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UK Non-Native Species Secretariat
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Dear Sirs

UK non-native organism risk assessment scheme V3.3
***Crassostrea gigas* – Pacific oyster**

The Sea Fish Industry Authority (Seafish) is a non-departmental public body that provides support to all sectors of the seafood industry. It is not involved in resource or environmental management, but has interests in the outcomes of the management process. Seafish has a publicly stated commitment to "*the sustainable and efficient harvesting of those resources on which the UK seafood industry depends, the protection of marine ecosystems and the development of marine aquaculture based on sustainable resource utilisation and best environmental practice*".

We are writing in relation to the recent risk assessment published for the economically important non-native oyster species *Crassostrea gigas,* Thunberg, more commonly known as the Pacific or Japanese oyster. It is the mainstay of the UK oyster cultivation industry since its introduction by MAFF in 1965 and it contributes an estimated £3.3 million at first sale value to the UK economy each year.

We share the concerns expressed by and strongly endorse the comments and representations made in the detailed responses from the industry representative bodies, namely the Shellfish Association of Great Britain (SAGB) and the Association of Scottish Shellfish Growers (ASSG).

We consider that there are considerable technical short-comings and unsubstantiated assumptions in the document, but before moving on to them we have the following more general observations:

1. The risk assessment does not appear to have been peer reviewed.
2. We note that the risk assessment document does not list the academic authors or the date of completion.
3. The citation list is selective and restrictive; it does not fully reflect the breadth of knowledge on this species.
4. The document does not state the reason(s) for performing the risk assessment; the very first step in the process.

5. It is extremely doubtful that the entire 573 060 ha identified as potential habitat would be suitable for Pacific oysters and no attempt has been made to refine the criteria to make the assumption more credible.
6. The entire document does not appear to have been completed in an objective manner. Whenever or wherever a negative effect can be noted from elsewhere in the world it is given more weight than actual UK experience. Whereas none of the more positive (or non-negative) effects noted in the UK appear to get equal credence.
7. It is extremely tenuous to attempt to consider the Waddenzee to be comparable to the majority of the UK habitats that might be considered to be 'at risk'. The Waddenzee, whilst the only European example of where potential negative impacts may most clearly be postulated, is, by the documents own admission, a very much smaller area than the UK habitats, and it is far more restricted in its nature. Very very few UK areas would warrant direct comparison.
8. In many instances a very simplistic view of a complex set of factors has been taken; usually with a negative interpretation and consequences.
9. The scores awarded in the risk matrix appear to be very arbitrary, particularly as the narrative in the 'Comment' section often does not answer directly the question posed in the first column or offer any insight as to the scoring. They tend to offer parallel or tenuously related information at best.
10. The UK's traditionally tighter legislative controls on Pacific oyster cultivation, imports and movements do not appear to have been considered.
11. There does not appear to have been any liaison with any sectors of the UK industry to discuss their practices and experiences.
12. There are few references to actual UK experience, but many references to the experience of other countries.
13. Taken in its totality, many of the conclusions in the risk assessment lack substantive evidence. There is a lack of direct knowledge and there appears to be a bias in its tone. It is to be hoped that the risk assessments for other species are of a higher standard.
14. Consideration should be given to the approaches being adopted by other EU nations so as not to disproportionately affect the UK industry, with little environmental gain.

Moving on to a more detailed consideration of the points made in the risk assessment, we offer the following observations and additional information.

Reproduction

We would like to know the source data used to compile the scores when discussing matters relating to reproduction.

The UK aquaculture industry is dependent upon hatchery produced seed from a limited number of closed system hatcheries, 2 in England and 1 in the Channel Islands. Reproducing the species, even in the controlled conditions of well established hatcheries is far from guaranteed and straight forward and output varies year on year. The larvae are a very sensitive and delicate stage, they lack the robustness of the adults and are easily killed by incorrect conditions. Reproduction under natural conditions is far harder and very much less certain.

In UK field conditions there is evidence from industry of successful reproduction in some areas and in some years when ideal conditions (water temperatures above 19^{o} C) have pertained for long enough to allow larval settlement. The majority of these areas are restricted to the southern part of the UK. However, there appears to be little evidence of consistent reproduction year on year. It is also true that as one moves north, the likelihood of reproductive success decreases in proportion to decreasing summer sea temperatures.

At best, the evidence from industry suggests that in ideal conditions only a small proportion of a population mature in to breeding condition and of these only a small proportion go on to spawn successfully. From the industry, we know that in a hatchery, the larvae spend between 14 - 21 days in the planktonic phase before settlement. In nature, where temperatures are more variable and generally lower, the planktonic phase is likely to be extended towards the 21 – 30 days cited or beyond. Again from hatchery experience, we know that temperature fluctuations weaken the larvae and the longer the planktonic phase, the less likely the larvae are to complete development and settle. In addition, in nature the longer the planktonic period, the higher the likely larval losses will be to predation and other causes of natural mortality, thus reducing the chances of any settlement.

UK cultivators generally welcome warmer summers, when they occur, as they help to produce high quality animals in good condition. However, the last thing they desire is for the animals to spawn as this results in a drastic loss of condition and it renders the stock unsaleable. Many operators manage their stocks accordingly, actively seeking through good husbandry to reduce the likelihood of spawning if it is thought likely. For instance, stock may be moved carefully to a sub-tidal or very low intertidal location so that it is submerged in cooler waters for longer.

If reproduction from UK cultivation sites were widespread and consistent, it would undermine the very basis of the industry, as Pacific oysters are not a seasonal harvest, but a year-round one. In addition, it is highly likely that the farms would have registered the settlement either on their site or in the locality and used this source of ‘free’ seed for future cultivation. This is not the experience of the vast majority.

The experience of areas where there has been settlement is that it is seldom sufficient and reliable enough to form the basis of a commercial enterprise, although small-scale artisanal fisheries have sprung up in some locations to exploit the stock. These fisheries tend to be vulnerable and vary markedly between years. Effort will be switched elsewhere in very poor years.

To date and so far as can be ascertained, the locations that we are aware of that are cited as areas where successful reproduction and recruitment has been witnessed have, at some point in the past, had Pacific oysters present in the area or close by for cultivation or other purposes.

The use of triploid only stock for cultivation has been proposed, but it is a far from fool-proof system. In many instances the induction of triploidy is not 100% and reversion to diploidy has been reported. There are also potential issues of consumer sensitivity to be considered.

Larval dispersal

The information in the risk assessment relating to larval dispersal requires substantiating and referencing. There is a pressing requirement for further research to establish beyond doubt the precise dispersal mechanisms and larval preferences for this species.

In order to travel '*up to 1300 km*' the larvae, if maintained at hatchery temperatures, would have to move between 60 – 90 km per day. There are very few areas in the UK where the tidal residuals are likely to approach that value. Extending the development time by lowering the temperatures would lessen the daily distance requirement, but equally it would decrease the likelihood of completing successful metamorphosis. In addition, evidence from elsewhere suggests that larval dispersal, when it occurs, is more likely to be in the region of 5 -10 km as cited by SAGB rather than longer distances.

It is also far from proven that Pacific oyster larvae are the passive drifters assumed in the document. It is becoming increasingly accepted that many planktonic larvae seek, through various mechanisms and behaviours, to regulate their position within the water column and thereby influence their dispersal. In general, it appears that many larvae seek to remain close to the optimal areas where they were spawned or to arrive back at these locations after completing their development process. There is some suggestion of preferential settlement towards existing adult populations. It is usually acknowledged that good growing areas for the adults are good also for the juveniles.

Contrary to the impression generated in the risk assessment, temperature is not the only or even the main factor that influences larval development and dispersal. The complex interacting factors influencing development are covered in the literature and do not require restating.

Predators, competitors and pests

The information sources relating to predators etc in the risk assessment appear to be sparse. Pacific oysters are far from free of predators.

During their planktonic phase Pacific oyster larvae are likely to be subject to the same predatory pressures as any other larvae. There is no evidence that their survival is any greater than any other species. Hatchery experience suggests that it might be lower.

On settlement after metamorphosis the spat are subject to predation by a number of species. From the experience gained through cultivating small spat, they are very vulnerable to starfish (various species), crabs (particularly brown *Cancer pagurus*, shore *Carcinus maenas* and, in some areas, velvet *Necora puber*) and birds. In some areas cultivators have to double or treble bag their stock to protect them from predation by the Oystercatcher *Haematopus ostralegus*. This problem is particularly acute at the smaller sizes, but does apply to all size classes. It has also been suggested that Eider duck *Somateria mollissima* may predate small oysters. These direct observations appear to be at variance with the assertions made in the risk assessment, but they are why the industry now seeks to purchase seed at the largest economic size in order to minimise such losses. In addition, husbandry practices have evolved to manage or mitigate the chances of losses to these predators.

In some locations both the native tingle (*Ocenebra erinacea*) and the non-native American tingle (*Urosalpinx cinerea*) can cause substantial losses at all sizes if they are not properly controlled and managed.

The introduced Slipper limpet (*Crepidula fornicate*) is a serious competitor and pest to cultivators in some areas. Dense formations and settlement can smother stock.

More importantly, in view of opinions expressed in the risk assessment, it is the direct experience of UK cultivators that dense settlement of the native Blue mussel (*Mytilus edulis*) spat can and has caused serious problems in some years by smothering Pacific oyster stock and preventing feeding and respiration. The problem has been particularly acute in nursery locations and has resulted in a shortage of oyster spat for the industry. This experience directly contradicts the information cited in the document. In the Waddenzee it is likely that the damage caused to mussel beds has allowed Pacific oysters to fill the niche to the extent that they might be considered as detrimental to the mussels. However, this is not the case in vast majority of areas in the UK. Whilst Pacific oysters have been found on an important mussel bed in the Wash, and this has caused concern, there is no evidence to suggest that they might be or are a problem on the majority of UK mussel seed beds. In deed, mussels are more often a problem for the oyster producer than vice versa.

Similarly dense barnacle settlement has smothered stocks in some areas in some years. Again the smaller sizes are most vulnerable but it can affect even marketable stock.

Mud worm (*Polydora ciliate*), sponges (*Cliona spp*), sea squirts (Ascidiacea) and pea crabs (*Pinnotheres spp*) also cause problems and losses to cultivators and can be expected to do so to non-contained stock.

For UK cultivators, pest and predator control is one of the main husbandry tasks. It goes on year-round, but peak vigilance and activity is through the spring to autumn when pest and predator settlement occurs and the adults are most active. Without such actions farm losses are great. Unprotected stock might be expected to be far more vulnerable.

Due to the responsible actions and practices of the growers the UK, fortunately, appears to be free, at this time, of most of the diseases that can cause death in Pacific oysters. Of particular concern is the recent occurrence of large-scale mortalities in France and Ireland from what is now thought to be a herpes virus outbreak. However, should this disease cross to the UK, there is the potential for high mortalities within both cultivated and non-cultivated populations. Strenuous efforts are taking place to try and ensure that it does not transfer to the UK.

The pressures affecting farmed stock, which are protected and cared for, would equally affect stock in the natural environment – and it might be expected to a greater extent. Were such natural checks and balances not present around the UK shores, far greater densities of uncontained Pacific oysters might be expected in areas where they have been shown to reproduce, but they have not been observed.

Cultivation

Where was the information about cultivation practices in the UK derived from? It appears to show little appreciation of the realities.

To grow successfully Pacific oysters have a set of fairly specific requirements that are well documented within the literature. From direct experience it is known that not every site that appears on paper to offer a suitable location for growth will actually support the animals. More often than not other factors, often not immediately apparent, will prevent successful rearing. The industry would be amazed to learn that 573 000 ha might be considered suitable habitat; in practice very few of the areas will provide the conditions required for successful establishment.

Pacific oyster cultivation in the UK is dependent upon seed sourced from closed system hatcheries. Biosecurity is a major concern for the hatcheries. There is no deliberate or commercial reproduction in open marine systems.

Oyster densities per bag or pocket vary depending on the size of the animals, being greater with smaller spat and least at harvestable size. Operators reduce densities progressively to ensure optimal growth, shape and body condition as the animals grow. To achieve their goals most growers stock at below the maximum possible density.

Bags or pockets are grouped together on trestles or, more recently, lines set intertidally. The arrangement of trestles, inter-bag distances and overall stocking varies from site to site. It is dictated by the direct experience of the operator and depends upon the physical and biological factors that pertain to that particular location. Again it it's the growers goal to achieve optimal growth and development in a natural environment. Over-stocking results in poor growth and low quality, so operators do their utmost to avoid falling in to that trap.

In the UK all cultivation sites are discrete and separated in accordance with established locational guidelines and separation distances. The majority of sites are small; in Scotland around 66% produce less than 5 tonnes per annum and only a very few operators produce over 10 tonnes (>125 000 shells) per year, usually from 2 or more locations.

Pacific oyster cultivation is not a large-scale or high density business in the UK and this is unlikely to change. This is in marked contrast to the situation elsewhere in Europe.

It would not be viable for the industry to move towards only cultivating the native Flat oyster (*Ostrea edulis*). Flat oysters are more difficult to breed, less robust, more prone to disease, slower growing, are a seasonal harvest, require greater working capital and investment, and have a small niche market that is unlikely to expand significantly. These are the very reasons why Pacific oysters became the species of choice for cultivation in the first place. Were UK reared Pacific oysters unavailable, the price differential would ensure that the demand was met by imports. This carries a number of risks such as importing non-native species, parasites or diseases. It would decrease national food security and would also adversely affect the UK economy.

Controls

The use of 'detrimental control measures' is referred to in the risk assessment, but the methods used or considered are not explained or cited.

In some locations where optimal summer conditions more regularly facilitate successful spawning, settlement, survival and growth, small-scale localised fisheries have developed to harvest the non-cultivated Pacific oyster stocks. They utilise very light-weight gear that is acknowledged to cause very little environmental impact in comparison to more conventional fishing dredges. Natural England is recorded as viewing these fisheries favourably.

These fisheries act as a brake upon the increase in population that may settle in to the natural environment. Prosecuted and managed responsibly using appropriate gear they can successfully control and constrain Pacific oysters in areas where they may occasionally prove problematic. In most instances this can be achieved with minimal impact on non-target species and the environment. Such a course of action may be under consideration in the Wash.

These fishers and the cultivators also form a valuable surveillance resource that can be used to monitor the environment and to provide appropriate controls when and where required.

Biodiversity

There is little or no evidence that Pacific oysters have adversely affected the biodiversity of UK shores. Such effects have been postulated from elsewhere in Europe, but set against that there are contra suggestions from N America and Europe that Pacific oyster beds can, in some circumstances, increase biodiversity within an area.

Changes observed within the Waddenzee are unlikely to be due to Pacific oysters per se. They are more likely the result of Pacific oysters opportunistically occupying a niche made available by the direct actions of man on the mussels.

As far as we are aware, Pacific oysters have not been linked to the introduction of any other non-native species to the UK. Unfortunately the same cannot be said for movements and imports of the native Flat oyster and the American oyster (*Crassostrea virginica*).

Public impact

Consumer research suggests that the majority of the oyster consuming population are unaware which species they are eating and few would care. A minority of connoisseurs would prefer native Flat oysters to Pacific oysters, but there is little market demand from elsewhere. The year-round capability of the supply of Pacific oysters makes them the preferred choice at most outlets.

In terms of the tenuous linkage to reducing consumer demand and/or tourism, walking on any shellfish or shell bed with unprotected feet is likely to be uncomfortable and there is no evidence that Pacific oyster beds would pose any more ‘risk’ to the public or its footwear than any native species, such as Razorfish (*Ensis spp*). A converse view may be that the presence of Pacific oysters may actually benefit an area by discouraging walkers and thereby conferring protection on more vulnerable sessile fauna.

Economic impact

The assessment of the potential economic impact in the risk assessment is extremely weak. The figure given is inaccurate and very much ‘worse case’. No attempt has been made to conduct a reasoned and objective assessment of any potential impact. An expedient approach with no credibility has been adopted. Whilst the highly speculative projected maximal loss of £12.2 million per annum is not directly offset by the documented estimated annual value at first sale of £3.3 million, the downstream market value multipliers should be applied to this figure in order to obtain the full value of the Pacific oyster

market to the UK economy. Experience with other species in the value chain suggests that these multipliers can be in the order of 4 – 8 times value.

Conclusions

Pacific oysters are a commercially important non-native species that can, in some favourable years and in some favourable locations, reproduce successfully resulting in settlement in to the natural environment. Selective harvesting of such resources is an environmentally acceptable control measure. There is no convincing evidence that it is invasive or spreading rapidly beyond its established sites of introduction in the UK. There is no evidence of adverse effects on UK mussel seed beds or mature beds.

The economic impact of curtailing the well run Pacific oyster cultivation industry would have far reaching effects on many fragile rural economies, particularly in the north and west of Scotland. Such actions would run counter to the policies of the devolved Administrations and central Government social and food objectives.

Experiences elsewhere have raised concerns and it is right and proper that an informed assessment of its status be undertaken. However, any assessment has to be performed objectively, free from bias or supposition, based on the best available science and tempered by the direct experience of those that work with the species on a day to day basis within the UK. It is apparent that further research is required to reduce the many uncertainties within the document.

We strongly urge the UK Non-Native Species Secretariat to revisit the Pacific oyster risk assessment and to engage actively with the industry before progressing further with the risk management plan if it proves to be justified. Working together jointly can produce a credible document that will act to safeguard the UK marine environment and the industry. The development of a workable pro-active industry code of practice as an addition to their already high standards and practices could be a positive development.

As an independent organisation working across the seafood sector in the UK, Seafish would welcome the opportunity for an active involvement in any future development of the Pacific oyster risk assessment or risk management plan.

Yours faithfully,

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