main pathways and vectors for the introduction and spread of INNS in the Tamar Estuaries area, and for the outward transport of INNS already present here to other areas, has identified the following pathways/vectors as presenting the highest risks:

- Naval and commercial freight shipping
- Cross-channel ferries
- Fishing
- Recreational boating
- Fouling of recreational equipment
- Port infrastructure as a receptor
- Relocation of structures and equipment
- Marine litter
- Aquarium and catering trades
- Natural spread

Some of these carry the risk of introducing species from distant parts of the world e.g. naval shipping and the aquarium trade, whereas others are more likely to spread species already present in the UK or N Europe e.g. cross-channel ferries and recreational vessels.

Pathways/vectors which are not considered to be high risk locally at the moment but could become so if circumstances change include aquaculture (currently limited to a few small trout farms); and offshore infrastructure associated with the oil, gas or renewable energy sectors.

Table 3: High risk activities in the Tamar Estuaries area

Pathway/Vector	Activity/Risk	Notes/Considerations
Naval vessels and cruise ships	Ballast water transfer Hull fouling transfer	Worldwide NNS can survive in ballast tanks, sea chests etc. over long distances.
Freight shipping	Ballast water transfer Hull fouling transfer	Mainly UK and N Europe but some worldwide.
Cross-channel ferries	Ballast water transfer Hull fouling transfer	N France and Spain.
Fishing vessels	Fouled nets and gear Disposal of by-catch Ballast water Hull fouling	Mainly N European waters (N Sea, Channel and Celtic Sea).
Recreational vessels	e.g. yachts, cruisers Hull fouling	Mainly S coast, Channel Is., France, but some worldwide.
Recreational equipment	Transfer between water bodies on equipment and clothing e.g. kayaks, dive gear, jet-skis, fishing gear.	Mainly S coast.
Port infrastructure – Walls/breakwaters/jetties/ piers/slipways Marinas Docks Ship/boat repair yards	Construction and maintenance, importation of materials. Dredging Provision of recreational berthing facilities and moorings. Provision of berthing for naval and commercial vessels. Moving, berthing and haul out of vessels from outside local water body.	Use of slow moving vessels in construction or dredging, often from outside the local water body. Dredged material disposal area. Introductions on vessels can release larvae/spores which may colonise nearby structures. Once established the NNS can then colonise other boats and vessels that berth there. Artificial structures in sheltered areas such as marinas and docks are readily colonised by NNS. Disposal of fouling removed from vessels or port infrastructure during cleaning.
Relocation of structures and equipment	Movements or disposal of pontoons, barges, buoys, anchor chains, underwater equipment	
Marine litter	Tidal and ocean currents e.g. discarded fishing gear and plastic waste.	Many small species such as bryozoans, barnacles and tube worms can survive on small plastics. Plastic litter can travel long distances e.g. from N America.
Aquarium and catering	Escape Deliberate release Waste disposal	Fish such as the lion fish *Pterois miles* may be accidentally released. Unused stock of the American lobster, *Homarus americanus* have been thrown overboard from cruise ships.
Natural spread	Water currents	Even sessile species such as barnacles have free swimming larvae which can be carried over long distances.

6. Monitoring / Surveillance /Detection

Current monitoring

The presence of a number of marine research institutions such as Plymouth University, the MBA, PML and SAHFOS in the area and its status as a European Marine Site with several designated marine protected areas has meant the Tamar Estuaries and surrounding waters have been monitored and studied by many different groups with a variety of aims, the most relevant of which for NNS are detailed below, more detail is given at Appendix 1. Fig. 2 shows some of the sites monitored by these surveys.

Table 3: Relevant surveys in Tamar Estuaries

NNS surveys	**Sites covered**	**No. NNS looked for**
Marina Rapid Assessment Surveys	7 marinas, repeated visits	40
NNS timed searches	4 shores	40
Other surveys		
Natural England/Defra	SACs	
Environment Agency	Upper estuaries	
Marclim	3 rocky shores, repeated visits	17
CoCoast		18
ShoreThing	6 shores	8
Bioblitz	5 shores	

Note that the majority of monitoring activities mentioned above required funding from a range of sources such as charitable grants, e.g. CoCoast is supported by the Heritage Lottery Fund and the 2016 marina RASs were funded by The Bromley Trust.

Fig. 2: Current monitoring/survey sites

Recording

The Archive for Marine Species and Habitats Data (DASSH) based at the MBA is responsible for the long-term curation, management and publication of marine species and habitats data, within the UK and internationally. It receives records from local record centres, research publications and online recording schemes such as Sealife Survey, irecord, Seasearch and Wakame Watch, and verifies them and coordinates their input onto the online NBNGateway[15] which provides open access to species distribution maps and records. Unfortunately, not all surveyors record their NNS observations and sometimes the significance of new records is not noted. Another problem is that some records on NBNGateway only display at 10km resolution which prevents detailed examination of species distributions.

Future monitoring, surveillance and recording

Marine species can often be extremely difficult to identify with the naked eye and can look very similar to other marine species from the same family. Often laboratory identification with the use of a microscope is required to be absolutely certain of the species. It is therefore essential that any guidance documents circulated to help identify INNS contain enough information to allow the user to be fairly certain it is indeed the relevant INNS that has been sighted and that, where appropriate, these sightings are checked by an appropriate organisation. Examples of suitable ID sheets are held on the GB NNSS website under 'identification sheets'.[16] Waterproof copies of the MBA's Guide to NNS are available on request or can be downloaded.[17]

A reporting system exists for the Carpet sea squirt (*Didemnum vexilium*), the Chinese mitten crab (*Eriocheir sinensis*) and Wakame (*Undaria pinnatifida)* through the GB NNSS website. All other marine NNS can currently be reported via the Sealife Survey on the MBA website[18] or via many of the other recording schemes which feed into it. Unfortunately, however, despite the high level of monitoring activity carried out in the area, there are significant gaps with regard to NNS monitoring. In addition, the dissemination of information resulting from many of the current activities is not coordinated or timely.

It is important therefore that training be supplied to people who are regularly performing equipment and infrastructure checks in the marine environment, including marina staff, port authority staff and fishermen, not only to identify species of interest but also to correctly report them or ask for further investigation. Members of the public, especially those involved in marine recreation, can also play an important role in surveillance.

Artificial habitats have been well covered at the mouth of the estuaries see Fig. 2, but RASs have not been carried out in the more brackish areas, mainly due to the lack of access to suitable sites. Natural shore and sub-tidal surveys have in the main focussed on the distribution and abundance of native species, including only a limited number of NNS, although the focus is now shifting in many cases. The timed searches of shores used by several of the Citizen Science projects have yielded NNS records but tend to focus on easily identifiable species such as the Slipper limpet and Wakame. The lack of local taxonomic expertise for some species groups, e.g. fine red seaweeds, can also be a hindrance to successful monitoring.

Additional funding sources would need to be identified for all survey works.

The MBA, including DASSH, currently acts as a single point of contact for NNS sightings in the area – contact Chris Wood cwo@MBA.ac.uk.The MBA will provide a regular summary of NNS records/new arrivals to TECF and can be contacted by any organisation to provide INNS records on request.

For help with identification contact recording@mba.ac.uk. Alternatively, local taxonomic experts or organisations that could help with identification and/or training:

- Marine Biological Association: Chris Wood cwo@MBA.ac.uk

[15] National Biodiversity network (NBN) Gateway https://data.nbn.org.uk/
[16] See https://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?sectionid=47
[17] www.mba.ac.uk/fellows/bishop-group/guides
[18] www.mba.ac.uk/recording

- Natural England: Angela Gall angela.gall@naturalengland.org.uk
- Capturing our coast https://www.capturingourcoast.co.uk/

7. Contingency Plan / Rapid Response Plan

Even with good biosecurity procedures in place it is highly likely new NNS will arrive in the area. It is important that the response to such an event is rapid and proportionate to the threat posed, to reduce the potential for further spread and detrimental effects on the local ecology or economy.

. If new species are detected the following procedures should be followed for reporting:

Table 4: Reporting Procedures

Event	Action
Unusual/unknown species detected.	Photograph specimen. Record location and approximate size of area affected. Contact taxonomic expert from contact list or MBA/DASSH to aid identification if required. Once identified: • If NNS known from area then simply record sighting in Biosecurity Log book and report via Sealife survey www.mba.ac.uk/recording. • If low/medium risk UK NNS not previously known from area record sighting, and record via Sealife survey www.mba.ac.uk/recording. • If high risk NNS not found locally or not known from UK see box below.
High risk INNS not found locally but present elsewhere in UK detected e.g. Chinese mitten crab, Carpet sea squirt, Asian shore crab. or High risk INNS not currently present in UK detected e.g. North Pacific seastar.	Photograph specimen, record location and approximate size of area affected. If feasible keep specimen in a pot/bucket of seawater for expert to examine. Make sure this is kept securely and disposed of appropriately and cannot contaminate other waterbodies. If practicable carefully remove specimen(s) from water e.g. if on rope or fender. Contact taxonomic expert from contact list or MBA/DASSH to aid identification if required. Contact Natural England for advice.

For certain new high-risk species that are not yet present in the UK or established, a rapid response would be triggered by new records which would be coordinated nationally by the responsible authority. The responsible authority would take on coordinating verification, surveying and a rapid response, working closely with stakeholders. The responsible coordinating authorities depend on the greatest likely area of impact of the new species:

- Biodiversity - Natural England
- Aquaculture – CEFAS
- Fisheries – Marine Management Organisation

If the arrival of a new high-risk species to the area is confirmed then a range of actions could be instigated, possibly including the use of specialist contractors, agency staff or local volunteer groups:

- Visual survey of the site containing NNS (including vessel hulls).
- Assessments of the risk posed by the NNS before any additional measures are taken.
- Determine the size and distribution of the NNS population at the site of introduction.
- If possible, and considered necessary, identify vessel(s) carrying NNS and move away from the coastline to open-ocean waters or move to land and clean.

- If possible and considered necessary, begin local treatment to remove the NNS.
- Inform all other marine users e.g. marinas, fishermen, local recreational boaters of the detection and advise that extra caution should be taken to avoid further spread.

Treatment options

Once introduced, the options for NNS management are limited and the environmental impact associated with control or eradication treatments must be taken into account, i.e. non-target species can be affected as well as the NNS. In some cases, it may be deemed preferable to accept the presence of the new NNS and attempt to control rather than eradicate it. Some possible treatments are described in Appendix 2.

8. Actions / Control measures

The actions and control measures proposed below are primarily focussed on the first two stages of the GBNNS Framework Strategy's 3- stage approach of:

- Prevention – most effective and least environmentally damaging
- Rapid Response – early detection and surveillance, potential eradication
- Control & Containment – where INNS is widespread and eradication is not feasible, control of the population and mitigation against negative impacts

Acronyms Used

AFC: Antifoul coating **INNS**: Invasive Non-Native Species **NNS**: Non-Native Species **IWHC**: In-water hull cleaning **UW**: Under water

Table 5: Biosecurity Actions and Control Measures

	TECF/Local Authorities (in priority order)	
	Action/control measure	**Responsibilities** **Notes**
1	Roll out signage around the Estuaries - at public slipways, beaches and other access points. Identify NNS champions who could help put up or monitor signage and may be interested in training. Ensure signage is robust and attractive and provides consistent and useful messages.	TECF Work with existing signs e.g. check clean dry and with Green Blue MMO – keep on top of messaging around marinas Include in annual mooring agreements
2	Ensure Tamar Estuary stakeholders are aware that MBA can be contacted for INNS records and provide contact details.	TECF to communicate
3	Develop a monitoring/surveillance network of key sites: • Identify suitable artificial habitat monitoring sites throughout the area, particularly in the upper and middle reaches of the estuaries, preferably easily accessible floating structures. • Identify suitable shores throughout the area, including the upper and middle reaches and with a range of habitats. • Devise a protocol for timed shore searches focussing on NNS for use by volunteer groups • Devise a monitoring schedule for these key sites. • Discuss collaborative monitoring with Environment Agency (responsible under WFD for fresh and transitional waters). • Seek funding to support expert surveys of the monitoring network sites, with a focus on surveillance for new species, to be supplemented by data from voluntary surveys and ad hoc recording.	MBA, EA and NE

4	Work closely with industry bodies such as RYA, British Marine, The Green Blue etc. to identify opportunities for joint work and to develop lines of communication to their members and audiences.	QHM, Green Blue & PCC to work together to deliver coordinated messages/campaign re NNS to marinas, PPSA etc
5	Encourage and support all infrastructure owners and other stakeholders to develop their own site, operation and/or event biosecurity plans – see appendix 3 for suggested actions to include. Encourage sharing of plans.	All - communication through TECF
6	Monitor uptake of this plan. Evaluate and review the outcomes and impacts of actions undertaken.	To be included in annual survey and as a regular update slot at TECF meetings
7	New development planning – Check provision for : hull cleaning facilities including land disposal of debris; equipment & structures able to be slipped/dry docked if infestation occurs; use of low fouling materials.	All e.g. through MMO marine licence
8	Monitor Horizon Scanning reports from the GB NNSS for potential new INNS.	MBA to circulate as central data repository – ongoing action
9	Encourage 'open access' recording of NNS by researchers, students, volunteers and amateur taxonomists.	Ongoing – all through engagement in projects
10	Explore the feasibility of eradication and/or control & containment measures for existing INNS e.g. *Crassostrea gigas* (including ongoing work), *Crepidula fornicata* or *Undaria pinnatifida.* D vex seems to be behaving unpredictably in the estuary, it is possible that early identification and removal has led to local eradication. Further survey would be useful to confirm.	Natural England – to investigate further and report back
11	Develop a better understanding of tidal currents and salinity and their role in the spread of NNS. Develop links with universities and other research organisations to encourage this type of study in the area.	Longer term priority – part of science partnership working
12	Work with local pet, live food and plant nurseries to ensure they are aware of issues and have appropriate signage and knowledge.	Longer term – e.g. MMO promotion through restaurants

All users of Tamar Estuary – to be promoted through TECF

Action/control measure	Where action is implemented	When action is implemented	Suggested further actions
Develop site based biosecurity plans where appropriate – see appendix 3 for actions that could be	All sites	Ongoing	Developing local actions and training staff will encourage effective monitoring and reporting.

included in site based plans			
All users to be aware of and adhere to the 'Check, Clean, Dry' approach to biosecurity.	Throughout estuary: in, on, under and around.	Continually	Signage at access points. Information included in pre-event communications, handbooks and guides for the area.
Minimise marine litter/debris which can carry NNS.	Throughout estuary: in, on, under and around.	Continually	Coordinate beach cleans and work with anti-litter campaigns.
Do not release animals and plants from aquaria or other sources.	Throughout Tamar Estuary	Permanently	
Event biosecurity planning	At site or at event planning meetings	Ongoing	Ensure all event organisers are aware of the biosecurity plan and that they encourage participants to arrive with a clean hull and equipment.

Future events – TECF to promote

Action/control measure
Plymouth is in the planning stage of a cruise ship terminal at Millbay Docks by 2019. ABP, Brittany Ferries and PCC have been consulting on the cruise ship market potential of Plymouth, with Millbay Docks being the proposed destination port for large cruise ships by 2019. Any potential changes in biosecurity risk should be considered as part of the marine licensing requirements for the development and findings incorporated in the Tamar Estuaries Biosecurity Plan.
Plymouth is organising the 400th anniversary celebrations of the sailing of the Mayflower from Plymouth, to occur in 2020. This will see the incoming of large numbers of visiting vessels, many anticipated to arrive from the USA. A Biosecurity Plan should be included in the Risk Assessment and Environmental Management Plan. (See Commonwealth Flotilla Biosecurity Plan 2014, by RYA Scotland for suggestions).

9. Evaluation and Review

Progress in delivering the objectives of this Biosecurity Plan will be determined by the level of engagement, support and commitment of the stakeholders and partners to deliver action against shared priorities. That is the challenge for all parties as we seek to implement the actions and deliver the objectives of this Biosecurity Plan.

To ensure the effective implementation of this plan, it is vital that the outcomes and impacts of the actions are recorded, monitored and reviewed to ensure that the objectives are being met. A review by TECF should include assessment of:

- The occurrence and distribution of INNS within the Tamar Estuaries area.
- The efficacy of surveillance.
- The ability to close or restrict established pathways of transmission.
- Any established rapid-responses, control and eradication programmes undertaken.

Appendix 1 – Monitoring/ Surveillance survey activities

A number of monitoring sites and opportunities were suggested by participants at the workshop including:

- Scrubbing piles (need to map these)
- QAB wave screen, PYH renovation of pontoons
- All moorings licenced by QHM and are required to be surveyed annually – small number of operators offer a full lifting service, these staff should be trained to identify INNS.
- Mayflower – all moorings inspected annually using CDM Fowey
- Navigation buoys maintained by QHM – routine maintenance undertaken by Serco on a 5 year rolling programme.
- Council moorings are lifted and inspected annually.
- New landing stage is going in at the Mountbatten centre
- A group purchased ROV would be helpful but there are plenty within the university available for a student project.
- Slipways are regularly pressure washed by the council.
- Council assets are surveyed once a week but have no maintenance budget.

NNS surveys

Marina Rapid Assessment Surveys

The Bishop Group at the MBA have undertaken rapid assessment surveys (RAS) in marinas all around England (2009 – 2016), Wales (2014) and Brittany (2010 & 2013). RAS are timed searches which are specifically designed to detect over 40 target NNS and look for new arrivals; it should be noted that these surveys focus on detection rather than assessment of impact. Access via floating pontoons means surveys can assess sub-tidal biofouling at any state of the tide. These surveys have identified 11 species new to the UK or England including the Asian shore crab, *Hemigrapsus takanoi*, the Carpet sea squirt, Orange-tipped sea squirt, Red ripple bryozoan, Orange ripple bryozoan, Compass sea squirt and Orange cloak sea squirt and the spread of these and other species around England and Wales[19] and from Brittany[20]. In the Tamar Estuaries area seven marinas have been monitored in 2009, 2010, 2013 and 2016. However most of these sites are near the mouth of the estuary, see Fig. 2.

NNS timed searches

Recent trials by the Bishop group of NNS-specific timed searches of natural shores in the area look promising e.g. a 2 person, 1 hour survey of Beggar's Island (close to the National Trust Antony estate) detected 9 NNS, most previously unrecorded from that site.

Other surveys which may record NNS

Natural England/Defra

Under the Habitats Directive the UK is obliged to report on the Favourable Conservation Status of SAC features every 6 years. Natural England is responsible for carrying out condition assessments of SACs to inform this reporting and to inform site management requirements. Condition assessments can include data from bespoke surveys designed to answer specific question about site condition, indirect evidence from other relevant surveys or assessments and expert judgement. Under the Marine Strategy Framework Directive, Defra is responsible for reporting on the introduction of INNS and is therefore developing a monitoring programme.

[19] Bishop, J.D.D., Wood, C.A., Yunnie, A.L.E., Griffiths, C.A. 2015. Unheralded arrivals: non-native sessile invertebrates in marinas on the English coast. Aquatic Invasions 10(3): 249-264.
[20] Bishop, J.D.D., Wood, C.A., Lévêque, L., Yunnie, A.L.E., Viard, F. 2014. Repeated rapid assessment surveys reveal contrasting trends in occupancy of marinas by non-indigenous species on opposite sides of the western English Channel. *Mar. Pollut. Bull.*

Environment Agency

The EA is responsible, under the WFD, for monitoring inland waters, including estuaries, however currently there is no specific monitoring for NNS, although incidental recordings are reported.

Marclim

The MarClim project was set up to investigate the effects of climate change on the biodiversity of rocky shores, but a number of key NNS are included in the species recorded during a timed search element. There are three MarClim study sites in the Tamar Estuaries area, see Fig. 2.

Voluntary work

Citizen Science projects such as CoCoast and The ShoreThing, organised events such as the annual Bioblitz, MBA members' activities e.g. the annual '*Corella* concert', and work by voluntary organisations such as Seasearch and Cornwall and Devon Wildlife Trusts all contribute records of NNS.

Research

Research undertaken by staff and PhD and MSc students based at the four research institutions can contribute distribution and impact data; for example, there are currently several ongoing PhD studies on the impact and control of Wakame and the Pacific oyster and the effect of environmental variables, such as salinity, on native and non-native species.

Courses

Nationally recognised courses such as the Phycological Society's seaweed identification course frequently use local shores and marinas such as Wembury for field trips, which have also resulted in new NNS records for the area.

Potential sources

There are other statutory monitoring programmes which could provide NNS data in the future[21] but currently do not e.g. The Clean Seas Environmental Monitoring Programme (CSEMP) carried out by CEFAS has the potential to detect planktonic NNS off shore but currently the data is not readily accessible, likewise the SLAB5 Monitoring of dredged material disposal sites.

Table 6: Hull fouling ranking

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 surfaces

[21] Stebbing, P et al. 2014. Monitoring and surveillance for non-indigenous species in UK marine waters. Available at*:* www.nonnativespecies.org/downloadDocument.cfm?id=1232

Appendix 2 – Possible control treatments

Exposure to air

Drying is one of the more successful and inexpensive methods of NNS removal. This method is currently employed by the aquaculture industry to remove fouling species from structures, equipment, and mussel shells. The lifting of boats and small craft out of the water for storage is an effective method for killing any fouling species present on the vessel, and subsequently reduces the potential for spread between marinas.

Mechanical and manual removal

This requires a more direct approach to management and can be an effective method for reducing any impacts associated with INNS. In addition to removing NNS by hand, either by diving surveys or coastline searches (a method that has been used for Pacific oyster), there are a number of tools to assist with NNS removal, such as suction or vacuum devices, high-pressure water spray or dredging.

Enclosure and/or chemical treatment

For large or fixed structures that cannot be removed from the water, such as docks, treatment has to occur in the water. Enclosure involves wrapping a structure with sheets of plastic that can contain the surfaces being treated along with the surrounding water. By restricting the supply of fresh water, an oxygen deficient environment is created, which will kill the organisms contained within. This process can be further accelerated by adding chemicals (e.g. bleach, chlorine) or freshwater. This can be an effective method for treating the hulls of small boats: the placement of made-to-measure plastic coverings that create a bath around the boat, which can then be treated.

Methods, such as spraying acetic acid and submergence in 0.5% bleach or strong salt solutions have also met with some success at removing fouling species from shellfish farms.

Eradication

The eradication of NNS, prior to any impact, is the ideal solution but there are very few examples of successful marine eradication attempts. The main challenges with eradication are:

- Detecting the NNS early enough when eradication is feasible.
- Determining whether the NNS in question poses a big enough threat.
- Having an eradication protocol prepared and ready to go as soon as an NNS is detected.

With any eradication operation, a detailed risk assessment needs to be carried out, prior to any work, which addresses the following points:

- Which NNS to eradicate? Whether an NNS will eventually become problematic or not and therefore, the likely level of damage to the local economy and/or environment has to be assessed prior to a costly eradication program.
- How the cost of an eradication programme will be assigned amongst the parties involved?
- What is the probability of a successful eradication?
- Which method is most effective for the target NNS?
- What is the probability of reintroduction? If an NNS is successfully eradicated, is there a high possibility that it will be re-introduced?

Appendix 3 – Further operation specific actions/control measures

The following actions are those suggested that could be contained within site based biosecurity plans. The feasibility of each action will be site and operation specific and therefore the below suggestions are intended as a guide and are advisory. The uptake of site based actions and biosecurity plans will be monitored through action 5 (see section 8):

Commercial and military shipping/port and harbour authorities

Action/control measure	Where action is implemented	When action is implemented	Suggested further actions
Quick wins and awareness raising – these actions could be carried out by all and immediately. QHM to provide guidance annually through existing communications:			
New developments or maintenance works.	Throughout the estuary	Ongoing	In all relevant new contracts include text relating to biosecurity appropriate to the level of biosecurity risk associated with the works. For example, this could include the following: • The contractor to submit a Biosecurity Plan or Risk Assessment for written approval at least 6 weeks prior to commencement of the works. • The contractor to submit an updated Biosecurity Risk Assessment for written approval by a relevant date. • The contractor to ensure that all equipment, materials, machinery and PPE used are in a clean condition prior to their arrival on site to minimise risk of introducing non-native species into the marine environment.
New pontoons.	Any development	Ongoing	When procuring new pontoons or other underwater structures consider the fouling potential of the materials being commissioned. Consider using low fouling or easy release materials.
Ballast water treatment to follow best practice guidelines and legal obligations.	At sea, prior to arrival at destination port.	Preferably in deep water, away from land.	Consider using mid water transfer – see Orkney ballast water management actions. www.orkneyharbours.com/pdfs/bwm/Ballast%20Water%20Management%20Policy%20for%20Scapa%20Flow%2010%20December%202013.pdf
AFC of all accessible sub-surface structures when being maintained and where feasible	On land/in dry dock.	According to AFC manufacturer's guidelines, or if AFC compromised. When structures lifted for maintenance.	Raise awareness of AFC guidelines and the importance of following manufacturer's recommendations closely. Run AFC days/disseminate information around the estuary to raise awareness of how to apply coatings and which coatings work best. Use social media to promote AFC best practice. Work with coatings manufacturers to develop a network of settlement panels to test different coatings. Encourage local universities to run MSc or PhD programmes which will study efficacy of AFC in the area.

			Be aware of the need to ensure balanced reviews and do not unfairly disadvantage manufacturers.
Ensure that high risk vessels arrive clean by writing this expectation into harbour regulations.		Prior to arrival	If a vessel arrives with hull fouling in excess of level ¾ advice should be given to the owner about biosecurity and they should be encouraged to clean at next available opportunity. Vessels with hull fouling levels of 4 or above should be notified to the competent authority. Fouling ranking details – see Appendix 1.
Monitor and keep records of the last port of call of vessel.	At the dock/port	Constantly	For vessels from a new location or taking new cargoes/routes follow a Risk Assessment to assess level of risk posed by the vessel and route.
Longer term – training and capacity building with staff:			
Training of staff.	Relevant operations staff	Ongoing	Develop 'toolkit talks' for staff which highlight NNS issues, encourage reporting and develop awareness. Cattewater Harbour Commission staff to receive training for identifying INNS.
Identify a network of high risk areas for monitoring – either for research access in partnership or through regular inspection.	On all anthropogenic structures e.g. pontoons, pilings, quay walls, submerged ropes.	Regularly & continually throughout year.	Consider providing access for and/or partnering with local marine monitoring i.e. MBA, NE, EA or if feasible, high risk areas could be inspected at least once a year for significant changes in the biota. Photograph the areas and keep a record. Consider using any regularly maintained infrastructure as early warning system e.g. navigation buoys/pontoons which are regularly removed from the water could be made available to local marine researchers or other trained personnel for regular study when they are hauled out for maintenance
To be built into site specific biosecurity plans and actions depending on the facilities:			
Provide wash down facility for hull & niche area cleaning: Regular removal of fouling from hulls, props, inlets etc. & vessels mooring lines.	On site, on land, or in-water if full capture IWHC device available.	Annually	Where practical a minimum annual cleaning should be encouraged. Also before long journeys and particularly for journeys to locations with restrictions e.g. NZ/AUS and California
Appropriate disposal of debris removed during cleaning operations i.e. not returned to sea.	At cleaning facility, on land.	During and after cleaning.	Raise awareness of key NNS and encourage reporting by wash down staff.
Removal of extraneous equipment	Throughout the estuary	Ongoing	Where it is cost effective to do so encourage removal of all unnecessary equipment or material from the water. Including but not limited to disused infrastructure e.g. pontoons, shellfish trestles or other structures. Also including structures not needed seasonally e.g. pontoons, moorings, vessels or fenders not in use in winter.
Safe disposal of untreated bilge water (potentially containing NNS and chemical toxins).		When vessel is moored at site	Provision of grey water treatment facilities.

		with disposal facility	
Use any freshwater inflows to best advantage to reduce fouling on equipment and vessels.	On site.	At planning stages.	Encourage local universities to run research programmes which will study salinity and settlement patterns in the area. Where opportunities exist and are cost effective consider options for developing a decontamination pontoon or mooring where high risk vessels can take advantage of a freshwater flow to aid cleaning of their hulls.
Use of rat guards on mooring lines & gang planks.	At any location vessel is moored.	When vessel is moored alongside pontoon, quay, berth etc	Avoid accidental introduction by humane disposal of captured animals.
Establish Contingency Plan in the event of INNS introduction.	At management level	ASAP	Include proposed quarantine of vessels and treatment of infested structures. Work closely with competent authorities.

Marinas/leisure facilities

Action/control measure	Where action is implemented	When action is implemented	Suggested additional actions
Quick wins and awareness raising – these actions can be carried out by all and immediately. QHM to provide guidance annually through existing communications:			
Follow The Green Blue guidance and work towards a clean, active and healthy marina.	Signage in marina reinforces ideology, celebrating the local biodiversity whilst engaging people about NNS. Text in the berth holders manual/marina guide includes relevant information.	At initial contact with customers & throughout their residency.	A healthy ecosystem will always be a good defence against NNS so follow TGB advice to ensure the environment is in a good state of health and that the site is clean and tidy. Make it clear to existing and new berth holders that the marina welcomes clean, active boats. Encourage awareness of the need to have a clean hull and consider the possibility of including annual lift and scrub clause in marina Terms & Conditions.
Proactively support & communicate “Check, Clean, Dry” and The Green Blue messages.	Marina office, noticeboards and communal areas, club meetings etc.	Continually	Particularly relevant to activity centres and clubs e.g. kayaking, diving, fishing.

Provide ID guides for INNS	Marina office, noticeboards and communal areas. Guides from MBA, GB NNSS and The Green Blue.	Continually	Encourage dissemination of The Green Blue advice and guides.
Ensure boat owners are aware of the benefits of annual hull cleaning/removal of fouling.		From beginning of contract with customer & throughout contract	Consider placing an annual lift out clause in the terms and conditions for the marina. Discuss with British Marine and The Yacht Harbour Association the possibility of a UK wide clause to ensure wider uptake, ensure issues regarding liability for boats hauled out are dealt with. Use social media to promote messages.
Ensure all vessels are effectively and appropriately treated with AFC		Beginning of the sailing season or at regular haul outs.	Encourage appropriate use of AFC. Run regular AFC best practice events and work with local suppliers to offer appropriate advice to consumers.
Use of boats	Marinas, yacht clubs etc.	Ongoing	Encourage boat owners to use their vessels regularly – this makes the ablative AFC work better and therefore discourages settlement of NNS.
New developments or maintenance works.	Throughout the estuary	Ongoing	In all relevant new contracts include text relating to biosecurity appropriate to the level of biosecurity risk associated with the works. For example, this could include the following. For example, this could include the following: • The contractor to submit a Biosecurity Plan / Risk Assessment for written approval at least 6 weeks prior to commencement of the works. • The contractor to submit an updated Biosecurity Risk Assessment for written approval by a relevant date. • The contractor to ensure that all equipment, materials, machinery and PPE used are in a clean condition prior to their arrival on site to minimise risk of introducing non-native species into the marine environment.
New pontoons	Any development	Ongoing	When procuring new pontoons or other underwater structures consider the fouling potential of the materials being commissioned. Consider using low fouling or easy release materials such as HDPE
Longer term – training and capacity building with staff:			
Train key staff to identify INNS, and report suspicious organisms appropriately.	On site and/or training courses/by computer	Continually	Develop a partnership with local research organisations who may be able to undertake this work for you as part of their existing programmes.
Identify high risk areas and inspect some sub-surface structures where feasible e.g. pontoons at least once a year for significant changes in the biota. Photograph the areas and keep a record.	On all anthropogenic structures e.g. pontoons, pilings, quay walls, submerged ropes.	Regularly & continually throughout year.	Develop a partnership with local research organisations who may be able to undertake this work for you as part of their existing programmes. QAB wave screen, PYH renovation of pontoons good sites for monitoring.
To be built into site specific biosecurity plans and actions depending on the facilities:			

Use any freshwater inflows to best advantage to reduce fouling on equipment and vessels.	On site.	At planning stages.	Encourage local universities to run MSc or PhD programmes which will study salinity and settlement patterns in the area. Where opportunities exist and are cost effective consider developing a decontamination pontoon or mooring where high risk vessels can take advantage of a freshwater flow to aid cleaning of their hulls.
Install inceptor or closed-loop wash-down system for cleaning vessels when possible.	At marina	ASAP	Do not allow scrub down at piles within the estuary area. Mapping the pilings would be a helpful step to inform the monitoring programme.
Appropriate disposal of debris removed during cleaning operations i.e. not returned to sea.	At cleaning facility, on land.	During and after cleaning.	Raise awareness of key NNS and encourage reporting by wash down staff.
Assess the risk of new vessels when they arrive and if necessary ask them to wash down as soon as possible.	At marina	Constantly	If a high risk vessel declines and leaves the marina use the email group to inform other harbours and marinas and ask them to encourage the owners to wash down before proceeding.
Make vessel haul-out facilities and dry stack available.	At marina	Haul out typically Oct-April, plus option for year round haul out. When feasible, keep boats out of water as much as possible.	Development of dry stack facilities for RIBs and smaller vessels.
AFC of all accessible sub-surface structures – when being maintained and where feasible	On land.	When structures lifted for maintenance.	
Establish Contingency Plan in the event of INNS introduction. Including proposed quarantine of vessels and treatment of infested structures.	At management level	ASAP	Develop a policy and procedure for dealing with heavily fouled yachts.

Boat owners - reviewing actions of boat owners can be used to inform monitoring of site based and wider estuary biosecurity plan

Action/control measure	Where action is implemented	When action is implemented	Suggested additional actions
Follow The Green Blue guidance on antifouling and NNS best practice.	Individually and collectively.	Ongoing	Work with the berth holders association or yacht club to encourage NNS training, identification and reporting.
Be aware of and adhere to the 'Check, Clean, Dry' approach to biosecurity.		Ongoing	Advice in marina office or online at http://www.nonnativespecies.org/checkcleandry/

Hull clean and anti-foul, including niche areas.	If possible at a site local to your permanent berth/mooring to avoid transfer of NNS to other localities.	At least annually and before long trips	Seek advice on best AFCs for locality.
If the boat is kept in the water use it regularly or consider out of water storage e.g. dry stack.		Consider annually	Regular trips between marine and freshwater sites reduces fouling. Regular use of the boat makes AFC work well.
Learn about INNS		Ongoing	Get ID guide from marina office. Participate in training events.
Know what to do if unusual fouling noticed.		Ongoing	Contact marina office or Marine Biological Association for guidance.

Useful links and contacts

- GB Non-Native Species Secretariat – Non-native species information, Government policy and strategy for management. www.nonnativespecies.org
- National Biodiversity Network – Distribution maps and information about species. https://data.nbn.org.uk to be replaced shortly with NBN Atlas www.nbnatlas.org
- Guidance on Marine Biosecurity planning for England and Wales. www.nonnativespecies.org/downloadDocument.cfm?id=1401
- Marine Biological Association of the UK – Information on marine species including non-native species. www.mba.ac.uk
- Bishop Group, Marine Biological Association – Surveys of NNS and information on NNS. www.mba.ac.uk/bishop or www.mba.ac.uk/fellows/bishop-group-associate-fellow or email cwo@mba.ac.uk
- DASSH (The Archive for Marine Species and Habitats Data) – Responsible for the long-term curation, management and publication of marine species and habitats data, within the UK. http://www.dassh.ac.uk/
- PML Applications – Marine consultancy, primarily on ballast water, biofouling management, survey work and remote sensing. www.pml-applications.co.uk
- C2W – Marine Matters Managed – www.c2w.org.uk