Biosecurity Plan

2014 – 2019

Incorporating

Marine Invasive Non-Native Species

and

Shellfish Disease

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Produced November 2014

Thanks

Thanks to the following people and organisations for their suggestions and advice which contributed directly to the production of this plan:

Mandy Knott and Abigail Leadbeater- *NWIFCA Science Officers*
Dr Emily Baxter- *Cumbria Wildlife Trust*
Lyn Byrne & Meryl Norris- *Wildlife Trust Wales*
Ron Jessop- *Eastern Inshore Fisheries and Conservation Authority (EIFCA)*
Chris Lumb, Rob Whiteley, Jo Bayes, Jan Maclennan, Ruth Crundwell- *Natural England (Cumbria area)*
Pam Taylor & Clair McFarlan- *Solway Firth Partnership*

Executive summary

This biosecurity plan has been produced by the North Western Inshore Fisheries and Conservation Authority (NWIFCA) to take action and minimise the risk of transmission of marine invasive non-native species (INNS) and diseases within its district. It is for use by all stakeholders in the district and details the current status of the area, potential threats, and suggested measures to improve biosecurity and avoid any potentially damaging effects.

The key objectives for meeting the vision of the NWIFCA plan are:

***Objective 1*:** Reduce the risk of introduction and spread of marine INNS and disease within the NWIFCA district and to other areas, with a focus on 'key-risk' INNS.

***Objective 2*:** Promote suitable detection, monitoring and rapid response systems for marine INNS and disease which pose significant threats to biodiversity and the local economy, with a focus on 'key-risk' INNS.

***Objective 3*:** Develop effective control programmes for existing marine 'key-risk' INNS and diseases which are practical and sustainable, and prevent their spread to other parts of the district or country.

These objectives are in accordance with the three elements of the Invasive Non-Native Species Framework Strategy for Great Britain 2008 (http://www.nonnativespecies.org/index.cfm?sectionid=55).

Key actions for NWIFCA district stakeholders:

- Awareness and reporting of potential key-risk INNS sightings (Chinese mitten crab*, slipper limpet, carpet sea squirt, leathery sea squirt*, Asian shore crab) or disease to NWIFCA
- Comply with standard 'Check, Clean, Dry' campaign in general water use
- Support mitigation actions to control spread of key-risk INNS and disease (detailed in plan)

**Currently present within district*

Contents

Abbreviations and Acronyms

APB	Aquaculture Production Business
CBD	Convention on Biological Diversity
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CCW	Countryside Council for Wales
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EMS	European Marine Site
FHI	Fish Health Inspectorate
GB NNSS	Great Britain Non-Native Species Secretariat
IFCA	Inshore Fisheries and Conservation Authority
INNS	Invasive Non-Native Species
LNR	Local Nature Reserve
MarLIN	Marine Life Information Network
MBA	Marine Biological Association
MMO	Marine Management Organisation
MPA	Marine Protected Area
NE	Natural England
NNS	Non-Native Species
NRW	Natural Resources Wales
NWIFCA	North Western Inshore Fisheries and Conservation Authority
RAFTS	Rivers and Fisheries Trusts of Scotland
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

1. Introduction

1.1 Biosecurity

What are Invasive Non-Native Species (INNS)?

Non-native species (NNS) have been introduced deliberately, for cultural and economic benefit, and accidentally to the UK over many hundreds of years. With an increase in global shipping, climate change, aquaculture and recreational tourism, there is now a greater threat of introduction and spread of non-native species across the UK marine environment.

Not all NNS are invasive, they become 'invasive' (INNS) when they become established and thrive aggressively, threatening native species, ecosystems, natural features (such as mussel beds), or interfering with man-made structures and business interests such as aquaculture or fisheries. They can compete with native species for resources such as space, light and food or in some cases local species can become prey to INNS. The presence of INNS can also impact on the physical water environment and the condition of protected areas, increasing the risk that these sites do not meet their favourable conservation target or the requirements of the Water Framework Directive or the EU Marine Strategy Framework Directive.

What are the impacts of shellfish diseases?

The introduction of shellfish (and finfish) diseases to places they were not previously present can cause significant environmental and economic damage. Once a disease is present within a shellfish harvesting area it is difficult to control, therefore disease prevention is the only effective measure. There are many examples across the world where introduced diseases have had devastating effects on the shellfish farming industry, including the spread of Bonamiosis in native oysters within the UK. The introduction of a disease to an area can decimate stocks and in turn have hugely negative effects on the wildlife that relies on those fisheries and the local fishing economy.

What is Biosecurity?

Biosecurity is the procedures or measures taken to reduce the risk of introducing and prevent the spread of lethal or harmful organisms and diseases, including harmful invasive non-native species. The Great Britain Invasive Non-Native Species Framework Strategy (Defra, 2008) is intended to provide a strategic framework within which the actions of government departments, their related bodies and key stakeholders can be better coordinated in INNS work.

The three key elements of the framework strategy are:

- Prevention - most effective and least environmentally damaging
- Rapid response - early detection, surveillance, monitoring and potential eradication
- Control and containment - mitigation, control and eradication

The application of INNS and disease biosecurity in fisheries and aquaculture is a shared responsibility; each individual involved plays a critical role in its implementation. In order to be effective, biosecurity is necessary at all levels within the shellfish fisheries and aquaculture industry, from the control of marine INNS and infectious disease spread at an international level, to the development of national controls, and down to operation of suitable practices at a local level. In these terms, the World Organisation for Animal Health monitors the status of international diseases, our government (through Cefas and the Environment Agency) is responsible for controlling biosecurity within national limits, and Aquaculture Production Businesses are responsible for biosecurity within their own enterprises. [*]

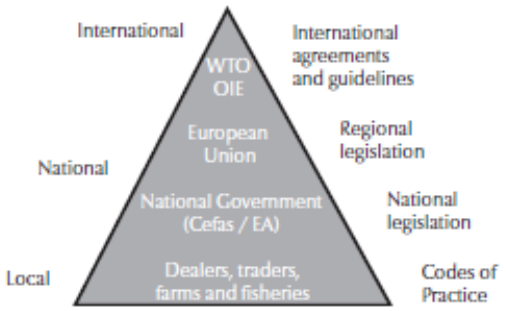

Figure 1: Delivery of biosecurity measures from an international level down to a local level (taken from Cefas FHI Shellfish Biosecurity Measures Plan-guidance and template for shellfish farmers, 2009)
(WTO- World Trade Organisation, OIE- World Organisation for Animal Health, Cefas- Centre for Environment, Fisheries and Aquaculture Science, EA- Environment Agency).

The key elements of biosecurity are: practical and appropriate legislative controls, adequate diagnostic and detection methods for INNS and infectious diseases, disinfection and pathogen eradication methods and best management practices. At the local level, implementation of an effective biosecurity measure plan is essential in reducing the risk of marine INNS or disease introduction to an area. This follows the traditional principle that prevention is better than cure, which is also a cornerstone of the Animal Health and Welfare Strategy for Great Britain published in June 2004.

[*] Information taken from Cefas FHI Shellfish Biosecurity Measures Plan-guidance and template for shellfish farmers, 2009

The NWIFCA plan

This plan describes the biosecurity issues present in the marine and coastal areas of the North Western IFCA district. It presents actions for the prevention, early detection, control and mitigation of the introduction and spread of selected INNS and diseases that affect or impact upon marine, estuarine and coastal environments and their fisheries. It includes reference to those species that spend a part of their life-cycle in freshwater and will link with other previously produced biosecurity plans such as Cumbria Freshwater Biosecurity Plan 2011 (prepared on behalf of the Cumbria Freshwater Invasive Non-Native Species Initiative), the Dee Catchment Biosecurity Action Plan 2014 and Solway Firth Partnership Bio-security Plan 2013, to ensure biosecurity measures join-up across the district and cover both the marine and freshwater environment.

Given the high costs for the mitigation, control and eradication of INNS and fish and shellfish diseases once they are established, **this plan emphasises the need for prevention and rapid response** to their introduction before becoming established. The NWIFCA considers the production and implementation of this plan and associated management measures as essential components in the protection and enhancement of the marine environment, which will help minimise risk, conserve biodiversity in the area, protect stocks, improve the marine environment, and in turn safe-guard sustainable fisheries for the local economy in the future. However, the spread of marine INNS and disease is not confined within north-west England, and monitoring the host of pathways that facilitate the entry and spread of marine INNS and disease requires coordination and communication with neighbouring local authorities and stakeholders. The ultimate key to the effectiveness of this plan is in increasing awareness in local members of the public and taking a partnership approach with other local relevant stakeholders (Table 1). This approach will ensure the success and long-term sustainability of the biosecurity actions and the marine environment.

Implementation of this biosecurity plan will bring many environmental and socio-economic benefits including:

- Control of existing marine INNS and disease in the area.
- Prevention of new marine INNS and disease becoming established.
- Safeguarded biodiversity and the conservation of the marine environment in the NWIFCA district and its European and nationally designated sites.
- Contribution to the achievement of Good Environmental Status in the Marine Strategy Framework Directive and Good Ecological Status addressing Water Framework Directive and other relevant legislative actions.

Table 1: Relevant local stakeholders in the NWIFCA district

Local Stakeholders	
Commercial	Fishing industry, water companies including United Utilities, power stations, marinas, harbours, ports, boat hire companies, developers, consultancy and construction companies.
Government	Defra, Cefas, Marine Management Organisation (MMO), Natural England, Natural Resources Wales (NRW), Marine Scotland, Scottish Natural Heritage (SNH), Scottish Environment Protection Agency (SEPA), Environment Agency, Cumbria County Council, Allerdale Borough Council, Copeland Borough Council, Barrow-in-Furness Borough Council, South Lakeland District Council, Lancashire County Council, Lancaster City Council, Wyre Council, Blackpool Borough Council, Fylde Borough Council, West Lancashire Borough Council, Sefton Metropolitan Borough Council, Liverpool City Council, Cheshire West and Chester Council, Wirral Council, Halton Borough Council, other IFCAs, GB NNS Secretariat.
Non-governmental Organisations	The Rivers Trusts, National Trust, Salmon and Trout Association, Angling Trust, RSPB, The Wildlife Trusts, Morecambe Bay Partnership, Duddon Estuary Partnership, Solway Firth Partnership, Marine Conservation Society, NW Coastal Forum, Mersey and Dee Estuary Conservation Groups.
Invasive species initiatives	Cumbria Freshwater Invasive Non-native Species Initiative (CFINNS), Dee Invasive Non-native Species Action Project, Duddon Invasive Species Group, Cheshire Region Invasive Species Initiative, Lancashire Invasive Species Project (Ribble Rivers Trust).
Recreation	Angling clubs, canoeing/ boating clubs, RYA and other water users including divers, kite-surfers, jet-skiers, sailors.
Other	Landowners, schools, colleges, universities (through biosecurity education).

1.2 The NWIFCA and District

IFCAs replaced Sea Fisheries Committees in April 2011, with an expanded remit to "lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry". The duties and powers of the IFCAs are set out in sections 153 to 158 of the Marine and Coastal Access Act 2009. Each IFCA manages a district that covers part of the English coastline and extends out to 6 nautical miles, with its inland boundaries aligning with those of its constituent local authorities. IFCAs also manage sea fisheries resources in estuaries that fall within their district, excluding salmon, trout, eels, lampreys, smelt, shad, any other migratory (freshwater to marine and vice versa) fish and any freshwater fish (Marine and Coastal

Access Act, 2009 & http://www.marinemanagement.org.uk/about/ifcas/).

The NWIFCA district extends from the Welsh administrative boundary in the Dee Estuary to the south, up to the Scottish administrative boundary in the Solway Firth to the north (Figure 2). The seaward extent is from the coast (baseline waters) to the 6 nautical mile limit.

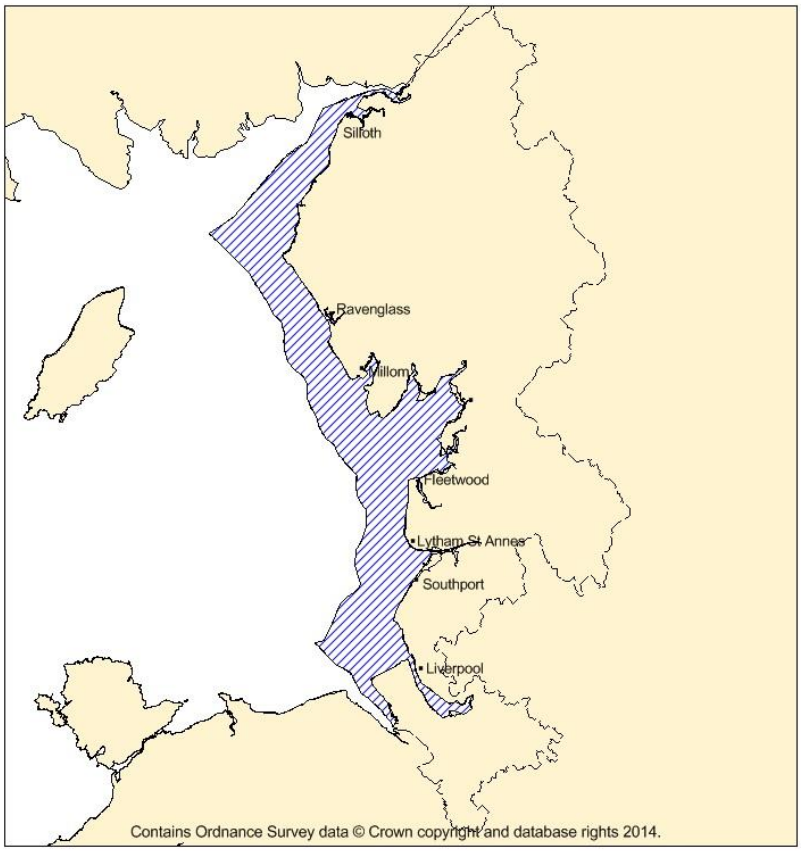

Figure 2: The NWIFCA district - the area of coast covered under the NWIFCA Biosecurity Plan.

The North West's coast is highly dynamic and generally low-lying and sedimentary, with vast intertidal mudflats as well as salt marshes, sand dune habitats and sandy beaches. In the Cumbrian part of the district there are areas of vegetated shingle and small areas of coastal cliff habitat at St Bees. Additional cliff habitats can be found further south in the district, at Hilbre Island in the Dee Estuary. Sefton is home to the largest continuous sand dune system in England. At the same time parts of the coast are receding and the tidal flats and channels in Morecambe Bay (the second largest drying embayment in the UK) are all constantly changing. The region's coastal areas include important ports and fisheries, major resort towns (and associated tourism) and industry, all contributing to a thriving maritime economy and high volume of shipping activity (http://www.nwcoastalforum.org.uk/about-the-nw-coast/environment/).

Over 50% of the NWIFCA district is designated as European or nationally important protected areas, with Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) (European Marine Sites), and Marine Conservation Zones (MCZs). As part of the

protection of these sites the biodiversity must be maintained and enhanced, fish and shellfish stocks must be protected, the water environment must be maintained, and where necessary improved, and European marine sites should be maintained at favourable status. This biosecurity plan will help contribute to these sites staying in a favourable condition. The bays and estuaries of the area host large populations of resident and migratory wildfowl and protected bird species, providing important feeding grounds for them (http://www.nwcoastalforum.org.uk/about-the-nw-coast/environment/). In addition, the marine environment itself is host to a diverse range of species from *Sabellaria alveolata* (honeycomb worm) reefs to cockles and sea bass.

This plan covers marine and coastal species only, including some of those that spend a part of their life-cycle in fresh waters. Galloway Fisheries Trust, the River Nith District Salmon Fishery Board and the Annan District Salmon Fishery Board in Dumfries and Galloway have prepared Biosecurity Plans through Rivers and Fisheries Trusts of Scotland (RAFTS). Several organisations carry out biosecurity measures in the North West area covering both freshwater and brackish water species, including the Angling Trust North West, and Rivers Trusts (Welsh Dee, Ribble, Lune, South Cumbria and West Cumbria Trusts), North Wales Wildlife Trust, the Solway Firth Partnership and the Freshwater Invasive Non-Native Species Initiative in Cumbria. The NWIFCA have produced this biosecurity plan for inshore fishery areas. It is important that this plan overlaps the marine and freshwater plans to ensure all potential marine INNS at every stage of their life-cycle are covered.

1.3 Use of marine resources in the district

The NWIFCA district hosts a variety of habitats and species leading to a diverse range of fisheries. The main fishing ports and harbours include Whitehaven, Maryport, Silloth, Barrow, Fleetwood and Liverpool. Shellfish fishing dominates the area including fisheries for cockles, mussels, whelks, nephrops, shrimp and potting for lobsters and crabs. Highly valuable seed mussel resources are also present within Morecambe Bay. There are also finfish fisheries within the district including netting for cod, whiting and plaice, and trawling for turbot and sole.

Morecambe Bay and the Cumbrian coast host aquaculture operations for Pacific oysters, while mussels are farmed at Ravenglass, and there are proposals for developing mussel aquaculture in Morecambe Bay. There are currently no marine finfish farms in the District.

There are various recreational uses of the marine environment in the NWIFCA district including recreational angling, sailing clubs, kitesurfing, windsurfing, scuba-diving and jet-skiing. There is also vessel movement in the area associated with a number of wind farms present in the district, including from Workington and Barrow harbour, and ferry and cargo ports in Heysham and Liverpool. Liverpool is also a port to ocean-going cruise ships with ongoing development of deep-water berthing facilities.

2. Context

2.1 Biosecurity: The nature of the problem

Biosecurity issues are of increasing economic and ecological significance. Globalisation has expanded

the possibilities, extent and complexity of world trade and the growth of the tourism market has expanded the number of destinations for activity holidays and travellers. Technological advances have increased the distances fishing vessels can travel. These trends have led to the increased probability of the unintentional introduction, establishment and spread of marine invasive non-native species (INNS), parasites and diseases in the UK. Climate change is also causing species to extend their natural range, allowing them to live in areas they have not previously inhabited, or where they are already present their tolerance may lead to them becoming invasive and thus causing changes to the new habitat.

INNS

According to the Convention on Biological Diversity (CBD) (2006, http://www.cbd.int), INNS are one of the greatest threats to biodiversity, being capable of rapidly colonising a wide range of habitats and excluding the native flora and fauna. Furthermore, INNS have contributed to animal extinctions where the cause of extinction is known (Esk Rivers and Fisheries Trust Biosecurity Plan, 2009). As water is an excellent pathway for the dispersal of many of these species, the sea, shorelines, rivers and their banks are amongst the most vulnerable areas to the introduction, spread and impact of these species with more than 90 marine NNS identified in British and Irish waters (Payne *et al.* 2014). "It is estimated that 7,000 species are carried around the world in ballast water every day and 10 billion tonnes of ballast water are transferred globally each year" (IUCN Marine Menace report). The ecological changes wrought by INNS can further threaten already endangered native species and reduce the natural productivity and amenity value of water-bodies. The threat from invasive species is growing at an increasing rate assisted by climate change, pollution and habitat disturbance with a correspondingly greater socio-economic, health and ecological cost. It is estimated that the direct cost of INNS to marine industries in Great Britain, including aquaculture, shipping, recreational boating, fisheries and power generation, is approximately £40 million per year (Payne *et al.* 2014).

There is also a growing recognition of the impacts of translocated species. Translocated species are species that have been purposefully translocated outside of their natural range and can have severe ecological impacts. An example in the marine environment is the Pacific oyster, which was deliberately introduced to the UK in the 1960s for commercial purposes and escapees have since established unintentional populations elsewhere. There is also evidence of natural larval dispersal and later settlement leading to their spread not just from aquaculture developments, but also potentially from other countries. Genetic studies on southern UK Pacific oyster areas showed one spatfall may have been of French origin, with a possible explanation of the natural dispersal of larvae from France by water currents (Child *et al.* 1995). Once established they may out-compete and displace native species, as well as potentially smothering or excluding other marine life and altering habitats (http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=1013).

Disease

Restrictions on the import of live fish into the UK have helped prevent the introduction and spread of serious fish diseases. The Fish Health Regulations (1997) legislation governs the health conditions of aquaculture animals. The Cefas Fish Health Inspectorate (FHI) work on behalf of Defra to prevent the introduction of, and control the spread of serious fish and shellfish disease in England. There are

'notifiable' serious fish or shellfish diseases (see section 3.4, Table 2) which, if suspected, must be reported to the FHI immediately.

The main risks of disease transmission identified for the NWIFCA district are through oyster, cockle and mussel movements (similar to Eastern IFCA). Aquaculture Production Businesses in the UK must be authorised and licenced by the FHI and shellfish movements checked and recorded to ensure disease is not spread to unaffected areas. Records of seed bivalve shellfish movements are not required under EC Regulation 853/2004 (Hygiene of food of animal origin- Annex 3, Section 7). However, if they are shipped outside of England, Scotland or Wales they are subject to Cefas FHI inspections. As harvesting can potentially occur throughout the year monitoring of all activities can be difficult to achieve.

Pathways

The main pathways or means of introduction of marine INNS and disease may be through:

- Intentional introduction or release
- Hull fouling and ballast water of marine commercial and private vessels (including construction vessels)
- Escapes of plants and animals from fish farms, ponds and gardens
- Fish and shellfish from the aquaculture industry as disease vectors
- Natural occurrences
- Fouling of recreational water-sports equipment and vessels (e.g. diving gear, fishing lines from anglers, canoeists, mooring ropes, dinghies)
- Improper control and disposal measures
- Commercial fishing vessels introducing marine INNS or disease from other areas
- Vehicles used to launch boats or quads introducing marine INNS or disease from other areas
- Fishing gear (including aquaculture cages, dredges, clothing and boots) introducing marine INNS or disease from other areas
- Organisms attached to structures and equipment subsequently relocated e.g. pontoons acting as 'stepping stones'
- Importation or movement of new species, shellfish or stock for aquaculture
- Relaying of infected seed mussel harvested from outside the district and potential for disease transfer to nearby naturally occurring beds
- Mussel and cockle bags used for transportation are exchanged between vessels both in NW area and around other fisheries and shellfish processing plants in the UK

Rapid response before a marine INNS or disease becomes established is vital. Without some form of coordinated and systematic approach to the prevention of introduction and control of the spread of marine INNS and disease, it is likely that the ecological, social and economic impacts and the costs for mitigation, control and eradication of these species and diseases will continue to increase. Once established, it may not be possible to fully eradicate some invasive species and diseases, or it may be too costly, therefore prevention of arrival is crucial. One of the problems involved with managing

marine INNS and disease is the continuity of the marine environment and the fact it is almost impossible to seal off an area to treat it, there is a potential for larval transport of INNS and it could be very easy for reinvasion to occur (IUCN Marine Menace report). There have been some successful eradications of marine INNS but it is far better and more cost-effective to prevent an introduction in the first place. This plan is a first attempt to set out and implement such an approach at a district level for selected species and diseases that significantly impact fisheries and the marine environment.

2.2 Legislation

The UK has international obligations to address INNS issues, primarily through the Marine Strategy Framework Directive, Water Framework Directive and the EU Habitats and Birds Directives, the Convention of Biological Diversity including the International Plant Protection Convention and the Bern Convention on Conservation of European Wildlife and Habitats. The actions presented in this plan conform to UK and European legislation associated with the prevention, management and treatment of INNS, disease and parasites including:

- **European Water Framework Directive** (2000) - the two aims within this directive are that water bodies reach at least 'Good Ecological Status' (if not 'High Ecological Status') by 2015 (or by 2027 at the latest if longer timescales can be justified) and that no deterioration in ecological status is permitted. This applies to the impact of INNS in the marine environment as well as inland. Under WFD, depending on the invasive species and their extent, water bodies with INNS are not able to reach the high ecological status; the maximum level obtainable is good ecological status and in order to achieve this, the Directive requires that INNS "have not damaged the native aquatic plant and animal communities".
- **EC Marine Strategy Framework Directive (2008/56/EC)** - requires each Member State to work towards 'Good Environmental Status' (GES) of their marine waters by 2020. There are 11 high level descriptors of GES including Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions; and 2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.
- **The Invasive Non-native Species Framework Strategy for Great Britain** – published by DEFRA, the Scottish Government and Welsh Assembly Government in 2008; this aims to address the key weaknesses in our capacity to respond to the threat posed by INNS. It provides a framework for a more coordinated and structured approach to dealing with INNS and any potential threat in or to Great Britain.
- **EU Council Directive 2006/88/EC** sets out legislation to prevent and control certain diseases in aquatic animals. These diseases are 'notifiable' – i.e. the owner or anyone else attending to the animals must immediately report suspicion of notifiable diseases to the FHI.
- Section 14 of **The Wildlife and Countryside Act** (1981) makes it illegal to allow any animal which is not ordinarily resident in Great Britain, or that is listed on Schedule 9 to the Act, to escape into the wild, or to release it into the wild. It is also illegal to plant or otherwise cause to grow in the wild any plant listed on Schedule 9 of the Act.
- The **Import of Live Fish** (England and Wales) **Act** 1980 gives the relevant Minister the power to make Orders to prohibit or licence the import into, or the keeping or release in any part of

England and Wales of live fish, or the live eggs of fish, of a species which is not native to England and Wales and which might harm the habitat of, compete with, displace or prey on any freshwater fish, shellfish or salmon. This Act also allows the courts upon conviction of an offence under this Act to order the forfeiture and destruction of illegally stocked specimens of certain fish or fish egg species.

- The **European Aquaculture Regulation** 708/2007/EC (2007) establishes a dedicated framework to assess and minimise the possible impact of non-native and locally absent species used in aquaculture on the aquatic environment.
- The **Alien and Locally Absent Species in Aquaculture Regulations** 2011 control the use of non-native and locally absent species on farms.
- Worldwide, the **Convention on Biological Diversity** (1992) states under Article 8(h) that each Contracting Party shall "prevent the introduction of, control or eradicate those non-native species which threaten ecosystems, habitats or species" and the **United Nations Convention on the Law of the Sea** (1994) (Article 196) requires Member States to take all measures necessary to prevent, reduce and control the intentional or accidental introduction of species (non-native or new) to a particular part of the marine environment, which may cause significant and harmful changes.
- The **International Convention for the Control and Management of Ships' Ballast Water and Sediments** (2004) **(International Maritime Organisation- IMO)** – outline procedures for minimising non-native species introductions from ballast water discharge while protecting ships' safety and will provide a uniform, standardised regime for managing ballast water.

In addition to obligations under Animal Aquatic Health Directive, NWIFCA has obligations under the Marine and Coastal Access Act 2009, Countryside and Rights of Way Act 2010 and the Conservation of Species and Habitats Regulations 2010 to maintain biological diversity and further the conservation objectives of marine protected areas.

2.3 Existing planning framework

Many conservation organisations are introducing best practice biosecurity measures into their everyday work. This biosecurity plan links Government-led policy with local actions, and links and supports with the following relevant existing plans in the area:

- Solway Firth Partnership Biosecurity Plan 2013
- Cumbria Freshwater Biosecurity Plan (2011-2015) prepared on behalf of the Cumbria Freshwater Invasive Non-Native Species Initiative.
- South Cumbria Rivers Trust provide information on biosecurity measures for a range of stakeholders (http://www.scrt. co.uk /biosecurity/biosecurity).
- Lancashire Invasive Species Project (ongoing)
- Dee Invasive Non-native Species Action Project- Dee Catchment Biosecurity Action Plan (2014-2020)
- North West River Basin Plan (2009)

- Solway Area Management Plan (2010-2015)
- Cumbria Biodiversity Action Plan (2001)
- Morecambe Bay Management Scheme (ongoing)
- Local Aquaculture Production Businesses - There is a statutory requirement on APBs to have Biosecurity Plans in relation to disease. The plan should identify the risks of disease due to shellfish movements, the risks of contracting and spreading disease due to site procedures, risk limitation measures and detail a monitoring scheme and contingency plan.

Plans from other parts of the UK have also been referred to, to assist in the production of this plan, including:

- Eastern IFCA Biosecurity Plan (2014) for the Wash Fishery Order area (http://www.eastern-ifca.gov.uk/documents/EIFCA%20Biosecurity%20Plan%202014.pdf).
- Scottish Rivers Trusts: including Argyll, Cromarty, Esk, Firth of Clyde, and Spey.

3. Biosecurity issues in the area

3.1 Marine INNS threats

This Biosecurity Plan focuses on the 'key-risk INNS' identified to be associated with fisheries within the NWIFCA district:

- Chinese mitten crab*
- Leathery sea squirt*
- Slipper limpet
- Carpet sea squirt
- Asian shore crab

** Currently present in the district*

Detailed information will be given for these species; additional information for other INNS currently present or of threat to the area can be found in Appendices 1 and 2.

Some species that can survive in brackish or estuarine waters have been included in the plan for completeness, to ensure an overlap with freshwater biosecurity plans in the area.

3.1.1 Current threats from marine INNS

At least eleven marine INNS species have been reported within the NWIFCA district (NBN Gateway 2014):

- Acorn barnacle *Elminius modestus*
- Chinese mitten crab *Eriocheir sinensis*
- Common cord grass *Spartina anglica*
- Green sea fingers *Codium fragile*
- Japanese skeleton shrimp *Caprella mutica*

- Leathery sea squirt *Styela clava*
- Orange tipped sea-squirt *Corella eumyota*
- Pacific oyster *Crassostrea gigas*
- Tube worm *Ficopomatus enigmaticus*
- Wakame *Undaria pinnatifida*
- Wireweed *Sargassum muticum*

There may be others that are yet to be found and/or reported in the district so this section will need to be kept updated. Currently INNS of potential risk to NWIFCA district fisheries are:

Chinese mitten crab *Eriocheir sinensis* [1]

The Chinese mitten crab is a large crab with a distinguishing dense mat of hair on its claws, originally from South East Asia. Juveniles occur in lower estuaries and marine habitats, and migrate upstream into freshwater and brackish systems as they develop. Adults migrate into deep, open marine locations to reproduce and can travel over land for long distances.

Chinese mitten crab- (image from http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=1379)- © Crown Copyright 2009- The Food and Environment Research Agency (Fera)

The most likely pathway of Chinese mitten crab and pelagic larvae transportation is in ships' ballast water, water currents and attached to hulls, as well as through aquaculture stock movements. It will consume a range of invertebrate species and the eggs of fish leading to predation of and competition with both freshwater and marine native species, as well as spatial competition, impacting invertebrate and fish populations. They can also carry disease. Adults usually burrow and live in river banks, increasing erosion and river turbidity, causing banks to collapse and the siltation of gravel beds, causing damage and loss of salmonid spawning grounds. In addition, there are economic implications such as repairing flood defences, land reclamation and reinforcing river banks damaged by burrowing.

The Marine Life Information Network (MarLIN) publishes records of marine INNS sightings (http://www.marlin.ac.uk/rmlsightings.php) showing the Chinese mitten crab is established in England with the first record taken in 1935. In the NWIFCA district, Chinese mitten crab was reported in 2009 in the River Mersey at Warrington in freshwater, approximately 2.8 km upstream of the tidal limit. It is reported to be established in the Dee Estuary and was investigated during management of the fishery for under-size mussel at West Kirby in 2011. Mitigation measures were taken in the area, including taking it into account in the timing of the fishery, and making it a condition of catches to inspect and report any findings. The most recent sighting of Chinese mitten crab was reported to the NWIFCA on 12th April 2012 – an adult female carrying eggs was found on 30th March at Millom Pier (South Cumbria Rivers Trust via the Environment Agency). This was the fourth report from this site in seven years. However, there is no evidence to show there is an established population in the Duddon, and it is possible that these reports are of crabs washed in from other areas with known populations. It is not currently known to be present in the Solway, and measures must be taken to ensure it is not spread.

[1] Neal (2005) and http://www.nonnativespecies.org/factsheet/downloadFactsheet.cfm?speciesId=1379

Leathery sea squirt *Styela clava*[2]

Leathery sea squirt (image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=styela+clava&habitat=&organismtype=&cmdSearch=Search) ©Chris Wood, Marine Conservation Society

A brown solitary sea squirt attached by a small flat holdfast at the base of a narrow stalk with two siphons close together at the free end. The surface is tough and leathery, with folds and swellings. It is hermaphroditic and natural dispersal of it is quite limited, there is a brief motile phase as larva and it is sessile as an adult. Young sessile individuals are vulnerable to predation by gastropods, fish or starfish, but larger adults (protected by very tough tunic) have no known predators in the Atlantic.

Originally from Korea, it was first recorded in Plymouth in 1953 and is now established in the UK. It is widespread around the coast of the Clyde in Scotland, around the south coast of England, and up to the Humber in the North-East. There are also scattered localities in Ireland, and on the Atlantic coast of Europe from northern Denmark to southern Portugal. It attaches to solid surfaces in harbours and marinas as well as natural surfaces.

They are large organisms that can reach high densities, becoming locally dominant and displacing native species. This species can be a fouling pest on ship hulls and aquaculture infrastructure. They may have a negative effect on the abundance and habitat occupancy of other shallow-water suspension feeding sessile invertebrates, but it is not known if they can cause the local extinction of them. As the holdfast takes up little space, and the tunic covering is often covered by other sessile species, the sea-squirt could actually enhance biodiversity per unit area of substrate.

MarLIN records show the leathery sea squirt was recorded at Fleetwood marina and Holyhead marina during surveys between June 2002 and October 2003. It is known to be present in Liverpool Docks (2009) and the Solway (Solway Firth INNS report).

More information on other marine INNS species in the district can be found in Appendix I.

3.1.2 Potential threats from marine INNS

Potential threats of introduction of marine INNS into the NWIFCA district come from those species that are not currently found here but are present in neighbouring areas, those that could have access through one or more pathways to the area, or could be spread further within the district:

- Asian shore crab *Hemigrapsus sanguineus*
- Carpet sea squirt *Didemnum vexillum*
- Killer shrimp *Dikerogammarus vilosus*
- Slipper limpet *Crepidula fornicata*
- Zebra mussel *Dreissena polymorpha*

[2]Information taken from http://www.nonnativespecies.org/factsheet/downloadFactsheet.cfm?speciesId=3430 and http://www.solwayfirthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20Species/Marine%20INNS%20in%20Solway%202013.pdf.

This section will need to be updated regularly to keep species threats up to date. Again, this plan will focus purely on marine INNS that may be of risk to or from the district's fisheries, more information on other marine INNS threats can be found in Appendix 2.

Asian shore crab *Hemigrapsus sanguineus* [3]

Asian shore crab (image from http://www.brc.ac.uk/risc/asianshore_crab.php) ©Martin Burke

Although this species has only recently been reported at Herne Bay and Glamorgan (both in May 2014- NNSS factsheet- http://www.nonnativespecies.org/ factsheet/factsheet.cfm?speciesId=3818), there is potential for it to further invade England in the next few years through boat movements. It is a small crab with banding on its walking legs and three distinct 'teeth' on each side of the square carapace (up to 4.5 cm across). It is variable in colour, from orange-brown to greenish-black with distinctly white claws, and typically found on exposed rocky shores as well as in soft sediments, under rocks, shells, artificial structures, mussel beds or oyster reefs. It is a voracious, opportunistic omnivore that may affect native crab, fish and shellfish populations by disrupting the food-web. When established it also competes with native shore crabs for food and space, and may prey on commercially important species such as small bivalves therefore potentially damaging shellfish production/ fisheries. It can be distinguished from the native shore crab as the shore crab carapace is more triangular than square, with five teeth on each side of the carapace and no clear banding on the legs.

Carpet sea squirt *Didemnum vexillum*[4]

Carpet sea squirt (image from http://www.nonnativespecies.org/gallery/index.cfm?) © Crown Copyright 2009 CCW

A fast-growing, pale orange, extensive sheet or mat forming sea squirt thought to be of Asian origin. It can reproduce both sexually and asexually, rapidly producing genetically identical colonies through budding. Any small patch left untreated could initiate another colonisation. It can potentially smother underwater structures and native plants or animals and grows in shallow water marinas and harbours. It was confirmed in British waters in 2008 in Holyhead Harbour (GBNNSS) although identification requires microscopic analysis to discriminate against similar looking native species. Holt and Cordingley (2011) reported that leisure craft could be implicated as the prime pathways as virtually all reports of the species were from marinas. Holyhead is an active area for commercial and pleasure craft, including a ferry route to Ireland. There are strong concerns that it will quickly colonise a much wider area as in other countries. Based on current predictions, this species could cost mussel farming between £1.3 and £6.8 million over the next ten years, as well as potentially clogging fishing equipment, biofouling boats and smothering reef habitats. An eradication method used in New Zealand, wrapping affected surfaces in polythene sheets secured with cable ties, was utilised in Holyhead marina in 2009-10. This controlled eradication attempt was financed by the Welsh Government in order to protect the economically important mussel aquaculture in the Menai Strait, it was a costly and labour intensive

[3,4,5] Information taken from 'Invasive Non-native Species in the Solway Identification Guide- Solway Firth Partnership' [3] http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=3818 [4] http://www.nonnativespecies.org/index.cfm?pageid=227 and [5] http://www. nonnativespecies.org/ factsheet/factsheet.cfm?speciesId=1028

but relatively effective exercise. However, the potential for repopulation is high unless leisure and other sea-going craft undertake regular cleaning and inspections.

Slipper limpet *Crepidula fornicata* [5]

Originally from the USA, the slipper limpet was transported to the UK with aquaculture stock, as well as possibly on ships hulls and ballast waters. It outcompetes local filter feeding species and is found mainly associated with pebbly shores or attached to structures such as piers. It can be associated with aquaculture operations and is a pest on oyster and mussel beds. It is present in South Wales (NBN Gateway records) and was present in the Menai Strait for a short time in 2006 following an accidental introduction from moving contaminated material within the UK. However, infrastructure to act quickly was in place and divers physically removed them. The area was then smothered in sediment in 2007 and they are not believed to have been present since. It is not currently known to be present in the NWIFCA district but any boat or stock movements from affected areas could lead to its spread.

Slipper limpet (image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=Crepidula%20fornicata)- ©Crown Copyright 2009

3.2 Disease threats*

**Only shellfish aquaculture facilities exist within the NWIFCA district, therefore only shellfish disease will be discussed in this section.*

3.2.1 Current status of disease

At present the NWIFCA district is shellfish disease free and continuing management measures are required to ensure this situation remains and disease is not transferred in from other areas of the UK. Shellfish resources in the district, particularly seed mussel, have become extremely important to the UK and Ireland's aquaculture industry partly due to their disease-free status and it is essential that this situation continues.

3.2.2 Potential threats of disease

The greatest risk of introducing disease comes from the movements of live shellfish. Presently seed mussels are fished in the district and re-laid in the Walney channel (also within the district) or areas such as the Menai Strait and Northern Ireland (outside of the district). There are movements of live Pacific oysters to aquaculture areas within the district, where spat are on-grown on frames. If a disease outbreak occurred in an aquaculture area, there could be huge economic damage to the company, as well as potentially vast environmental impacts should a disease spread. The disease prevention and mitigation measures required will be detailed later in this plan (section 4.1) to reduce the risk of the spread of diseases into the NWIFCA district through pathways such as fishing vessels and gear.

Potential threats of introduction of shellfish disease into the NWIFCA district come from those diseases that are not currently found here but are present in neighbouring areas in the UK or Ireland and Europe, and those that could have access through one or more pathways to the area:

Bonamiosis [6]

Generally limited to the genus *Ostreae*, it is widespread in continental Europe. Outbreaks can occur throughout the year and cause great economic loss in shellfish. It is caused by the infestation of the protozoan parasite *Bonamia ostreae*. It was first recorded in Europe in the 1970s following an investigation of oyster mortalities in French shellfish farms, with the first British record in 1982 in the River Fal. Current prevalence in the UK is relatively low but it is spread through movements of infected stock with transmission of the parasite by water contact or through an intermediate host. Clinical signs can take up to 5 months to appear after exposure and include yellow discoloration and lesions in the gill connective tissue, mantle and digestive gland. There is no treatment for it; therefore prevention is the only effective measure. Native oysters (*Ostrea edulis*) are particularly vulnerable to this due to the status of stocks. Designated disease areas include the Menai Strait, the south coast between Portland Bill and Selsey Bill, and the east between Landguard Point and North Foreland lighthouse.

Marteiliosis [7]

A disease caused by *Marteilia refringens* affecting both wild and cultivated native oysters (*Ostrea edulis)*, and has been known to affect *Mytilus edulis* (blue mussels) and *Crassostrea gigas* (Pacific oyster). The first European report of this disease was in France in 1967- it has not been identified in oysters in the UK to date but is classed as a notifiable disease. Outbreaks occur mainly during the summer as water temperatures increase and can cause economic losses in shellfish. Clinical signs may include dead and weakened gaping oysters, with visceral tissue becoming pale in colour and the mantle (in some instances) becoming translucent. In highly infected oysters the infected tissue may appear shrunken and slimy. There is no treatment for it; therefore prevention is the only effective measure. There are import restrictions in place in the UK in order to reduce the risk of infection entering the country via infected oysters.

Mikrocytosis [8]

An intracellular protistan *Mikrocytos mackini* which causes microcell disease to Pacific and Native oysters and can cause mortalities of up to 40% in affected species. It predominantly occurs during spring months and seems to affect oysters more than three years old. As a result of this it is thought that its effect on farmed stock is limited, as harvesting usually takes place within three years. Experimental work has, however, shown that spat can also suffer high mortality as a result of infection; the risk of infection can be minimised by introducing stock after the spring transmission period. Transmission of the disease is horizontal, from host to host via the water column and is probably acquired across the gills while feeding. Clinical signs include dead and gaping oysters; examination may reveal focal lesions which may develop into pustules, abscesses and ulcerations in the area of the mantle often with corresponding brown scars on the shell. *M.mackini* has not been found in oysters in the UK to date and as there is no treatment, prevention and control are the only management strategies.

[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292127/Guide_to_bonamiosis.pdf and https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278755/Bonamia_ostreae.pdf
[7] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292128/Guide_ to_marteiliosis.pdf
[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292129/Guide_to_mikrocytosis.pdf

Oyster Herpes Virus [9]

A viral disease of the Pacific oyster *Crassostrea gigas*. It is temperature dependent, only occurring when water temperatures exceed 16°C and can affect all life stages of oyster. Adult mortality ranges from 10-30%, while juvenile mortality is higher, between 60 and 100%. The disease has spread through major oyster growing areas in France (both the Atlantic and Mediterranean coasts), Jersey and parts of Ireland. The first UK outbreak was in 2010 in Whitstable, Kent and there are currently four designated disease areas: Poole Harbour, North Kent coast, River Crouch and Black Water in Essex. There is no cure currently available for the disease, therefore the most efficient method to prevent the spread is to minimise the movement of stock.

3.3 Existing INNS control activities in the NWIFCA district

At a national level, the GB NNSS and Marine Biological Association (MBA) provide information regarding identification, reporting and distribution of INNS. The national 'Check, Clean, Dry' campaign (Appendix 3) is advertised by several organisations around the area to promote public awareness. Natural England project tenders require the recording of any INNS found during survey work on the MBA website, and biosecurity is being increasingly included in project planning and tenders in the construction and consultancy industry. The Marine Pathways project aims to "protect marine biodiversity in the UK and Ireland by managing key pathways by which marine invasive non native species are introduced and spread", understanding the risk associated with pathways and investigate biosecurity measures. It will contribute to the delivery of the Non-Indigenous species descriptor of the Marine Strategy Framework Directive and is undertaken by organisations within the UK and Ireland including Cefas, Natural England and Defra. There are currently research projects being carried out for this project, gathering information to aid the control of NNS. One project is on Chinese Mitten Crabs in the Dee and runs from 2013- 2015. The objectives include gaining an estimation of population size and its extent, investigating the environmental cues driving migration and raise awareness of stakeholders (http://www.nonnativespecies.org/index.cfm?pageid=475).

Solway Firth Partnership have produced and distributed identification guides and posters for INNS (Appendix 4) around ports and harbours in their district to St Bees Head. In the Dee catchment, Cheshire Wildlife Trust has held biosecurity workshops, and the Dee Invasive Non-Native Species (DINNS) Project has financed and assisted with the delivery of biosecurity workshops and awareness talks to angling clubs and distributed national awareness materials throughout the catchment. In addition to this, Welsh Assembly government funding (the Resilient Ecosystem Fund) 'has enabled the DINNS project to produce personal biosecurity packs to be given to water users to encourage them to carry out biosecurity' containing brushes (to clean equipment), waterproof ID guides, Check Clean Dry information and a user guide (Dee Catchment Biosecurity Action Plan, 2014).

Although the NWIFCA may not directly come across other non-key-risk marine INNS present in the district, currently awareness is raised where possible through distribution of marine INNS identification leaflets and posters from other organisations. Currently any reports of INNS are noted within the NWIFCA system, and reported to the MBA website. The NWIFCA is aware of the potential presence of Chinese mitten crab in the area of district's fisheries and consideration is given to this when undertaking surveys and responding to marine planning and licensing consultations in

[9] http://www.thefishsite.com/diseaseinfo/10/oyster-herpes-virus-oshv1

potentially colonised areas. The most recent occurrences of mitigation measures to minimise risk of transferring of Chinese mitten crab to outside of an already colonised area was during the hand-gathering fishery for under-size mussel from West Kirby in the Dee Estuary. Protocols produced by the Countryside Council for Wales (CCW) (now incorporated into NRW) and Dr Andrew Woolmer of Salacia-Marine Ecological Consultancy for a seed mussel dredge fishery on Salisbury Bank in the Dee Estuary in 2011 were adapted to screen for presence of the species. The timing of the fishery was managed to coincide with the time of minimal risk of presence in relation to the life-cycle of the species. These protocols will be used for future fisheries as necessary.

As a precautionary measure, screening inspections are made for Chinese mitten crab for any mussel fishing activity around the area of the Duddon Estuary. To date there has been no evidence of the species on these mussel beds.

3.4 Existing disease control activities in the NWIFCA district*

For many years, the Government has implemented initiatives to prevent serious fish, shellfish and crustacean diseases being introduced into Great Britain. This has been a significant factor in ensuring Great Britain has maintained a high aquatic animal health status, remaining free from the most serious disease. In the early 1990s, national fish health rules were replaced by EU rules. These are designed to encourage trade within the single market and, at the same time, protect parts of the EU with a high aquatic animal health status – e.g. Great Britain. The Aquatic Animal Health (England and Wales) Regulations 2009 recognises the importance of effective biosecurity measures in restricting disease spread. It requires APB operators to implement a biosecurity measures plan as a condition of their authorisation. The Cefas FHI is responsible for protecting, enhancing and improving aquatic animal health, with a main objective of preventing the introduction and spread of serious fish and shellfish disease in England and Wales.

The EU Council Directive 2006/88/EC sets out legislation to prevent and control certain diseases in aquaculture animals. The owner or anyone else attending to animals must immediately report suspicion of notifiable diseases (classified as either exotic or non-exotic, Table 2) to the FHI. Exotic diseases are those diseases not currently present in the EU. They could have a significant economic and environmental impact if they were introduced and all infected fish and shellfish must be destroyed as soon as possible.

Non-exotic diseases are those that are present in parts of the EU, under containment and subject to long-term eradication. They are controlled to prevent them spreading to unaffected areas of the EU. As well as exotic and non-exotic diseases, there are other notifiable diseases that are present in the EU and which are controlled by national programmes. The FHI also has powers to prevent the spread of new and emerging diseases, that are not listed but that have the potential to present a significant economic or environmental threat to our aquatic animal populations.

The spread of notifiable diseases is controlled by:

- Strict rules for importing live fish, molluscs and crustacea.

* Information taken from https://www.gov.uk/protecting-freshwater-fish -and-other-aquaculture-species

- Regular monitoring of fish, shellfish and crustacean farms by the FHI to check for disease and monitoring of consignments of live shellfish and fish to outside of the UK.
- Speedy containment of outbreaks of serious disease where detected by the FHI or notified by someone else.
- Operators of fish farms, shellfish farms, crustacean farms, and fisheries taking all the necessary precautions when buying, selling, keeping and moving live aquatic animals.
- Controls on the movement of live shellfish around the British coast, restricting live movements from positive areas to prevent the spread of disease.

Where a notifiable disease is suspected in aquaculture animals (fish, molluscs or crustaceans), the FHI will undertake an investigation and samples will be taken for diagnostic testing. The FHI will also apply controls to the affected area in the form of an initial designation notice in order to minimise the risk of any further disease spreading. This initial designation notice is a temporary 'standstill' notice that is usually served to the owner or operator of the affected site or area in the form of a written notice, describing the control area and the restrictions applied to prevent any further spread of disease. Depending on the test results, the initial designation notice will be lifted (if negative), or a Confirmed Designation issued (if positive). This is a public, legal order restricting aquatic animal movements into, out of and within the affected area without prior written permission from the FHI, and remains in force until the disease is no longer present in the designated area.

Table 2: Some of the listed notifiable diseases taken from EU Council Directive 2006/88/EC (irrelevant freshwater species have not been included)

EXOTIC DISEASES		
	DISEASE	**SUSCEPTIBLE SPECIES**
FISH	Epizootic ulcerative syndrome	Genera: *Mugil* (mullet)
MOLLUSCS	Infection with *Bonamia exitiosa*	Australian mud oyster (*Ostrea angasi*) and Chilean flat oyster (*O.chilensis*)
	Infection with *Perkinsus marinus*	Pacific oyster (*Crassostrea gigas*) and Eastern oyster (*C.virginica*)
	Infection with *Microcytos mackini*	Pacific oyster (*Crassostrea gigas*), Eastern oyster (*C.virginica*), Olympia flat oyster (*Ostrea conchaphila*) and European flat oyster (*O.edulis*)
CRUSTACEANS	Taura syndrome	Gulf white shrimp (*Penaeus setiferus*), Pacific blue shrimp (*P.stylirostris*), and Pacific white shrimp (*P. vannamei*)
	Yellowhead disease	Gulf brown shrimp (*Penaeus aztecus*), Gulf pink shrimp (*P.duorarum*), Kuruma prawn (*P. japonicus*), black tiger shrimp (*P. monodon*), Gulf white shrimp (*P. setiferus*), Pacific blue shrimp (*P. stylirostris*), and Pacific white shrimp (*P. vannamei*)
NON-EXOTIC DISEASES		
	DISEASE	**SUSCEPTIBLE SPECIES**
FISH	Viral haemorrhagic septicaemia (VHS)	Herring (*Clupea* spp.), whitefish (*Coregonus s*p.), haddock (*Gadusaeglefinus*), Pacific cod (*G.macrocephalus*), Atlantic cod (*G. morhua*), Pacific salmon (*Oncorhynchus* spp.), rainbow trout (*O.mykiss*), rockling (*Onos mustelus*), brown trout (*Salmo trutta*), turbot (*Scophthalmus maximus*), sprat (*Sprattus sprattus*) and grayling (*Thymallus thymallus*)

	Infectious haematopoietic necrosis (IHN)	Chum salmon (*Oncorhynchus keta*), coho salmon (*O. kisutch*), Masou salmon (*O.masou*), rainbow or steelhead trout (*O.mykiss*), sockeye salmon (*O. nerka*), pink salmon (*O. rhodurus*), chinook salmon (*O. tshawytscha*) and Atlantic salmon (*Salmo salar*)
	Infectious salmon anaemia (ISA)	Rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*) and brown and sea trout (*S. trutta*)
MOLLUSCS	Infection with *Marteilia refringens*	Australian mud oyster (*Ostrea angasi*), Chilean flat oyster (*O. chilensis*), European flat oyster (*O. edulis*), Argentinian oyster (*O. puelchana*), blue mussel (*Mytilus edulis*) and Mediterranean mussel (*M. galloprovincialis*)
	Infection with *Bonamia ostrae*	Australian mud oyster (*Ostrea angasi*), Chilean flat oyster (*O. chilensis*), Olympia flat oyster (*O. conchaphila*), Asiatic oyster (*O. denselammellosa*), European flat oyster (*O. edulis*), and Argentinian oyster (*O. puelchana*)
CRUSTACEANS	White spot disease	All decapod crustaceans (order *Decapoda*)

4. Biosecurity Management Strategy

4.1 Management of INNS in the general marine environment

As described previously, the objectives of this plan will be achieved through a partnership approach focusing on:

- Prevention of INNS entering the NWIFCA district
- Early detection, surveillance, monitoring, rapid response
- Mitigation, control and eradication

It will be focused on those INNS identified as of potential risk to fisheries in the NWIFCA district. The actions required to meet these objectives are detailed in this section.

4.1.1 Prevention

Actions for prevention are based on identifying and disrupting pathways for the introduction and spread of marine INNS and disease. This is the most effective and least damaging to the environment and steps must be effective, simple and realistic. The NWIFCA will work to raise public and stakeholder awareness around the importance of the prevention of marine INNS and disease and the practical measures suggested that should be taken by stakeholders as listed in Table 3. Although this plan focuses on fishery risk INNS, a general compliance with the 'Check, Clean, Dry' campaign should be promoted with all water users to prevent the risk of any INNS.

Table 3: Pathways, preventative action and relevant stakeholders

Pathway	Preventative Action	Stakeholder
Ballast water	Follow best practice and do not pump non-sterilised water out in harbours where possible	Port Authorities, Harbour Masters, boat owners
Hull fouling	Annual haul-out and anti-fouling of vessels (especially those that have not moved for prolonged time and those from contaminated areas - use of quarantine berths). Hull design to prevent fouling and encourage easy cleaning. Marinas could implement a 'clean hull policy'	All vessel owners and users- fisheries, recreational boating, shipping companies, boat/kayak designers
Port infrastructure as a receptor	Good housekeeping, design to discourage fouling, relevant staff trained to identify marine INNS and report any sightings	Port Authorities, Local Authorities
Fouling of fishing equipment	'Check, clean, dry' all equipment and clothing used in the marine and inter-tidal between use and before moving from one area to another (Appendix 3)	All fishing sectors and associations using equipment including hand-gatherers
Fouling of recreational equipment	'Check, clean, dry' all marine equipment and clothing between use and before moving from one area to another (Appendix 3)	All marine groups and associations using equipment including angling, scuba diving, sailing etc.
Relocation of structures and equipment	'Check, clean, dry' all structures and equipment before moving from one area to another (Appendix 3). Check for INNS. See 'Biosecurity for submerged structures' (Appendix 5)	Port Authorities, marinas, fisheries, renewables industry
Attached to marine debris/ litter	Minimise marine litter/ debris, beach cleaning activities and campaigns	All shipping, Local Authorities, fisheries, Marine Conservation Society, general public
Escape or release of plants and animals from aquaria	Do not release animals and plants from aquaria, use native species whenever possible	Aquarium stockists/ customers, general public
Natural dispersal	Understand tidal currents and spread risk for each invasive species	GB NNSS
General sightings	Promote knowledge of biosecurity	Landowners, general public, conservation organisations, schools

4.1.2 Early detection, surveillance, monitoring, rapid response

Should prevention fail, it is important that marine INNS are identified accurately and reported when found to ensure vital early detection so action can be taken quickly before they can spread (figure 3). Members of the public and other stakeholders should be encouraged by the NWIFCA and other partner organisations to keep a look out for new species, and training courses or awareness

programmes should be advertised and used to maximise community involvement and knowledge, as carried out by the Cumbria Freshwater INNS Initiative. GB NNSS campaign identification sheets and reporting information should be distributed to stakeholders to assist with this, and where appropriate sightings should be checked by a relevant organisation. A free 'That's Invasive!' smartphone app (Th@s Invasive, Natural Apptitude Ltd) is available and will be included in NWIFCA stakeholder information distribution as another way to help with identification and recording of INNS (Appendix 6). Surveys can establish locations of existing populations and routine monitoring of new or established populations can detect any changes.

Actions for rapid response focus on the establishment of a clear reporting and response system and advertised with a single point of contact but are dependent on awareness amongst marine users. The "eyes" of the early warning system will be trained members of the public, water users and stakeholders.

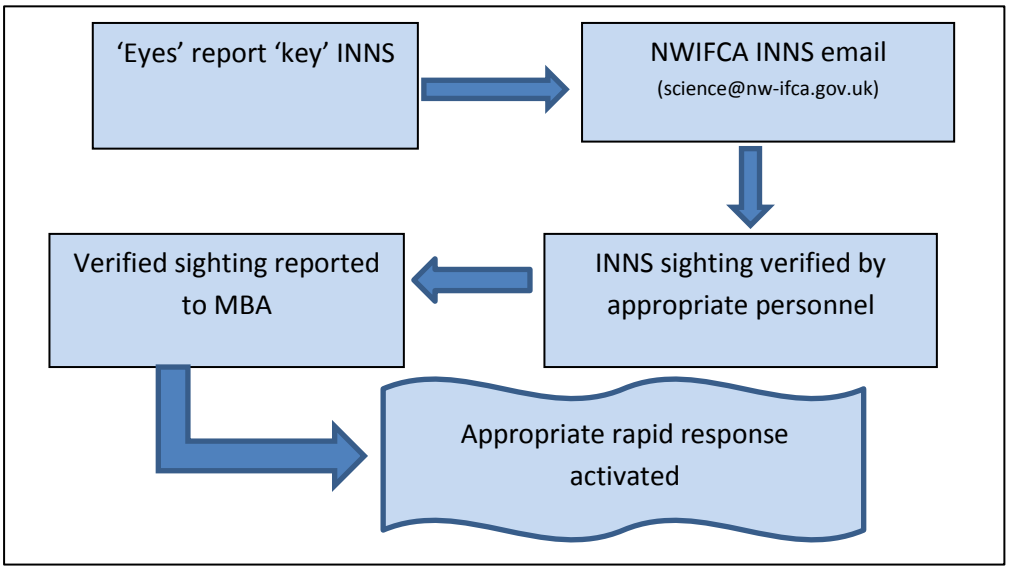

Figure 3: Reporting system for key-risk INNS

Any **'key-risk' INNS** found in the NWIFCA district should be reported (with photographs, date and precise location) to the **NWIFCA** using a reporting system (email: science@nw-ifca.gov.uk).

Other **'non-key' INNS** should be reported via the MBA reporting system (http://www.mba.ac.uk/recording) and NNSS (http://www.nonnativespecies.org/alerts/index.cfm)

Reporting should be promoted and facilitated by the NWIFCA to ensure all sightings are noted to build a clear picture at both a local and national level. The NWIFCA will inform the NNSS and MBA of verified sightings. Appendix 7 lists other specific INNS reporting websites. The type of rapid response will depend on the species detected and the threat posed - either a GB high priority response (part of the GB INNS strategy), a high priority local rapid response or a local response (Table 4). Once identified, an assessment of establishment should be undertaken through surveys, followed by containment, remediation and possibly eradication measures (taken by appropriate authority or organisation) if feasible (see section 4.1.3).

Table 4: Procedure protocols for the three types of response (taken from Cumbria Freshwater Biosecurity Plan, 2011).

GB Response	Local High Priority Response	Local Priority Response
•Report to GB institutions	•Report to local and GB institutions	•Report to local recording centres
•Determine the extent of infestation	•Determine the extent of infestation	•Build in INNS monitoring as part of surveys in course of normal work
•Isolation of area where practicable	•Isolation of area where practicable	•Establish source
•Establish source and check related sites	•Establish source and check related sites	•Risk assessments
•Closure of all pathways	•Closure of all pathways	•Inclusion of new areas in existing control/ eradication programmes
•Biosecurity measures implemented	•Biosecurity measures implemented	•Engagement and support of local interests
•Decision on appropriate action eradication/ containment	•Decision on appropriate action eradication/ containment	•Monitor as part of planned catchment monitoring programme
•Approved eradication methodology	•Approved eradication methodology	
•Engagement and support of local interests for surveillance, monitoring and biosecurity measures	•Engagement and support of local interests	
•Monitor	•Monitor as part of planned catchment monitoring programme	

4.1.3 Mitigation, control and eradication

Effective and sustainable control programmes should be developed for existing marine INNS, primarily in prevention of their spread to other parts of the country. Control and eradication programmes (if deemed necessary) would only be undertaken in line with national policy and using a combination of specialist contractors and staff due to the specialist nature of such operations in the marine environment. Additional funding sources would need to be identified for any survey, control and eradication works. Where possible, containment and mitigation measures will be identified and put in place in coordination with national programmes and advice. Again, stakeholder engagement will be vital in this situation in implementing procedures and preventing spread.

Specific steps to prevent marine 'key-risk' INNS and disease spread within the district's fisheries:

- Fishing anywhere within the North West district after returning from fishing in other impacted areas requires power-washing of vehicles and boats (deck and hull) prior to entering the new area to prevent introduction of new / additional INNS and disease (also leaving an impacted North West area to fish in other areas of the NWIFCA district or outside of it).
- Vehicles used to launch boats or quads entering the intertidal area should be power-washed afterwards to remove all sediment and organic matter, especially tyres, wheel arches and any surfaces that have come into contact with shellfish or intertidal sediments, for instance via loaded cockle or mussel bags, footwear or external clothing. This must take place in the vicinity of the area of fishing and prior to entering areas outside of this.
- Vessels and fishing gear used in the North West's fisheries must be power-washed to remove all sediment and organic matter prior to their use in other areas within the district, as well as outside of it. In particular, the boats hull, bilge area, deck and fixed equipment (anchor, winch etc.) should be cleaned and disinfected. Any bilge water should be pumped out whilst still in the original area. Particular emphasis should be placed on any areas that have come into contact with shellfish or intertidal sediments, for instance via loaded cockle or mussel bags, footwear, external clothing and the bilges of boats. Good practice would include steam cleaning and disinfecting to ensure no organisms or diseases remain.
- All participants in the fisheries, whether fishermen, merchants or regulatory and scientific staff carrying out surveys, must thoroughly wash and disinfect all external clothing and footwear and clean and disinfect all equipment / implements used in the fishery and allow time to dry. This includes cockle and mussel bags to be re-used in another fishery. All sediment and organic matter must be removed.
- Effluent arising from the washing and grading of live cockles and mussels must not be discharged untreated into estuarine and marine environments. Any arising should be boiled prior to discharge, as chemicals or irradiation might not be robust enough methods.
- In addition to fishing vessels, any survey vessels or recreational angling boats entering or leaving the North West area from/ to an area outside the NWIFCA district should be cleaned and disinfected thoroughly, including survey equipment and gear (grabs, sieves etc.) and crew PPE (drysuits, boots, waterproofs etc.).

Good practice would involve cleaning of gear all the time, not just when fishing in impacted areas; the specific suggestions stated here are for when an INNS or disease has been identified in an area. The practicality of implementing these suggestions is problematic and requires industry and stakeholders to support the process. Raising awareness of the potential damaging impacts caused by the establishment of a marine INNS and disease is crucial in ensuring assistance and support in control and mitigation, as discussed in section 4.3 and 4.4.

The NWIFCA will liaise with regulatory authorities in other areas such as Wales, Northern Ireland and Ireland, to ensure minimal risk of the transference from or to the NWIFCA district of any marine INNS or disease by visiting vessels. Defra and Natural England currently have the duty of rapid response coordination of any new marine INNS introduction but this is under review. The NWIFCA

will work closely with both agencies to facilitate a joined-up and effective response.

There is an 18 month project in place led by Natural Resources Wales in partnership with the School of Ocean Sciences at Bangor University which is developing a new warning system that could reduce the damage caused to Welsh marine industries and native wildlife by marine INNS through early detection (http://naturalresourceswales.gov.uk/our-work/news/133703/?lang=en#.U5hi_o5waUk). It is due to be completed by the end of March 2015 and the NWIFCA will keep up-to-date with this.

4.2 Management of disease in aquaculture and fishery sites

Prevention

A similar approach to the Eastern IFCA has been taken to mitigate against the risk of diseases to shellfish beds and aquaculture (Eastern IFCA Biosecurity Plan, 2014). The following procedures should be followed:

- Shellfish farmers are required to give prior notice to the NWIFCA if they intend to relay shellfish in the NWIFCA district from areas outside of the district – if the location is within a European Marine Site this will include a Habitats Regulation Assessment which will need to be agreed with Natural England prior to the activity occurring. The origin of shellfish will be considered and approval will only be given if the source of the introduced shellfish is marine INNS and disease free
- Under the notification (above) the shellfish farmers are required to provide details of the amount of seed to be brought in and its origin
- All shellfish farmers should be notified of the risks of spreading disease by the NWIFCA
- Shellfish farmers are required to report unusual levels of mortality to the NWIFCA

It is recognised that it is much simpler to apply meaningful biosecurity measures in intensive small-scale systems than in open marine environments. Aquaculture Production Businesses (APBs) produce their own plans and owners of shellfish farms should be aware of potential diseases. They can take a number of steps to protect the health of their shellfish and reduce the risk of spread or introduction of disease into their farm including:

- Awareness of the disease history and quality of the area shellfish are moved from, or, where possible, isolate imports until their health status is established
- Cleaning and disinfecting lorries and tanks used to transport shellfish before loading and after each delivery of shellfish
- Stocking only certified, disease-free shellfish from a reputable supplier
- Training staff in hygienic shellfish handling and disease prevention methods
- Staff training and early disease identification through regular stock assessments, keeping health and treatment records
- Identification of effective measures to take in the event of a disease outbreak or other unknown mortality, and staff awareness of the appropriate response procedure

- Awareness of other routes of disease spread including use of shared equipment and boats, site visitors and access by other water users. Limiting access could be taken as a precaution
- Using a pathogen free water supply, and preventing undue stress to shellfish from overstocking
- Providing disinfection facilities and requiring visitors to wear protective clothing

Contingency plan

In the event that diseased shellfish were positively identified by shellfish farmers, shellfish fishery hand-gatherers, or NWIFCA Officers within the district, the following actions would be taken if deemed appropriate:

1) Inform the Cefas FHI and the NWIFCA of the presence of diseased shellfish within the district (Appendix 8)

2) Inform all NWIFCA district fishermen (in writing) of the presence of a disease, outlining the steps that they must take to minimise the risk of spreading the disease

3) Place an information notice on the NWIFCA website detailing the disease and actions to take to minimise its spread. Also the use of social media, press releases and posters as appropriate to ensure all relevant audiences are reached

4) Identify the source of the diseased shellfish through surveys or sampling of shellfish stocks

5) Determine the extent of the spread of the disease through surveys or sampling of shellfish stocks

6) Introduce a temporary closure of any open shellfish fisheries to prevent spread and the movement of shellfish fishing vessels from spreading the disease

7) Revoke any outstanding authorisations or licences to fish shellfish to prevent the movement of diseased/contaminated shellfish or shellfish fishing vessels in/out or within the NWIFCA district

Industry monitoring plan (on-going)

- Shellfish farmers regularly inspect their lays - incidents of mortality and meat yields are reported to the NWIFCA and recorded
- Shellfish intended for relaying could be randomly inspected by NWIFCA Officers. Officers record inspections and these are held in the office. Any issues are reported to FHI
- Shellfish entering and leaving the NWIFCA district is monitored – report to FHI
- Records of seed mussel removed from within the district under NWIFCA authorisation is recorded

4.3 Public awareness

There is limited understanding by the general public and other organisations of the threats posed by marine INNS and disease. Improved awareness and understanding of the issues surrounding biosecurity is key to wider support for the relevant policies and programmes, and for engaging the public in decision-making. The public can play several roles, including modifying their behaviours to

help reduce the likelihood of introducing marine INNS or disease or the risk of facilitating their spread (Table 3), and assisting with their detection, reporting and monitoring (Figure 3). It is important that INNS identification guides and information is disseminated to sea users and the public - the appendices at the end of this plan contain useful information and links for this. The NWIFCA will use social media and its website to keep stakeholders informed and up to date.

4.4 Actions

Objective 1: *Reduce the risk of introduction and spread of marine INNS and disease within the NWIFCA district and to other areas, with a focus on 'key-risk' INNS.*

Output 1: Awareness will be raised in the district around the threat of INNS and disease, how they are introduced and spread, and what practical measures can be taken to minimise spread.

- Launching, promotion and distribution of NWIFCA Biosecurity Plan through website links and sharing with stakeholders (late 2014/early 2015)
- Raise awareness of 'Check, Clean, Dry' and collate and distribute national biosecurity spread prevention leaflets/posters via website links, social media and stakeholders with a focus on fishermen, canoeists, boaters, anglers and any other water users at water entry points and parking points, relevant retail outlets, meetings, open days (ongoing- from 2014/2015)
- Engage with stakeholders to identify the most practical biosecurity measures as best practice and develop and promote best practice guidelines (ongoing 2015)

Objective 2: *Promote suitable detection, monitoring and rapid response systems for marine INNS and disease which pose significant threats to biodiversity and the local economy, with a focus on 'key-risk' INNS.*

Output 2: Awareness will be raised in stakeholders of the key risk INNS and how to record any INNS found in the NWIFCA district in order to improve knowledge and allow early detection. Rapid response, control and containment is key to preventing the establishment of INNS within the district.

- Distribute NWIFCA Biosecurity Plan, key-risk INNS information and INNS reporting campaign information through posters, leaflets, website links, social media and apps to stakeholders with a focus on fishermen, canoeists, boaters, anglers and any other water users at water entry points and parking points, relevant retail outlets, meetings, open days (ongoing- start late 2014/2015)
- Develop NWIFCA reporting and response system (2015)
- Liaise and work with environmental groups, organisations, local community and partners to enhance awareness and monitoring (ongoing)
- Liaise with potential rapid response teams in national organisations such as the Environment Agency, Cefas, Natural England and Defra (ongoing).

Objective 3: *Develop effective control programmes for existing marine 'key-risk' INNS and diseases which are practical and sustainable, and prevent their spread to other parts of the district or country.*

Output 3:

- Liaise and work with environmental groups, organisations, local community and partners locally and nationally to control existing key-risk INNS and disease (ongoing)
- Distribute NWIFCA Biosecurity Plan and INNS spread prevention information through website links, social media and stakeholders with a focus on fishermen, canoeists, boaters, anglers and any other water users at water entry points and parking points, relevant retail outlets, meetings, open days (ongoing)

5. Monitoring

This biosecurity plan has been initiated by the NWIFCA in the NWIFCA district. Progress in delivering the objectives of this plan will be determined by the level of stakeholder and partner engagement, support and commitment delivery. It is important that monitoring of the effectiveness of the plan's actions is undertaken including:

- Assessment of efficiency of surveillance and rapid response
- Occurrence and distribution of marine INNS and shellfish disease
- Effectiveness of control/eradication programmes
- Assessment of ability to close/restrict pathways
- Monitoring general activity and risk of marine INNS and disease

The overall Biosecurity Plan will be reviewed in 2019 by the NWIFCA to update the records of current marine INNS and diseases present, environmental, socio-economic risks and potential threats and practical information on effectiveness of procedures and suggestions for the future. The NWIFCA may undertake to review particular sections (such as the 'current marine INNS' section) more frequently, as and when they are recorded.

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7. Appendices

Appendix 1 – Current threats from non-key marine INNS

Marine INNS currently present in the NWIFCA district but not of a direct threat to fisheries include:

Acorn barnacle *Elminius modestus*[10]

Elminius modestus- (Image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=elminius+modestus&habitat=&organismtype=&cmdSearch=Search) ©Crown Copyright 2009, Paul Brazier CCW

This is a small sessile barnacle, 5-10 mm in diameter, which is native to Australasia and is now widely distributed around most coasts of England and Wales and present in a few areas of Scotland (NBN Gateway). It attaches to a variety of surfaces including rocks, stones, hard-shelled animals and artificial structures including ships, and tolerates a wider range of salinity and turbidity than native species. It is a fast growing species that is quick to reach maturity, which, combined with its high reproductive output in water temperatures above 6°C, gives it a competitive advantage over native species. It can dominate hard surfaces and displace native species; it has largely displaced native barnacles in estuaries in southwest England, although impacts are less significant on exposed rocky shores. In favourable conditions it can be a nuisance as a fouling

[10]Avant (2007) and http://www.solwayfirthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20 Species/Marine%20 INNS%20in%20Solwa y%202013.pdf

organism. Spread of this species may be limited by the appropriate treatment of ships' ballast water and removal of hull fouling communities, but is unlikely to be prevented due to the species' ability to disperse naturally during the pelagic larval phase.

Common cord grass *Spartina anglica*[11]

A well-established and vigorously invasive grass of estuarine salt marshes found in England, Wales, Ireland and western Scotland. It is present in the Solway, Wyre and Morecambe Bay (NBN Gateway). It is a hybrid of a North American and a British native species which arose some time before 1892. It colonises the lower zones of estuarine salt marshes and intertidal mudflats, excluding native flora and fauna and can lead to a loss of habitat for bird feeding and roosting, seriously affecting populations of migratory wildfowl and waders. It may compete with areas used for commercial oyster and mussel farming, and have an impact on the recreational use of the coast by land locking sandy beaches. Removal by digging at an early stage of invasion can be successful, but manually intensive. Smothering in plastic sheeting has been locally successful, or alternatively herbicides have been used but may require frequent reapplication.

Green sea fingers (image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=green+sea+fingers&habitat=&organismtype=&cmdSearch=Search). ©Chris Wood, Marine Conservation Society.

Green sea fingers *Codium fragile*[12]

This is a spongy green seaweed with numerous Y-shaped, branching, cylindrical fronds with a felt-like texture. It usually grows to around 25 cm in Britain. It has the potential to compete with native species for space, forming dense clumps and potentially altering community structure. It can be a nuisance to fisheries and aquaculture, particularly on North Western Atlantic shores; it fouls nets and may attach to, uplift and move commercially produced shellfish and seaweed. Green sea fingers are present around Great Britain including the Scilly Isles, Channel Islands, South Wales, the south coast of England and the west coast of Scotland (NBN Gateway). It is well established so prevention of further dispersal is unlikely. Mechanical removal would be unlikely to succeed as the species can reproduce asexually from fragments; however, a population of green sea fingers in Oban was decimated through predation by sea slugs, suggesting a possible biological control strategy.

Japanese skeleton shrimp (image from http://commons.wikimedia.org/wiki/File:Caprella_mutica_2.jpg) ©Hans Hillewaert 2010.

Japanese skeleton shrimp *Caprella mutica*[13]

An aggressive skeleton shrimp originally from North East Asia which is rapidly invading and has established populations in

[11] http://www.solwayfirthpartnership.co.uk/uploads/Marine%20Invasive%20Nonative%20Species/Marine%20INN %20in%20Solway %202013.pdf).

[12] http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=866 and http://www.solway firthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20Species/Marine%20INNS%2in%20Solway%202013.pdf

[13] Oakley (2006).

the North Sea, West coast of Scotland and Irish Sea. It can clog equipment and nets, and outcompete native species. It is found in harbours and marinas amongst fouling growth on boat hulls, ropes and nets. First recorded in Scotland in 2000 (MarLIN records) and in the Mersey (NBN Gateway) during capital dredge work.

Orange tipped sea-squirt *Corella eumyota*[14]

This has been found along the south coast of England at Portsmouth and Weymouth (NBN Gateway) and in harbours on the south west, south and east coasts of Ireland. A record has also been noted in the Solway (Solway Firth INNS report) and the Menai Strait. This is a solitary sea squirt, 2-4 cm long, which often attaches to hard substrates such as cobbles, boulders, ship hulls and shells of mussels and oysters. The identifying feature is the distinctive curved or U-shaped gut, whilst other similar squirts have an S-shaped gut. It may threaten oyster and mussel farms through fouled gear and by smothering and outcompeting cultures.

Orange tipped sea-squirt (image from http://www.nhm.ac.uk/nature-online/species-of-the-day/biodiversity/alien-species/corella-eumyota/index.html) ©JDD Bishop

Pacific oyster *Crassostrea gigas*[15]

Originally from Asia but now farmed in aquaculture operations throughout England, Scotland, Wales and Ireland. It is also widespread in Europe. It was initially presumed that temperatures in British waters would not be suitable for Pacific oysters to successfully spread, settle and spawn locally, but escapees from aquaculture operations have established feral populations in south-east and south-west England and Wales. There are extensive beds of naturally recruited Pacific oysters in some southern estuaries of England and sparse settlements are known from the north coast of Wales near Conwy (NBN Gateway). They compete with blue mussels and smother other local species, and grow on lower shore coastal hard substrates. Up to 2014 there have been at least eight sites of observed 'wild' populations on the Scottish (Dumfries and Galloway) coast, some of which were verified by the MBA and destroyed under instruction. The Scottish Association for Marine Science has conducted surveys on these populations. The NWIFCA works with Natural England and aquaculture operators to ensure action is taken if any live individuals are observed in the NWIFCA district outside of the aquaculture facility in order to prevent populations establishing.

Pacific Oyster (image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=crassostrea+gigas&habitat=&organismtype=&cmdSearch=Search) © Crown Copyright 2009, GBNNSS

[14] http://www.solwayfirthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20Species/Marine%20INNS%20in%20Solway%202013.pdf

[15] http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=1013 and Hughes (2008).

Tube worm *Ficopomatus enigmaticus*[16]

Tubeworm (image from http://commons.wikimedia.org/wiki/File:Ficopomatus_enigmaticus_1.jpg#file) © Massimiliano Marcelli, 2011.

Reported on a vessel propeller in Whitehaven marina in October 2013, this small worm forms concretions with calcareous interlacing tubes. They may be spread through hull fouling or as larvae in ballast water and can survive in their tube cases for several hours out of water. They can cause blockages in pipes, foul surfaces in ports and docks such as hulls, and floating structures- requiring maintenance and cleaning. They are filter feeders, and while they can be of benefit to water quality by removing suspended particulate loads and improving the oxygen and nutrient status, they can also deplete phytoplankton resources and organic matter that might otherwise be used by other native filter feeding organisms. This species is already widely distributed in Europe, and may extend further northwards with warming seas.

Wakame *Undaria pinnatifida*[17]

Wakame- image from (http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=3643). © Crown Copyright 2009, Kathryn Birch, CCW

A large brown seaweed of Japanese origin, with wavy edges at the base giving it a corrugated appearance. Individuals can reach an overall length of 1-3m. It may compete for space with native species that live attached to hard surfaces, including native kelp species, due to its ability to grow quickly and colonise newly cleared areas. It may be a nuisance where it forms rafts and reaches high levels of abundance, fouling jetties, vessels, mooring and buoys. Observed by Liverpool University students in a Liverpool dock in 2012, verified by the MBA. Also reported at Fleetwood marina during a Rapid Assessment Survey by the MBA (2012) (information from Natural England pers. comm.).

Wireweed *Sargassum muticum*[18]

Wireweed (Image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=wireweed&habitat=&organismtype=&cmdSearch=Search) ©Crown Copyright 2009, GBNNSS

Wireweed is a highly distinctive, large, olive-brown seaweed, which grows to over 1m in length. The tough, wiry stem has regularly alternating branches with small, flattened oval blades and spherical gas bladders. It grows intertidally on hard surfaces in shallow waters and is established in the UK, present along the south and west coasts of England, Wales and Scotland (NBN Gateway). It is grazed on by sea urchins and some gastropods.

[16] http://jncc.defra.gov.uk/page-1700 and http://www.marlin.ac.uk/species information .php?speciesID=3335 and http://www.europe-aliens.org/pdf /Ficopomatus_enigmaticus.pdf
[17] http://www.nonnative species.org/factsheet/factsheet.cfm?speciesId=3643
[18] http://www.nonnativespecies.org/factsheet/downloadFactsheet.cfm?speciesId=3141 and http://www.solway firthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20Species/Marine%20INNS% 20in%20 Solway%202013.pdf

The first UK record was in 1973 on the Isle of Wight, and it has since spread along the south coast of the UK. This species is present in the Solway and there are reports of it in intertidal surveys on the West Cumbria coast, as well as in rock pools near Walney West Shore Park (Natural England pers.comm.). Its native range is the north-western Pacific shores of Japan, Russia, Korea and China. It was possibly unintentionally introduced with commercial oysters from Canada, or possibly Japan into France and then reached the UK by natural dispersal or as a fouling organism on boats and shellfish. It reproduces sexually and via floating fragments which can be transported long distances by ocean currents. It is established in many regions around the world.

Wireweed competes with native seaweeds and seagrasses through rapid growth, shading and abrasion. It can dominate rockpools, altering the habitat by reducing the light and changing the temperature. It is also considered a nuisance as large populations can be hazardous to boating in harbours and shallow waters through entanglement of propellers, as well as impairing other recreational activities such as swimming and diving. Economic impacts can be through fouling of commercial oyster beds and fishing gear and other manmade structures, increasing associated costs, and recreation related income may be reduced if activities are impaired.

Appendix 2 – Potential threats from non-key INNS

INNS that could potentially be spread into the NWIFCA district but not of a direct threat to fisheries include two brackish species:

Killer shrimp *Dikerogammarus vilosus*[19]

A highly invasive freshwater shrimp species with only a few known populations in Britain. It is often larger than native freshwater shrimp species and sometimes has a striped appearance. It is a voracious predator, killing invertebrates and small fish. It is able to quickly dominate the habitats it invades and can significantly alter their ecology. It is tolerant of poor water quality and brackish water and can survive in damp conditions for up to five days. It could therefore be spread in ballast water and also by people on kit used in the water, including angling gear, boats, kayaks and trailers.

Killer shrimp (image from http://www.nonnativespecies.org/gallery/index.cfm?searchtype=s&query=killer+shrimp&habitat=&organismtype=&cmdSearch=Search) © Environment Agency

Zebra mussel *Dreissena polymorpha*[20]

A freshwater mussel species with a distinctive striped colouration and shape. They are found commonly across England and Wales and in limited locations in Scotland and Ireland. It inhabits a range of clean and well-oxygenated freshwaters but can tolerate weakly brackish waters. It attaches, usually in groups, by sticky threads to anything solid underwater such as masonry, stones, wooden posts, tree roots or shells. This attachment can block pipework and affect lock gates and other hard structures in the water. They can also significantly alter ecosystems by smothering native species

[19] http://www.nonnative species.org/ factsheet/factsheet.cfm?speciesId=1219

[20] http://www.nonnativespecies.org/factsheet/factsheet.cfm?speciesId=1250andhttp://www.Solwayfirthpartnership.co.uk/uploads/Marine%20Invasive%20Non-native%20Species/marine%20INNS%20in%20Solway%202013.pdf

and rapidly filtering out nutrients from the water. The growth of these colonies is similar to that of marine mussels.

Additional species recorded nearby include:

Bugula neritina: A bryozoan recorded in Holyhead first in 2010

Tricellaria inopinata: A bryozoan recorded in Holyhead first in 2011.

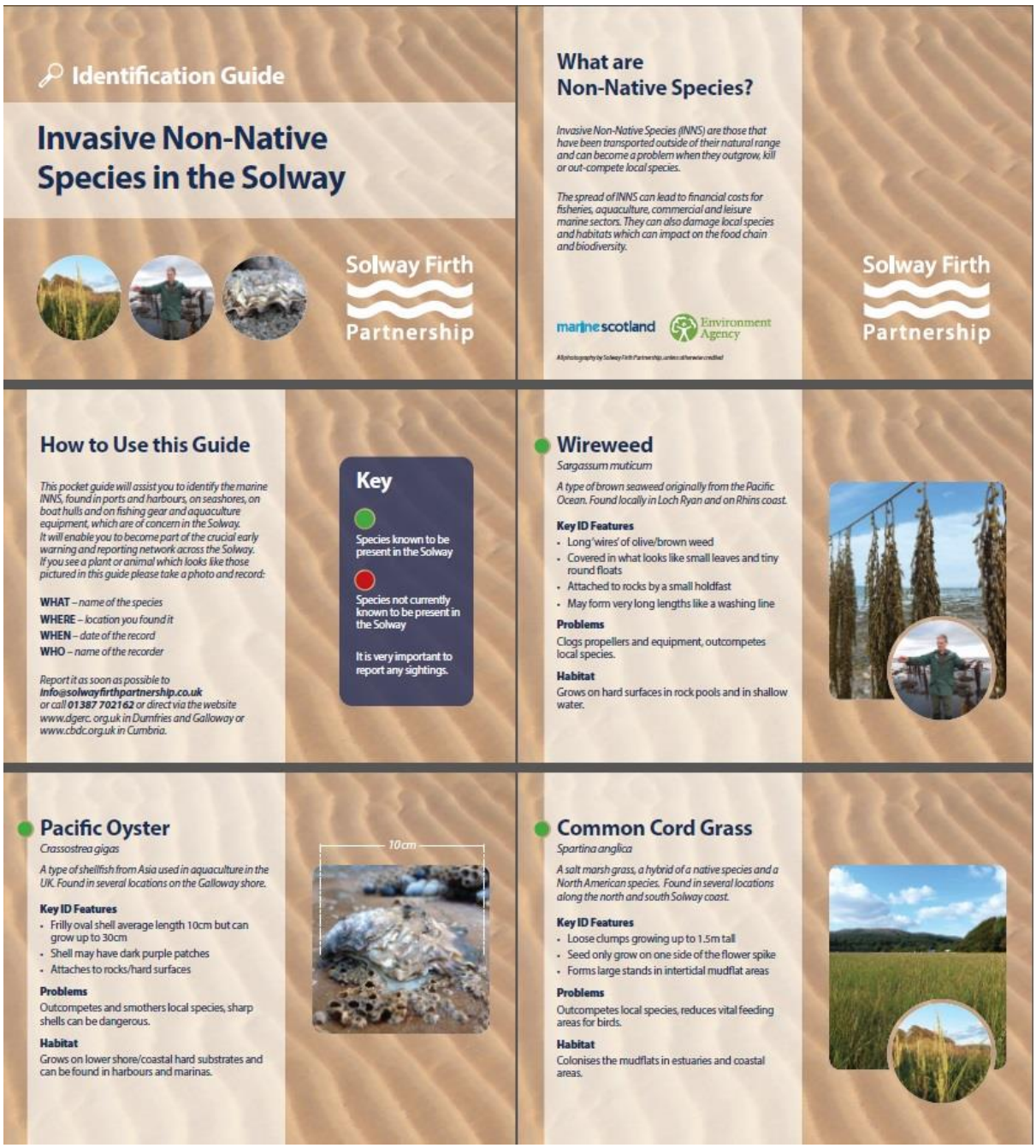
Schizoporella errata/ Schizoporella japonica: An encrusting bryozoan, first record for Holyhead in 2011.

(Overall information taken from 'Invasive Non-native Species in the Solway Identification Guide- Solway Firth Partnership)

Appendix 3– GB NNS 'Check, Clean, Dry' Campaign

www.nonnativespecies.org/checkcleandry

Appendix 4- Solway Firth Partnership INNS ID Guide and Poster



Orange tipped Sea squirt

Corella eumyota

A solitary sea squirt with a bright orange tip which attaches to hard substrates. At least one record on the Galloway Coast.

Key ID Features

- 2–4 cm in length
- Orange siphon in adults although the younger animals do not have the orange tip
- Distinctive curved/U-shaped gut rather than the S-shaped gut of similar sea squirts

Problems

Can clog underwater machinery and smother local wildlife.

Habitat

Attaches to solid surfaces in harbours and marinas as well as natural surfaces.

Darwin barnacle

Elminius modestus

A small sessile barnacle which is native to Australasia. Widely distributed including various sites around the Solway.

Key ID Features

- 5-10 mm in diameter
- White in colour with only 4 outer shell plates and low conical body
- Tolerant of a wider range of salinity and turbidity than native species

Problems

Can dominate hard surfaces and displace native species and can be a nuisance as a fouling organism.

Habitat

Grows on hard surfaces such as rock and shells but also on man-made structures such as boats.

Leathery sea squirt

Styela clava

A brown solitary sea squirt attached by a small flat holdfast at the base of a narrow stalk. Originally from Korea it is now widespread around the UK coast and has been recorded in Loch Ryan.

Key ID Features

- up to 20cm, shaped like a stout bag with 2 siphons
- Leathery appearance, rumpled/knobbly surface
- The siphons are close together with dark brown stripes on the inside

Problems

Large populations dominate and displace native species and can be a fouling pest on ship hulls and aquaculture infrastructure.

Habitat

Attaches to solid surfaces in harbours and marinas as well as natural surfaces.

Green sea fingers

Codium fragile

A spongy green seaweed from Japan, widespread around the UK shore. It has been recorded in Loch Ryan.

Key ID Features

- Grows to around 25cm
- Felt like texture to the fronds
- Fronds are cylindrical, spongy and end in a Y shape
- Form dense clumps
- Confirmation of identification requires a specialist

Problems

Compete with native species for space, forming dense clumps, potential nuisance to fisheries and aquaculture.

Habitat

Occurs in rock pools and attaches to exposed rocks on the lower shore.

Trumpet Tubeworm

Fipomactus enigmaticus

A reef building tubeworm, believed to be native to Australia and regions of the Indian Ocean. It is an aggressive species that dominates habitats, significantly altering water conditions and physical environments resulting in changes to native communities.

Key ID Features

- Thin, white calcareous tubes that turn yellowish-brown with age
- Up to 8cm in length and 0.1-0.2cm in diameter
- Thousands of individuals grow together forming huge reefs

Problems

Can form extensive reefs causing fouling to boat hulls, equipment and blockages to pipes.

Habitat

Found in shallow, sheltered coastal sites such as harbours and marinas.

Chinese mitten crab

Eriocheir sinensis

A brown crab which lives in freshwater – muddy riverbanks, but breeds in seawater. Originally from SE Asia.

Key ID Features

- Dense fur on claws like mittens
- Hexagonal body up to 8cm wide
- Legs very long and hairy

Problems

Cause damage to riverbanks by burrowing; feed on a wide range of native insects and fish eggs competing with native species.

Habitat

Found in rivers and estuaries.

Carpet sea squirt

Didemnum vexillum

A fast growing extensive sheet or mat forming sea squirt thought to be of Asian origin.

Key ID Features

- Firm smooth texture, not slimy
- Variable in colour - white, cream or orange/brown
- Can form long, pendulous outgrowths
- Veined or marbled appearance
- Attachs to boat hulls and other hard subrates

Problems

Fast growing, smothering underwater structures and native plants and animals.

Habitat

Grows in shallow water in marinas and harbours.

Slipper limpet

Crepidula fornicata

Smooth-shelled sea snail found in characteristic chains or ladders of up to 15 individuals. Originally from the USA it was transported to the UK with oysters.

Key ID Features

- A 'toe-nail' shaped shell, up to 5cm long
- Often forms stacks with the oldest shell at the bottom
- White or cream coloured with orange or pink blotches

Problems

Outcompetes local species, major pest of oyster and mussel beds.

Habitat

Attaches to solid surfaces in sediment, low intertidal or shallow coastal water.

Killer shrimp

Dikerogammarus villosus

An aggressive freshwater shrimp found in brackish water. Originally from Eastern Europe and although present in the UK has not been found in Scotland yet.

Key ID Features

- Larger than native shrimps, growing up to 3cm
- Tail with distinctive cones
- Tolerant of brackish and poor quality water
- Can survive up to 5 days out of water in damp conditions

Problems

Kills and outcompetes native species changing the ecology of the habitat.

Habitat

Found in still or flowing brackish water amongst hard surfaces or vegetation.

Zebra mussel

Dreissena polymorpha

A freshwater mussel that can tolerate brackish water.

Key ID Features

- Shell up to 3cm
- Distinctive D-shaped shell
- Light and dark bands of colour
- Attaches by sticky threads, usually in groups, to anything solid underwater

Problems

Can clog pipework and equipment, smothers and outgrows native species.

Habitat

Found in slow moving, brackish water such as in docks attached to hard substrates like stone, wood and pipes.

Japanese skeleton shrimp

Caprella mutica

An aggressive skeleton shrimp originally from NE Asia, which is rapidly invading and has established populations in the North Sea, West coast of Scotland and Irish Sea. It was first recorded in the UK near Oban in 2000 and is found at several sites in the Clyde.

Key ID Features

- Up to 49mm in length, males larger than females
- Fine hairs on the first two body segments
- Large spines on 3rd to 7th body segments in males
- Orange spots on female's brood pouch

Problems

Can clog equipment and nets, outcompetes native species

Habitat

Found in harbours and marinas amongst fouling growth on boat hulls, ropes and nets.

Biosecurity in the Solway

Some invasive species and/or eggs are known to survive for long periods out of water. Marine INNS can hitchhike on equipment, footwear, clothing and boats. When you move to a new site on the coast or elsewhere in the country the species can be released and may become established and alter the ecosystem. You can help to prevent the spread of marine hitchhikers by following a simple three step process every time you leave any water.

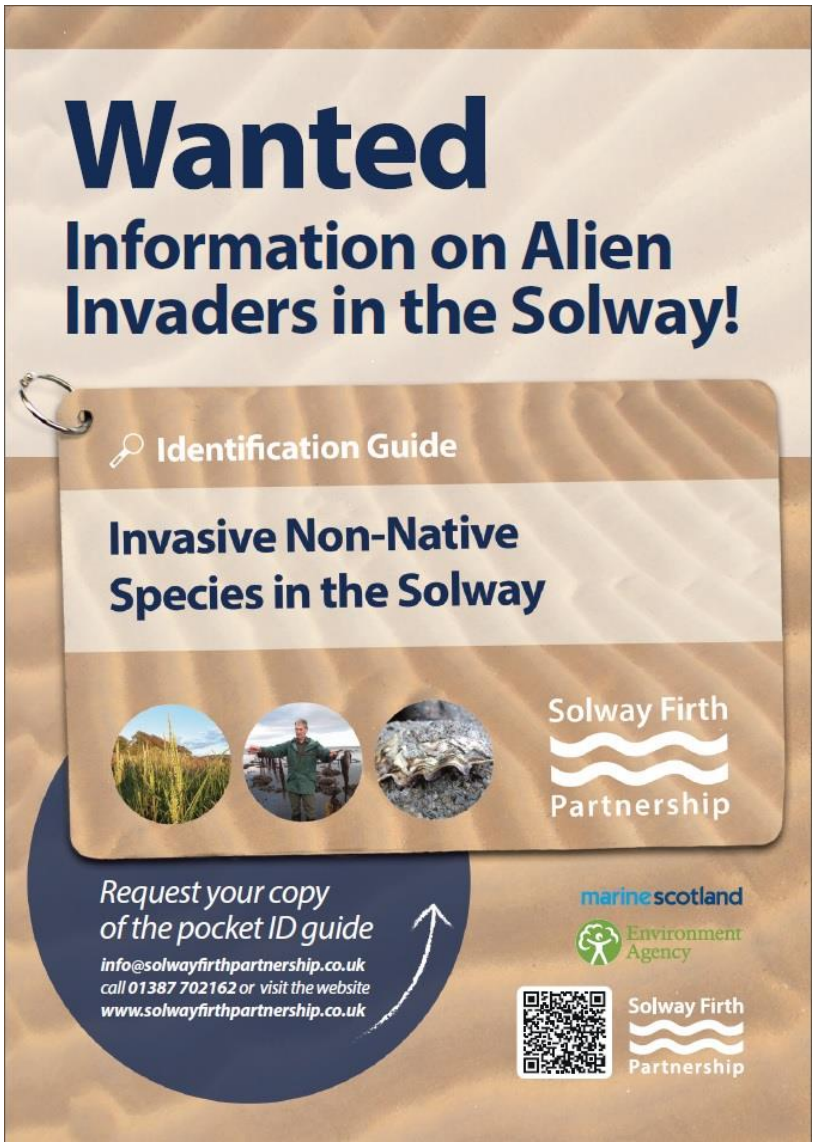
CHECK *Check your equipment and clothing for living organisms. Pay particular attention to areas that are damp or hard to inspect.*

CLEAN *Clean and Wash all equipment, footwear and clothes thoroughly. If you do come across any organisms, leave them at the place on the coast you found them.*

DRY *Dry all equipment and clothing as some species can live for many days in moist conditions.*

STOP THE SPREAD
INVASIVE AQUATIC SPECIES
CHECK-CLEAN-DRY


Further Information
The Wildlife and Countryside Act in England and Wales and the Wildlife and Natural Environment Act (Scotland) 2011 make it an offence to knowingly release or transport a non-native species.
This guide is based on the Biosecurity Plan for the Solway which can be downloaded from www.solwayfirthpartnership.co.uk
Further information about each of these species and the most up to date distribution maps for each can be found at www.nonnativespecies.org the website of the GB non-native species secretariat.
marinescotland
Environment Agency
You can also use your Smartphone to report your sightings:
Solway Firth Partnership


Wanted
Information on Alien Invaders in the Solway!
Identification Guide
Invasive Non-Native Species in the Solway
Solway Firth Partnership
Request your copy of the pocket ID guide
info@solwayfirthpartnership.co.uk
call 01387 702162 or visit the website
www.solwayfirthpartnership.co.uk
marinescotland
Environment Agency
Solway Firth Partnership

Appendix 5 – Biosecurity for submerged structures

*(www.nonnativespecies.org/downloadDocument.cfm?id=568***)**

Biosecurity for submerged structures

(version 1 21/01/11)

Interim guidance – avoiding the spread of invasive non-native species on submerged structures and surfaces.

This guidance sets out simple instructions for disinfection measures to prevent the accidental transfer of invasive non-native species on man made submerged structures and surfaces. This advice is relevant to a range of invasive non-native species, including:

- invasive shrimp *Dikerogammarus villosus*
- carpet sea squirt *Didemnum vexillum*
- leathery sea squirt *Styela clava*
- slipper limpet *Crepidula fornicata*
- zebra mussel *Dreissena polymorpha*
- wakame *Undaria pinnatifida*
- wireweed *Sargassum muticum*.

This guidance should be adopted when removing or transferring any structure or hard surface that has been submerged, including pontoons, walkways, jetties, buoys, posts, chains, ropes, hulls, engines, anchors and cages. The diversity and extent of biofouling species will be largely determined by the length of time the structure has been submerged.

Principles

- Managers of structures deployed in the water environment, including boat users, harbour masters, managers of marinas and boat yards and anyone working within the marine, freshwater or aquaculture industry should familiarise themselves with what these species look like and how they can avoid spreading it.
- Biofouling is one of the major causes of invasive species spread in the freshwater, marine and estuarine environment. Biofouling increases cost and maintenance and alters the ecology of habitats.
- Where feasible, structures should be removed and thoroughly cleaned at the earliest opportunity before transfer, to allow the maximum period of drying. They should also be carefully inspected and, in necessary, thoroughly cleaned on arrival.

- Biofouling waste must be disposed of appropriately.

Actions

- Structures should be removed from the water before cleaning, to reduce potential spread in the environment.
- Heavy encrustations and holdfasts should be removed with scrapers, prior to pressure-washing.
- Particular attention is needed on parts of the structure where access is difficult. These areas are more likely to retain encrustations, moisture and viable biofouling species. When designing structures, avoid these features to reduce cleaning and maintenance effort.
- Thorough drying is essential. The structure should therefore be removed, cleaned and left in a well-ventilated and preferably sunlit location for the maximum duration prior to transfer.
- Structures and boats that have been transferred to the site should be inspected prior to deployment. Any evidence of biofouling must be thoroughly removed away from the water environment. Failure to do so may result in an offence under Section 14 of the Wildlife & Countryside Act 1981.
- Some biofouling species are fairly easy to identify, and records of their presence are very useful. If possible, the species present should be identified and records provided to DASHH, The Data Archive for Seabed Species and Habitats, hosted by the Marine Biological Association. Identification guides are available from the Non-Native Species Secretariat and the Marine Biological Association MarLIN project.
- If you can't identify a species, you can upload an image of it onto iSpot and experts may be able to identify it for you for free.
- If you identify an invasive non native species (including those listed above) on a structure that has been transported to your site you should inform an appropriate person, such as the structure owner or site manager, at the site from which the structure was last deployed.
- Washings must not be allowed to enter the water environment. Microscopic larvae or fragments of organisms are capable of spreading into the wild.
- Waste produced from the cleaning process must be disposed of appropriately. Scrapings may contain residues of anti-fouling paints and must not be allowed to contaminate the environment. This waste must be disposed of at a licensed landfill site. Biofouling organisms

may remain alive for some time after removal and be capable of surviving and spreading if disposed of in the environment.

- Drying waste is an effective method for killing the biofouling organisms, but any other contaminants may still pose a risk to the environment. If the waste only contains organic material that has originated from the site, it can be left to dry just above the spring high water mark if it can be done so without causing a nuisance.

- Otherwise, you should agree the collection and disposal of waste with the Port Health Authority and the Environment Agency.

- Ideally, all cleaning and inspection operations should be supervised by a volunteer or member of staff.

- Invasive species have the potential to be spread on shellfish shells, and cages and ropes used in their cultivation. The Invasive Species Ireland project has produced a draft Marine Aquaculture code of Practice specifically for the shellfish industry.

Useful links

For general information on recognising and managing Dikerogammarus villosus and other invasive non-native species, see the Non-Native Species Secretariat website
https://secure.fera.defra.gov.uk/nonnativespecies/alerts/index.cfm?id=3

Guidance and identification guides are also available at the Marine Biological Association MarLIN project http://www.marlin.ac.uk/

For specific news and advice for boat users see the Royal Yachting Association website http://www.rya.org.uk/Pages/Home.aspx

For advice avoiding the spread of invasive species for the aquaculture industry
http://www.invasivespeciesireland.com/files/public/Codes/Aquaculture%20CoP.pdf

Biological records of marine species should be provided to DASHH, The Data Archive for Seabed Species and Habitats

If you are having problems identifying a plant or animal, advice is available from the iSpot website if you are able to upload an image of it
http://ispot.org.uk/

If you believe you have found a record for Dikerogammarus villosus or Didemnum vexillum at a new site, send an image to
alert_nonnative@ceh.ac.uk

The Australian Government have set up a comprehensive web site to manage the incursion of marine pests. This web site includes a wide range of marine INNS biosecurity guidlines: http://www.marinepests.gov.au/

DEFRA Guidance on Section 14 of the WL&C Act published in 2009 and updated in 2010 can be downloaded at: http://www.defra.gov.uk/wildlife-pets/wildlife/management/non-native/legal.htm

January 2011

For further information please contact Trevor Renals, Conservation & Ecology Technical Services. Tel: 01208 265033, trevor.renals@environment-agency.gov.uk

Appendix 6 – 'That's Invasive!' Smartphone app

(http://www.rinse-europe.eu/smartphone-apps- Th@s Invasive, Natural Apptitude Ltd)

Home > Resources > Smartphone App - That's Invasive!

Smartphone App - That's Invasive!

A crucial part of protecting our environment from the threat of invasive species is knowing detailed information on their numbers and locations. Without a detailed map of their distributions across Europe, we cannot begin to prevent further spread or plan large-scale control programmes. Unfortunately, many of our records for these species are patchy, from unreliable sources and lacking accurate location information.

To tackle this problem, RINSE has created and launched '**That's Invasive**!', a library of species **biology**, **ecology**, **identification** and **images** available at the click of a finger allowing you to **identify**, **photograph** and **record** over **35 invasive non-native species** commonly found within Europe. The app is available in **three languages** and can be downloaded on both iPhone and Android systems.

Using this app, RINSE hopes to harness the capacity of the general public, making them our eyes and ears across Europe in the hunt for invasive species.

What makes our app so special?

- Records from 'That's Invasive!' are verified by an expert using the geo-tagged photographs
- The app opens the recording of invasive species, enabling a wider audience to participate, increasing our records
- Available in three languages, 'That's Invasive!' is a unified recording system for Europe, allowing us to map the distribution of invasive species acrossEurope's most vulnerable area
- The data is accurate, taking advantage of the phone's inbuilt GPS system, the records can be mapped to a higher degree of detail

Want to check the app out? **You can download That's Invasive! on both iPhone and Android.**

Appendix 7 - Invasive Non-Native Species recording schemes and further information sources

Recording schemes

For all species:
http://www.nonnativespecies.org/alerts/index.cfm
http://www.mba.ac.uk/recording/
Email GB NNSS at alert_nonnative@ceh.ac.uk
http://www.marlin.ac.uk/marine_aliens/marine_aliens.htm

Chinese Mitten Crab
http://secure.fera.defra.gov.uk/nonnativespecies/index.cfm?pageid=254
http://mittencrabs.org.uk/contact

'That's Invasive' Smartphone App information available at: http://www.rinse-europe.eu/smartphone-apps

For further information on marine INNS:

GB Non-Native Species Secretariat
https://secure.fera.defra.gov.uk/nonnativespecies/home/index.cfm

For Advice on Best Practice for leisure boaters on preventing the spread of INNS
The Green Blue:
http://www.thegreenblue.org.uk/boat_users/antifoul_and_invasive_species.aspx

RAFTS Invasive Species and Bio-security Programme:
http://www.invasivespeciesscotland.org.uk/biosecurity_programme/biosecurity_plans.asp

International Maritime Organisation Ballast water
http://www.imo.org/OurWork/Environment/BallastWaterManagement/Pages/default.aspx

GB NNSS Identification Sheets to ensure accurate identification of species:
http://www.nonnativespecies.org//index.cfm?sectionid=47

Recording and species information:

http://www.nonnativespecies.org/index.cfm?sectionid=81

Appendix 8 - Disease recording schemes and further information sources

Cefas Fish Health Inspectorate: http://www.cefas.defra.gov.uk/our-services/aquaculture/fish-health-inspectorate.aspx

Cefas Shellfish Biosecurity Plan Template for APBs: www.defra.gov.uk/aahm/files/Book-Shellfish-BMP.pdf