Bangor Mussel Producers LIMITED

Code of Good Practice
for mussel seed movements

2019

Version 2: September 2019

Definition

An Invasive species is defined as a species that is : 1) Non Native (alien) to the ecosystem under consideration and. 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

https://www.invasivespeciesinfo.gov/whatis.shtml

1. BACKGROUND AND INTRODUCTION TO THE CODE

This document, version 2 – September 2019, builds on the original work undertaken by Dr Kate Smith of the Countryside Council for Wales (CCW) and James Wilson of Bangor Mussel Producers Association (BMPA) in 2007-2008. Time goes by and the world changes, this is a universal truth. Within this context the Countryside| Council for Wales are now part of National Resources Wales (NRW) and Bangor Mussel Producers Association became Bangor Mussel Producers Ltd in 2010.

Similarly the role of Grantee of the Menai Strait East Fishery Order, which had resided with the North Western and North Wales Sea Fisheries Committee (and previous incarnations) since its inception in 1962, changed in 2010. The catalyst for this change was the decision by the Welsh Government to take 'in house' responsibilities for fisheries management in Wales. As such, given that Welsh Government was 'de facto' the Grantor of the Fishery Order, and thereby disallowed by legal principle from also being the Grantee, a new organisation was created, to take on the responsibility for holding the Fishery Order and all associated obligations.

This body, the Menai Strait Fishery Order Management Association (MSFOMA), is a company limited by guarantee and incorporated in England and Wales (registered number 07163689). Its membership has been deliberately structured to be inclusive of the most appropriate stakeholders, as such it includes local authorities (both Gwynedd and Ynys Mon, Science (Bangor University) and industry and has an independent chair (previously Dr Sue Utting, currently Mr Alan Winstone). Welsh Government and National Resources Wales also sit with MSFOMA but only occupy the roles of observers. MSFOMA meets at least 4 times a year

The understanding of INNS and of what species present the highest risk and threat to biodiversity has also improved considerably over the previous decade. NRW have commissioned or participated in a number of projects that have looked to better inform the societal response to INNS and develop more effective remedial responses to control or curtail the geographic inclusion of INNS (e.g. PATHWAY).

The work has also been informed through ongoing contact with Dr Arjen Gittenberger of GiMariS, a Dutch based ecological consultancy. Dr Gittenberger has been providing assistance to the Dutch bivalve mollusc processing sector since 2010, in terms of producing a suite of species assemblages associated with those production areas that have trade with the processing sector. The Menai Strait is one of those areas and DR Gittenberger's work has enabled operators and associated regulators to have full taxonomic breakdown of species present over a number of years

The constituent members of Bangor Mussel Producers Ltd (Myti Mussels Ltd, Deepdock Ltd, Ogwen Mussels Ltd, ExtraMussels Ltd, Mon Shellfish Ltd) have agreed with MSFOMA that adherence to the Code of Good practice is inserted within leases that all operating companies hold. Thus adherence to the code and its requirements is obligatory.

i. The threat posed by Invasive Non-Native Species

It is widely accepted that one of the greatest threats to biodiversity across the globe is that posed by Invasive Non-Native Species. Globally, the introduction of organisms through human mediated dispersal into regions where they did not previously exist has resulted in significant ecological, economic and social consequences. The GB Invasive Non-Native Species Framework Strategy, launched in May 2008, provides a strategic framework within which the actions of government departments, their related bodies and key stakeholders can be better co-ordinated. The overall aim of the strategy is to minimise the risks posed, and reduce the negative impacts caused, by Invasive Non-Native Species in Great Britain, with an emphasis placed on prevention.

Invasive non-native species are such a threat because they can disrupt native marine life by preying on or out- competing native species for food and shelter. They can spread disease and also interfere with the genetic integrity (DNA) of native species. The BMP code aims to prevent INNS from spreading or being introduced into water under cultivation via movements of mussel seed. There are a variety of legislative drivers that structure such mechanisms at the Regional and national level, such as the Marine Strategy Framework Directive (MSFD). Under MSFD, a UK monitoring and surveillance list for marine non-native species has been developed (CEFAS in 2015[1]) to focus efforts on 'priority' marine species, representing those that do or could have a high environmental impact. Such considerations have been incorporated within the structure of the Code of Good Practice where applicable and relevant.

ii. Potential for mussel fisheries to contribute to the spread Invasive Non-Native Species

The seabed lay mussel fisheries operating in the Menai Strait are the largest in the UK and account for up to half of the entire UK output. The fisheries are entirely dependant on the import of 'seed' mussels from outside of the Fishery Order areas within which they operate. Seed mussels are fished and then re-laid onto leased plots within Fishery Orders in the Menai Strait, where they are cultured until they reach marketable size, at which stage they are lifted and sold. Seed mussel used in the Menai Strait is sourced most commonly from Caernarfon Bar and Morecambe Bay. In the past, supply has also been supplemented by seed mussels from south Wales (inside and outside of the Burry Inlet), the Thames estuary, the Wash, the south coast of England, Solway Firth, Dornoch Firth, Northern Ireland and the Republic of Ireland.

The import of large quantities of mussel seed into the Menai Strait from other areas around the UK has an associated risk of accidentally introducing Invasive Non-Native Species, not currently occurring in North Wales, with the mussels (either in the mussel seed, substrate or surrounding water).

Until 1992, this risk was assessed under the Molluscan Shellfish (Control of Deposit) Order 1965 (amended 1974 & 1983), which was designed to control the introduction and spread of named shellfish pests and diseases in England and Wales. Decisions on whether or not to issue licences under this Order were carried out on the basis of known or believed incidences of diseases or pest species in the source areas. Though never formally revoked, this legislation was superseded in Great Britain by the Fish Health Regulations 1992 (amended 1997), which control fish and shellfish diseases, but contain no measures to control the spread of shellfish pests. Since 2011, The Welsh Government have once again provided consents under

the Molluscan Shellfish (Control of Deposit) Order 1974, such that the risk of accidentally introducing Invasive Non-Native Species amongst the mussels would be formally addressed through this licencing regime. However, given that the content of this Order has remained static since 1974, the Code provides an additional and higher level of risk management

iii. The need for a Code of Good Practice for mussel fisheries in the Menai Strait

Version 1 of the Code was constructed, in recognition of the absence of alternative formal procedures, it was agreed in May 2007 by an inter-agency group, comprised of the Menai Strait mussel fishing sector, the Sea Fish Industry Authority (Seafish), the Countryside Council for Wales (CCW), the North Western and North Wales Sea Fisheries Committee (NW&NWSFC), the Welsh Assembly Government (WAG), the Marine and Fisheries Agency (M&FA), the Centre for Environment, Fisheries & Aquaculture Science (CEFAS) and the GB Non-Native Species Secretariat (NNSS), that a Code of Good Practice relating to sourcing mussel seed and importing it into the Menai Strait should be drawn up.

Since the development and application of the Code, BMP members have applied it on an annual basis to all movements of mussel seed into the cultivated plots within the Menai Strait Fishery Order. The approach has been successful and no invasive species have been detected within the consignments of mussel seed over the period 2008-2018. The provision and adherence of the Code of Good Practice by Bangor Mussel Producers members was an important factor in the award of the Marine Stewardship Council (MSC) certification for sustainability being awarded in 2010, the first award to a so called ‘enhanced fishery’ anywhere in Europe at the time.

iv. General approach in the Code and longer term options

Version 2 of the Code continues to take a semi-quantitative approach to assess the risk associated with the import of mussel seed.

The protocol within version2 of the Code of Good Practice is simple in form and draws upon the HACCP (Hazard Analysis and Critical Control Point) approach, which has been used to assess levels of risk associated with aquaculture operations elsewhere in the world, to prevent the spread of Invasive Non-Native Species. The HACCP approach to risk analysis and management is science based, systematic and recognized worldwide as an effective hazard control system. It identifies specific hazards and measures for their control, thus allowing regulators to assess what happens in various (aquaculture) operations and evaluate how potential hazards are being handled. The emphasis of this approach is on understanding the whole process and as such requires regulators and industry to communicate closely with each other. As in 2007, when CCW and the Menai Strait mussel fishing sector have worked in partnership to produce this Code, so in 2018 with continued collaboration between Natural Resources Wales and the mussel cultivators.

v. The wider context of Marine INNS in Marine Systems

In December 2017, Natural Resources Wales (Cyfoeth Naturiol Cymru) produced the Priority Monitoring and Surveillance list of Invasive species for Wales. This list represents an accurate and updated reflection of the species of most concern in context of the ability to become invasive. Some of the species on this updated list were incorporated within the Version #1 Code of Good Practice, for example the slipper limpet, (*Crepidula fornicata*), and the Chinese mitten crab, (*Eriocheir sinensis*). Both these species are known to be resident in different part of Wales already, often within or close to locations that have provided a source of mussel seed for the Menai Strait producers. Utilising the understanding of presence in combination with the biological characteristics of these species has enabled industry in combination with NRW to develop risk based approaches to mitigate any inadvertent introduction whilst still enabling movements of mussel seed to occur. A full list of species can be found within Appendix 1 of this document.

2. THE CODE

i. Code protocol

The Code of Good Practice will be applicable to **both ship borne and road movements** of mussel seed into the Menai Strait, and will be in addition to any other regulations currently in force. It is comprised of two elements – firstly a species list, iterative and updated, that describes the most current understanding of the status of INNS species of interest within the context of Welsh Waters. The second element of the code, is its application which breaks down the various stages and operations involved in the sourcing, fishing and relaying of mussel seed and evaluates how potential hazards will be handled at each stage of the entire process. The likelihood that an area dredged for mussel seed (including mussel seed, substrate and surrounding water) would contain any of these INNS depends on the prevalence of the species in the seed collection area (concentration) and whether the pest is evenly distributed throughout the area. In addition, the time of year of harvesting may play an important role in whether they are present in the dredged area. As such, these factors are all taken into account by incorporating certain species specific measures into the Code. Further information on these operations is provided in Appendix B.

ii. Species covered by the Code.

The code of good practice is an evidence based construction. It requires the input of high quality information in respect of invasive species of concern from the perspective of environmental protection, both in terms of where they are and what they can do; and on the other hand it also requires there to be good understanding of the biological and ecological capacity, capability and interactions that occur in order to formulate the best approach to risk managing any movement of mussel seed from potentially contaminated areas.

iii. Current source areas of mussel seed & the intersection with the code.

Whilst the Code is intended to be utilised in respect of all imported movements of mussel seed to the Menai East Fishery order, in reality the number of areas that will be able to provide a source point for mussel seed is limited.

There are four main source zones from where mussel seed has been imported into the Menai Strait in the recent (20yr) past – these are the North West (Including Fleetwood, Morecambe bay, Solway Firth), Mid Irish Sea (including the Dee, Conwy, locations N of Anglesey), Menai Strait (Caernarfon Bar) and South Wales (Port Eynon, Burry Inlet, Three Rivers).

Dialogue and advice from NRW has indicated a more tightly focussed list of species which have the greatest potential to be inadvertently translocated with movements of seed mussel from within these current source areas into the Menai Strait.

The application of the code and the evidence base which supports its identity within the framework of risk management will be more grounded with specific geographical focus. It also includes a more species focussed matrix, with less reliance on the geographic distance between any seed and the

presence of a known INNS. The scientific understanding of the life cycle of many of the major target species, described in table 2 below, has improved considerably over the period 2008-2019

Taxon	Risk	Wales North	Wales South	Dee	Morecambe Bay	Irish Sea	N.Ireland	Scotland
American Slipper *Limpet - Crepidula fornicata*	High	Not Reported	Present	Not Reported	Not reported	Not Well Reported	Present (Belfast Lough)	Present
Carpet Sea Squirt *Didemnum vexillium*	High	Present Holyhead harbour)	Not Reported	Not reported	Not Reported	Not reported	Present (Strangford Lough)	Not reported
Chinese mitten Crab *Eriocheir sinensis*	High	Present (single record Conwy estuary)	Present (disputed record Swansea Bay)	Present	Present (occasional finds Duddon Estuary)	Present (see Morecambe Bay)	Not reported	Present (Reports River Clyde)
Pacific & Portuguese Oyster *Crassostrea gigas* & *C. angulata*	Med	Present	Present	Not reported	Present	Present	Present	Present

A full list of the species currently found on the mussel beds within the Menai Strait Fishery order area has been produced as part of the Dutch protocol to risk manage the introduction of mussels into their coastal waters (including depuration systems directly connected to these waters). This can be found within Annex 3

Iv. Application of the Code

Operation of the code is visualized within Annex 2 of this document. IN terms of the central message – it is key to maintain vigilance at all times. Climate change and the effects of warming sea temperatures elevate the possibilities that the natural range of species will alter. It may increase the likelihood that for some invasive species not currently able to become resident in a new location due to environmental barriers associated with climate, may become a more prevalent risk.

Established practice during the time of Version 1 has been that the Statutory agencies – NRW, are alerted with sufficient notice to **ALL** planned movements or introduction of mussel seed prior to those occurring, by road or by sea. The intention is to maintain this working approach and to build on the level of transparency that already exists between the activities of the mussel sector (Bangor Mussel producer membership and any others), the Menai Strait Fishery Order Management Association (MSFOMA), Bangor University, NRW and Welsh Government in regard to any risks associated with the activities of the sector.

Version 2 of the code is intended to be considered more as a living document and will be adapted on the basis of any new information that comes to light during the following months and years.

Appendix 1 – NRW full list of invasive species of concern

The following tables detail the invasiveness of each species (risk assessment) and this is the basis for the separation of the species into **High, Medium and Low Risk**. Risk Assessment scores were obtained from the GB non-native species secretariat website http://www.nonnativespecies.org/index.cfm?sectionid=51, where available. The lists will be subject to continued review.

INNS already present and breeding in Wales (prioritised according to invasiveness, including spread and impact)

Tables 1 and 2 below take species which are on the UK monitoring list, which have been considered in a Welsh context and have been ranked based on the overall score of their risk assessment.

Table 1. High risk

Species and Group	**Risk Assessment Score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for Selection**	**Primary Introduction Pathway**[1]	**Impact Summary**[2]	**Management Action** (for further information contact NRW Intertidal / INNS ecologist)
Compass sea squirt (*Asterocarpa humilis)* Tunicate	High (CEFAS Rapid Risk Assessment) *	MSFD monitoring list	Fouling	Impact of this species may not be consistent in different locations (marinas vs natural shore). Could be a significant fouler of mussel and oyster culture gear, potentially competing for food with target species or smothering them, and rendering underwater gear and lines cumbersome.	Requirement to collate records from current monitoring as part of MSFD at a UK level. Report sightings if outside current range (action by all parties).
American slipper limpet (*Crepidula fornicata*) Mollusc	High	MSFD monitoring list/WFD High impact/ Schedule 9 of WCA 1981	Aquaculture (accidental contamination)	Smothering, trophic competition and larval predation. Economic impact on shellfisheries. Change to sediment movement.	Requirement to collate records from current monitoring as part of MSFD at a UK level. Report sightings outside current range (action for all parties).

[1] Taken from Stebbing, P., Tidbury, H. and Hill, T. 2015. Development of priority species lists for monitoring and surveillance of marine non-natives in the UK. Cefas contract report C6484. Issue date 30/10/2015.
[2] Summary taken from NNSS risk assessment / CEFAS risk assessment

Species and Group	**Risk Assessment Score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for Selection**	**Primary Introduction Pathway**[1]	**Impact Summary**[2]	**Management Action** (for further information contact NRW Intertidal / INNS ecologist)
Carpet sea squirt (*Didemnum vexillum*)	High	MSFD monitoring list/GB Alert species/WFD	Fouling, Aquaculture (accidental contamination)	Potential reduction in species diversity. Economic, environmental and social impacts are most likely to occur in shellfisheries in the Risk Assessment area. Environmental and social impacts will occur in	Requirement to collate records from current monitoring as part of MSFD at a UK level.
Tunicate		High impact		harbours, marinas and sheltered bays.	Alert species so should be reported to the GB NNSS by all parties. Look to control spread at current sites in Wales (dependant on land ownership/management.
Chinese mitten crab (*Eriocheir sinensis*) Crustacean	High	MSFD monitoring list/EU regulation 1143/2014/WFD High impact/ Schedule 9 of WCA 1981	Ballast water and natural dispersal	Erosion of river banks. Likely to impact native, benthic invertebrate populations in freshwater and marine systems, through predation and competition for space. Potential to outcompete the native white-clawed crayfish. May cause siltation of gravel runs used for spawning by salmon and trout. In native range, crab carries diseases; although unlikely this will spread in GB due to the absence of the primary host snail species. Economic impacts associated with repairing flood defences, land reclamation and river banks damaged by burrowing, loss of salmon and trout fisheries. Potential impacts on native species, such as the common eel.	Requirement to collate records from current monitoring as part of MSFD at a UK level. Stricter regulation for species of 'Union Concern' under EU Regulation. Report sightings outside of current range (action for all parties). Illegal to release or allow to escape into the wild under WCA 1981.

Species and Group	**Risk Assessment Score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for Selection**	**Primary Introduction Pathway**[1]	**Impact Summary**[2]	**Management Action** (for further information contact NRW Intertidal / INNS ecologist)
Devil's tongue weed (*Grateloupia turuturu*) *(includes G. doryphora. All records in the NE Atlantic have been assigned to G. turuturu, see Gavio & Frederic, 2002)* Red alga	Very High (CEFAS Rapid Risk Assessment) *	MSFD monitoring list	Aquaculture (accidental contamination)	Large, fast-growing, may have the potential to displace native species and its large, broad blades may shade neighboring species, however no ecosystem impacts documented in UK. Economic impacts relate to fouling. Fouling of boat hulls reduces the speed and efficiency of boats. Fouling of aquaculture equipment and shellfish can increase harvesting costs and reduce shellfish growth.	Requirement to collate records from current monitoring as part of MSFD at a UK level. Report any sightings outside current range (action for all parties).
Red ribbon bryozoan (*Watersipora subatra*) Bryozoan	High (CEFAS Rapid Risk Assessment) *	MSFD monitoring list	Fouling	The negative impact of this species in marinas and on boat hulls has been documented. However, the potential impact of this species on, for example, shellfish aquaculture and natural shoreline substrate is currently less certain.	Requirement to collate records from current monitoring as part of MSFD at a UK level. Report any sightings if outside current range (action by all parties).

Table 2. Medium risk

Species and Group	**Risk assessment score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for selection**	**Primary introduction pathway**[3]	**Impact summary**[4]	**Action to be taken if found**
Bonnemaison's hook weed (*Bonnemaisonia hamifera*) Red alga	Moderate (CEFAS Rapid Risk Assessment) *	MSFD monitoring list/ WFD	Ballast water and fouling	Very few records exist of *B. hamifera* causing specific detrimental ecosystem, social, or economic effects found within the literature. Analogous species have been classified as invasive, and been shown to cause significant impact, but despite long-term establishment in some regions *B. hamifera* has not been classified in the same way.	Requirement to monitor this species as part of MSFD at a UK level.
Japanese skeleton shrimp (*Caprella mutica*) Amphipod	Medium	MSFD monitoring list/ WFD Moderate impact	Fouling	Potential localised extinction of native caprellid species due to competition; potential impact on plankton communities during summer months; potential economic costs to the aquaculture (fin- and shellfish) industry, commercial shipping and recreational boating industry.	Requirement to monitor this species as part of MSFD at a UK level.
Pacific oyster (*Crassostrea gigas*) Portugese oyster *(Crassostrea angulata)*	Medium	MSFD monitoring list/ WFD Moderate impact	Aquaculture (intentional) and unintentional escapes	Primary economic loss may be though loss of mussel bed fisheries and loss of habitat for other intertidal bivalve species. Economic and social impacts may also be associated with loss of visitors to sites as oysters create a hazardous substrate. Environmental impacts are largely associated with loss of intertidal habitats, including mudflats and bivalve beds. Such	Requirement to monitor this species as part of MSFD where it is found outside of licenced aquaculture sites. Consider local control, dependant on land ownership.
Mollusc				impacts may affect habitats of high conservation value, including mudflats, estuaries, eelgrass beds and biogenic reefs.	

[3] Taken from Stebbing, P., Tidbury, H. and Hill, T. 2015. Development of priority species lists for monitoring and surveillance of marine non-natives in the UK. Cefas contract report C6484. Issue date 30/10/2015.
[4] Taken from NNSS risk assessment / CEFAS risk assessment where available. Other sources of information referenced.

Species and Group	**Risk assessment score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for selection**	**Primary introduction pathway**[3]	**Impact summary**[4]	**Action to be taken if found**
Orange striped anemone (*Diadumene lineata*) Cnidarian	Moderate (CEFAS Rapid Risk Assessment) *	MSFD monitoring list/ WFD (Unknown impact)	Fouling and Aquaculture (accidental contamination)	There are few documented impacts of this species. As a fouling species it will impact ships and boats and submerged infrastructure around marinas and ports etc. In addition fouling of oyster and mussel shells may reduce their growth and ability to feed.	Requirement to monitor this species as part of MSFD at a UK level.
American jack knife clam (*Ensis leei*) Mollusc	Moderate (CEFAS Rapid Risk Assessment) *	MSFD monitoring list	Aquaculture (intentional and accidental contamination) and natural dispersal (ocean currents)	This species has been identified as invasive and therefore is associated with negative impacts. However, the impact of this species is likely to strongly depend on the industry being considered. Impacts to recreation and biodiversity are possible. More information is needed to accurately determine the severity that the negative impact balanced with any positive impacts.	Requirement to monitor this species as part of MSFD at a UK level.
Polychaete tubeworm (*Ficopomatus enigmaticus*) Annelid worm (brackish)	No risk assessment available	MFSD monitoring list/ WFD High impact	Unknown	Its effects on native species are more likely to be beneficial than problematic. Favours waters which present some degree of stress to most open-shore marine organisms. Its requirement for variable-salinity water in which to spawn ensures that the major populations do not interfere with most indigenous species. It is a fouling species which affects ships, buoys and harbour structures.	Requirement to monitor this species as part of MSFD at a UK level.

Species and Group	**Risk assessment score** (NNSS rapid risk assessment / Cefas rapid risk assessment score)	**Justification for selection**	**Primary introduction pathway**[3]	**Impact summary**[4]	**Action to be taken if found**
Japanese wireweed (*Sargassum muticum*) Brown alga	Medium	MSFD monitoring list/ Schedule 9 of WCA 1981/WFD low impact	Fouling and natural dispersal	Unproven impact on biodiversity but will change community structure and dominance, having a visual impact where it forms dense beds. It is potentially a nuisance species.	Requirement to monitor this species as part of MSFD at a UK level. Illegal to release or allow to escape into the wild under WCA 1981. Possible local control, dependent on land ownership/management.
A bryozoan (*Schizoporella japonica*) Bryozoan	Moderate (CEFAS Rapid Risk Assessment) *	MSFD monitoring list	Aquaculture (accidental contamination)	Known to foul man-made and natural structures, altering ecosystems and resulting in economic and social impact. However, the extent to which this species will impact the risk assessment area remains uncertain and will likely depend on the specific location it is present and for example the native species inhabiting this location.	Requirement to monitor this species as part of MSFD at a UK level.
Leathery seasquirt (*Styela clava*) Tunicate	No risk assessment available	MFSD monitoring list/ WFD High impact	Fouling	Large and can become dominant in some habitats. May have negative effects on the abundance and habitat occupancy of other shallow-water suspension feeding sessile invertebrates. Not clear if would cause the local extinction of any species.	Requirement to monitor this species as part of MSFD at a UK level.
Wakame, Asian kelp (*Undaria pinnatifida*) Brown alga	Moderate (CEFAS Rapid Risk Assessment) *	MSFD monitoring list/ Schedule 9 of WCA 1981 /WFD	Aquaculture (accidental contamination), fouling	Impacts may be most likely suffered by the aquaculture industry. Growth on aquaculture cages and equipment. Fouling of boats will reduce their efficiency and results in increased cleaning and antifouling treatment. Out competes of native species.	Requirement to monitor this species as part of MSFD at a UK level. Illegal to release or allow to escape into the wild under WCA.

Surveillance lists

Invasive non-native species not known to be breeding in Wales but likely to arrive (prioritised for surveillance and implementing a contingency plan)

Table 3 contains all of the species on the MSFD surveillance list (or monitoring list if not yet in Wales) which are considered to be of higher risk to Wales. It has been ranked coarsely in order of importance for surveillance, due to the potential impact of the species. This is based on the GB NNSS Risk Assessment score (if available) and/ or score obtained in the UK Horizon scanning report (Roy et al., 2014[5]), where the top score is 125.

Table 3: MSFD Surveillance list

Species and Group	Likely introduction pathway /current distribution	Justification for selection for inclusion in the Welsh contingency plan	Impact Summary	Risk Management /Action (based on impact and ability to manage)
Asian rapa whelk *(Rapana venosa*) Mollusc	Shipping (ballast water) and Aquaculture (accidental contamination) Small stable reproducing population on Brittany coast. In GB, no evidence of established populations but individual records of several Rapa Whelks reported from offshore GB waters in 2005.	MFSD monitoring list (not yet in Wales)/GB NNSS Risk Assessment High/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 100)	Able to rapidly consume large quantities of prey and could become a serious competitor for the native common whelk. Reduced food availability may also impact other predators of bivalves including crabs, birds, fish and starfish. A decline in structure forming bivalves may affect local habitat, resulting in reduced refuge for juvenile crustaceans and other organisms. The provision of larger shells to hermit crabs may allow increased growth and increased demand by hermit crabs on food resources. The diet includes molluscs of commercial interest including oysters, mussels and clams; it has been predicted that successful establishment of this species in Great Britain may threaten the bivalve industry. A rapa whelk of 14 cm is reported to be capable of consuming an eight cm hard clam in less than an hour (NNSS)	**This species is subject to the marine INNS contingency plan.** Rapid response, which could be to investigate incursion, introduce biosecurity measures if possible, and raise awareness with stakeholders.

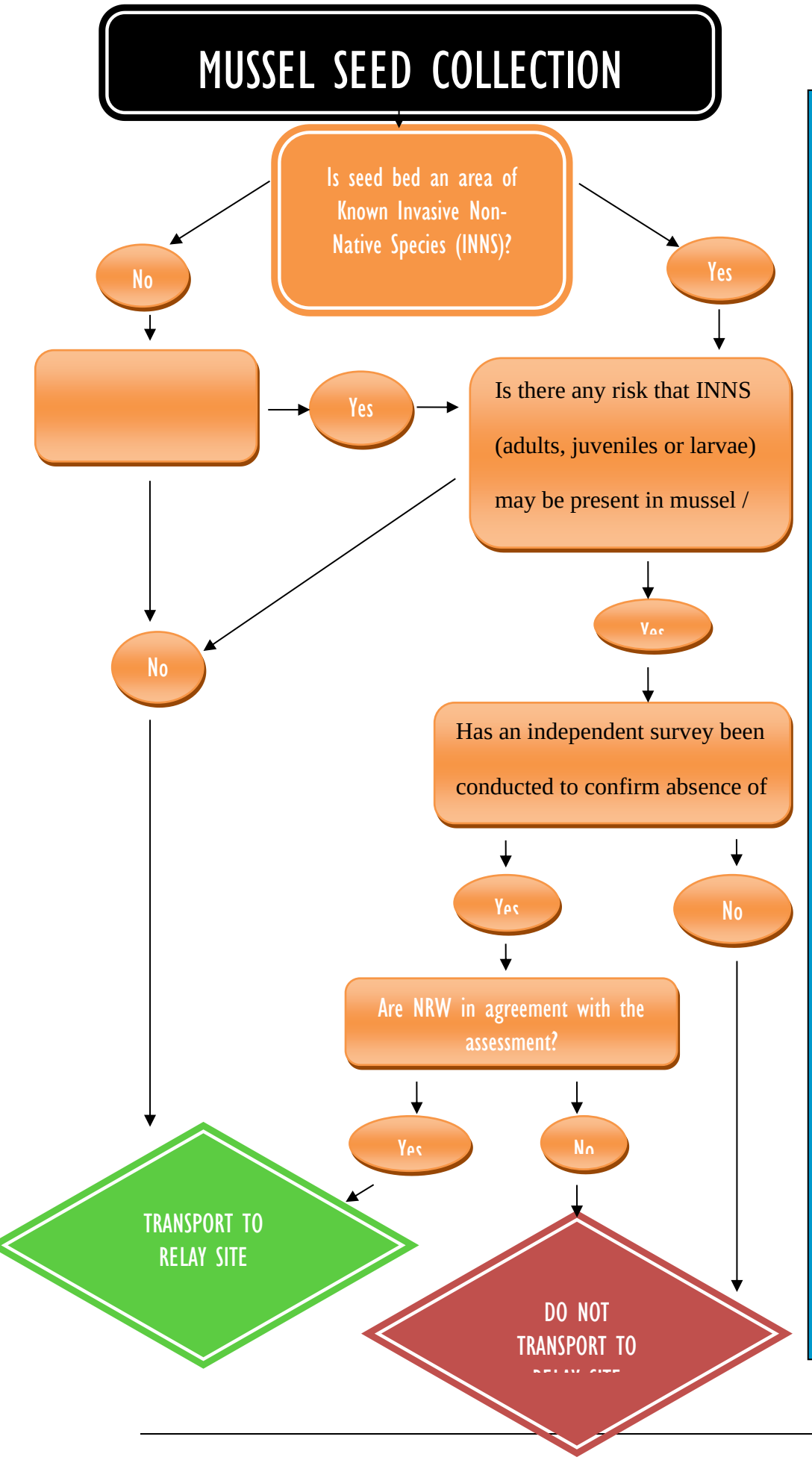
[5] Roy, H.E. , Peyton, J. , Aldridge, D.C. , Bantock, T. , Blackburn, T.M. , Britton, R. , Clark, P. , Cook, E. , Dehnen-Schmutz, K. , Dines, T. , Dobson, M. , Edwards, F. , arrower, C. , Harvey, M.C. , Minchin, D. , Noble, D.G. , Parrott, D. , Pocock, M.K.O. , Preston, C.D. , Roy, S. , Salisbury, A. , Schönrogge, K. , Sewell, J. , Shaw, R.H. , Stebbing, P. , Stewart, A.J.A. and Walker, K.J. (2014) Horizon scanning for invasive alien species with the potential to threaten biodiversity in Great Britain. Global Change Biology, volume 20 (12): 3859–3871.

Species and Group	Likely introduction pathway /current distribution	Justification for selection for inclusion in the Welsh contingency plan	Impact Summary	Risk Management /Action (based on impact and ability to manage)
American oyster drill *(Urosalpinx cinera)* Mollusc	Transported with oysters. Already established in England	MFSD monitoring list (not yet in Wales)/CEFAS Rapid Risk Assessment High/WFD High Impact	Preys heavily on native oysters and may compete with native molluscs such as the dog whelk *Nucella lapillus.* Lacking a free swimming larval phase, local populations increase rapidly as dispersal is limited. Juveniles are able to drill oyster spat and barnacles as soon as they emerge from egg capsules. As a serious pest to the commercial oyster industry, impacts to communities dependent on local fisheries may be significant (NNSS)	**This species is subject to the marine INNS contingency plan**. Rapid response, which could include; investigate incursion, eradication, introduce biosecurity measures if possible, and raise awareness with stakeholders.
American lobster (*Homarus americanus*) Crustacean	Imported live, escape or release from holding facilities Found sporadically in the English Channel since 1998. One individual caught in Scotland, 2 in southeast. No established populations (NNSS). A live individual was found in North Wales in 2016.	MSFD monitoring list/NNSS rapid Risk Assessment High/ WFD waiting list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 100)	Could outcompete native lobster for food and shelter, danger of hybridisation with native lobster, may compete with edible crab, significant disease risk for native lobster (white spot syndrome and epizootic shell disease), potentially significant economic impact due to loss of native lobster (NNSS Risk Assessment Summary)	**This species is subject to the marine INNS contingency plan.** Rapid response, which could be to investigate incursion, introduce biosecurity measures where possible, and raise awareness with stakeholders.
Red algae *(Gracilaria vermiculophylla)* Alga	Main Pathway of introduction is via oyster movements Present in Northern Ireland	MFSD surveillance list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 100)/EU Horizon scanning 500/WFD list (unknown)	Potential negative effect on native algae and seagrass (Global Invasive Species Database)	**This species is subject to the marine INNS contingency plan.** Report sighting.

Species and Group	Likely introduction pathway /current distribution	Justification for selection for inclusion in the Welsh contingency plan	Impact Summary	Risk Management /Action (based on impact and ability to manage)
American comb jelly (*Mnemiopsis leidyi*) Ctenophore	Ballast water (from risk management info) No records from GB but recently recorded from the North Sea off Netherlands coast (NNSS)	MFSD surveillance list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 100)/WFD Alarm list,	Major predator of zooplankton, fish eggs and larvae. Following introduction into the Black Sea a dramatic decrease in abundance of almost all prey species of pelagic fish and the disappearance of some zooplankton species was observed (NNSS)	**This species is subject to the marine INNS contingency plan.** Report sighting.
Asian shore crab (*Hemigrapsus sanguineus*) Crustacean	Ballast water and natural dispersal Individuals in South Wales (one record in Wales in 2014 – not confirmed as resident) and Kent. Found in Channel Islands since 2009 (NNSS)	MFSD surveillance list/NNSS rapid risk assessment High /WFD list as High impact (waiting list) /UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 100)	Aggressive and highly opportunistic omnivore, may significantly affect native crab, fish and shellfish populations by disrupting the food web. Known to feed on commercially important shellfish species (NNSS risk assessment).	**This species is subject to the marine INNS contingency plan.** Report sighting.
Asian/Japanese oyster drill (*Ocenebra inornata*) Mollusc	Likely to be transported with shellfish	MFSD surveillance list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 80)/WFD Alarm list	Predatory on bivalves, pest on oyster beds.	**This species is subject to the marine INNS contingency plan**. Rapid response, which could include; investigate incursion, eradication, introduce biosecurity measures if possible, and raise awareness with stakeholders.

Species and Group	Likely introduction pathway /current distribution	Justification for selection for inclusion in the Welsh contingency plan	Impact Summary	Risk Management /Action (based on impact and ability to manage)
Celtodoryx ciocalyptoides Sponge	Likely to be transported through movement of shellfish	MFSD surveillance list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al. 2014, score 60)/EU Horizon scanning 192/WFD Alarm list	Characterised by an extensive spatial broading and it rates today among the dominant benthic megafauna in the shallow waters of the Gulf of Morbihan and Dutch inshore waters. It competes successfully with other macrobenthic organisms, overgrowing some of the other sessile invertebrates such as other sponges and octocorals (Perez *et al*., 2006).	**This species is subject to the marine INNS contingency plan.** Report sighting.
Brush clawed shore crab (*Hemigrapsus takanoi*)	Ballast water, unintentionally with transportation of oysters for aquaculture,	MFSD surveillance list/UK Horizon Scanning Top 30 highest–risk future alien invasive species (Roy et al.	In Holland where densities are high, there has been a drastic reduction in the juvenile native common shore crab. In Dunkirk harbour this species has replaced the common shore crab.	**This species is subject to the marine INNS contingency plan**.
Crustacean	or associated with hull fouling communities. Natural range expansion following initial introductions occurs when pelagic larvae are dispersed by currents (NNSS website) First recorded in the UK in 2014 from River Medway, Kent and River Colne, Essex. In 2016, the species was recorded as very abundant in the River Orwell, Suffolk.	2014, score 100)	A similar impact could occur in GB (GB NNSS factsheet)	Report sighting.

Species and Group	Likely introduction pathway /current distribution	Justification for selection for inclusion in the Welsh contingency plan	Impact Summary	Risk Management /Action (based on impact and ability to manage)
Barnacle *(Amphibalanus amphitrite)* Crustacean	Ballast water and fouling	MSFD monitoring list / WFD	Fouls boat hulls, marina structures, equipment and aquaculture species resulting in both environmental and economic consequence. Level of impact for future introduction into the risk assessment area currently unclear.	Need to confirm species is breeding in Wales.
Hesperibalanus fallax Crustacean	Fishing equipment	MSFD monitoring list	It is apparent that species may pose a risk to a native species of sea-fan (*E. verrucosa*) listed as a vulnerable by the IUCN and Section 7 list. Potential fouling organism.	Need to confirm species is breeding in Wales.



ADDITIONAL PRECAUTIONARY MEASURES

- Maintain vigilance at all times
- Use of floodlights during night fishing to allow effective visual inspection
- Ensure no hull fouling
- Ensure any ballast water is exchanged in appropriate locations

Annex 3 – Species Assemblage Menai Strait (GiMARiS - 2014)

Tabel 2. De SASI lijst met soorten die levend bij de monstername tussen de mosselen zijn aangetroffen. Exoten zijn geel gearceerd.

Soort	Auteur	Hoofdgroep	Status
Aglaothamnion cf *hookeri*	(Dillwyn) Maggs & Hommersand	Algae	Inheems
Aglaothamnion tenuissimum	(Bonnemaison) Feldmann-Mazoyer	Algae	Inheems
Antithamnionella spirographidis	(Schiffner) E.M.Wollaston	Algae	Exoot
Ascophyllum nodosum	(Linnaeus) Le Jolis	Algae	Inheems
Ceramium secundatum	Lyngbye	Algae	Inheems
Ceramium virgatum	Roth	Algae	Inheems
Chorda filum	(Linnaeus) Stackhouse	Algae	Inheems
Dictyota dichotoma	(Hudson) J.V.Lamouroux	Algae	Inheems
Dumontia contorta	(S.G.Gmelin) Ruprecht	Algae	Inheems
Erythrotrichia carnea	(Dillwyn) J.Agardh	Algae	Inheems
Fucus serratus	Linnaeus	Algae	Inheems
Fucus vesiculosus	Linnaeus	Algae	Inheems
Furcellaria lumbricalis	(Hudson) J.V.Lamouroux	Algae	Uitheems
Gracilaria gracilis	(Stackhouse) Steentoft, Irvine & Farnham	Algae	Inheems
Griffithsia corallinoides	(Linnaeus) Trevisan	Algae	Inheems
Halurus flosculosus	(J.Ellis) Maggs & Hommersand	Algae	Inheems
Plocamium cartilagineum	(Linnaeus) P.S.Dixon	Algae	Uitheems
Polysiphonia elongata	(Hudson) Sprengel	Algae	Inheems
Polysiphonia fucoides	(Hudson) Greville	Algae	Inheems
Pylaiella littoralis	(Linnaeus) Kjellman	Algae	Inheems
Rhodomela confervoides	(Hudson) P.C.Silva	Algae	Uitheems
Rhodophyllis divaricata	(Stackhouse) Papenfuss	Algae	Uitheems
Saccharina latissima	(Linnaeus) Lane, Mayes, Druehl & Saunders	Algae	Inheems
Sargassum muticum	(Yendo) Fensholt	Algae	Exoot
Stylonema alsidii	(Zanardini) K.M.Drew	Algae	Inheems
Ulva cf *pertusa*	Kjellman	Algae	Exoot
Ulva compressa	Linnaeus	Algae	Inheems
Lepidonotus squamatus	(Linnaeus, 1758)	Annelida	Inheems
Lineus longissimus	(Gunnerus, 1770)	Annelida	Inheems
Spirobranchus triqueter	(Linnaeus, 1758)	Annelida	Inheems
Sthenelais boa	(Johnston, 1833)	Annelida	Uitheems
Tubulanus superbus	(Kölliker, 1845)	Annelida	Uitheems
Alcyonidioides mytili	(Dalyell, 1848)	Bryozoa	Inheems
Alcyonidium diaphanum	(Hudson, 1778)	Bryozoa	Inheems
Celleporella hyalina	(Linnaeus, 1767)	Bryozoa	Inheems
Conopeum reticulum	(Linnaeus, 1767)	Bryozoa	Inheems
Flustra foliacea	(Linnaeus, 1758)	Bryozoa	Inheems
Abietinaria abietina	(Linnaeus, 1758)	Cnidaria	Inheems
Alcyonium digitatum	Linnaeus, 1758	Cnidaria	Inheems
Dynamena pumila	(Linnaeus, 1758)	Cnidaria	Inheems
Halecium halecinum	(Linnaeus, 1758)	Cnidaria	Inheems
Hydrallmania falcata	(Linnaeus, 1758)	Cnidaria	Inheems
Metridium senile	(Linnaeus, 1761)	Cnidaria	Inheems
Nemertesia antennina	(Linnaeus, 1758)	Cnidaria	Uitheems

Soort	Auteur	Hoofdgroep	Status
Obelia geniculata	(Linnaeus, 1758)	Cnidaria	Inheems
Obelia longissima	(Pallas, 1766)	Cnidaria	Inheems
Sertularia cupressina	Linnaeus, 1758	Cnidaria	Inheems
Austrominius modestus	(Darwin, 1854)	Crustacea	Exoot
Balanus crenatus	Bruguiére, 1789	Crustacea	Inheems
Cancer pagurus	Linnaeus, 1758	Crustacea	Inheems
Carcinus maenas	(Linnaeus, 1758)	Crustacea	Inheems
Macropodia rostrata	(Linnaeus, 1761)	Crustacea	Inheems
Melita palmata	(Montagu, 1804)	Crustacea	Inheems
Necora puber	(Linnaeus, 1767)	Crustacea	Inheems
Pagurus bernhardus	(Linnaeus, 1758)	Crustacea	Inheems
Pisidia longicornis	(Linnaeus, 1767)	Crustacea	Inheems
Amphipholis squamata	(Delle Chiaje, 1828)	Echinodermata	Inheems
Asterias rubens	Linnaeus, 1758	Echinodermata	Inheems
Ophiothrix fragilis	(Abildgaard, in Müller, 1789)	Echinodermata	Inheems
Psammechinus miliaris	(P.L.S. Müller, 1771)	Echinodermata	Inheems
Buccinum undatum	Linnaeus, 1758	Mollusca	Inheems
Doris pseudoargus	Rapp, 1827	Mollusca	Inheems
Lepidochitona cinerea	(Linnaeus, 1767)	Mollusca	Inheems
Littorina littorea	(Linnaeus, 1758)	Mollusca	Inheems
Patella vulgata	Linnaeus, 1758	Mollusca	Inheems
Polycera quadrilineata	(O.F. Müller, 1776)	Mollusca	Inheems
Pholis gunnellus	(Linnaeus, 1758)	Pisces	Inheems
Hymeniacidon perlevis	(Montagu, 1818)	Porifera	Uitheems