RISK ASSESSMENT SUMMARY SHEET

Updated: October 2020

Atlantic oyster drill (*Urosalpinx cinerea*)

- A conical marine mollusc, up to four cm high and two cm broad, with a sharply pointed spire and whorls with pronounced ridges and ribs.
- Found primarily on the Essex and Kent coasts, especially in estuaries and associated with oysters.
- Introduced with aquaculture stock, but natural spread is slow because a free-swimming larval stage is absent.
- Potentially serious impacts as a predator of native and commercially grown oysters, as well as a competitor with native species.

Bill Frank, www.jaxshells.org

History in GB

First reported in Essex oyster beds in 1927 apparently introduced with oyster stock imported from the US. Subsequently found in estuaries of the rivers Colne, Blackwater, Crouch and Roach and in Kent. More recently established in the Netherlands.

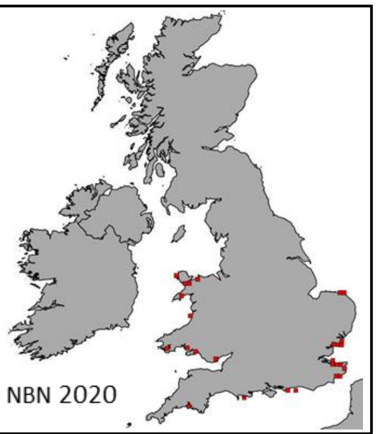
Native Distribution

Atlantic coast of north America rom Cape Cod to south-eastern Florida.

(no map available)

GB Distribution

Primarily Essex and Kent



Source: NBN 2020

Impacts

Environmental (moderate, medium confidence)

- Limited evidence, but could cause negative impacts through predation of / competition with native species.

Economic (major, medium confidence)

- A single individual has the potential to consume on average 59 1-year old oysters per year
- May consume 50% or more of commercial oyster spat.
- Therefore has the potential to cause significant impacts on commercial oysters in GB.

Social (minor, low confidence)

- If this species were to damage the commercial use of oysters in GB this might have knock on social impacts.

Introduction pathway

Contaminant of aquaculture - originally introduced with oysters.

Spread pathway

Natural (slow, medium confidence) no free swimming larval stage, so unlikely to disperse rapidly by natural means

Human (intermediate, medium confidence) could be spread, particularly as eggs, on aquaculture stock or marine equipment

Summary

	Response	Confidence
Entry	VERY LIKELY	VERY HIGH
Establishment	VERY LIKELY	HIGH
Spread	SLOW	MEDIUM
Impact	MAJOR	MEDIUM
Overall risk	HIGH	MEDIUM

Rapid Risk Assessment of: *Urosalpinx cinerea*
Author: Hannah Tidbury (Cefas)
Draft: Draft 1 (Feb 2015), Draft 2 (May 2018), Draft 3 (July 2018)
Signed off by NNRAP: May 2018
Approved by Programme Board: September 2020
Placed on NNSS website: October 2020

GB Non-native species Rapid Risk Assessment (NRRA)

Introduction:
The rapid risk assessment is used to assess invasive non-native species more rapidly than the larger GB Non-native Risk Assessment. The principles remain the same, relying on scientific knowledge of the species, expert judgement and peer review. For some species the rapid assessment alone will be sufficient, others may go on to be assessed under the larger scheme if requested by the Non-native Species Programme Board.

1 - What is the principal reason for performing the Risk Assessment? (Include any other reasons as comments)

Response: To assess the risk posed by *Urosalpinx cinerea* in line with requirements under the UK Marine Strategy (UKMS). Specifically, the risk assessment was performed as part of a series of risk assessments conducted to identify high and moderate risk species, already present in the UK, which should be prioritised for monitoring.

2 - What is the Risk Assessment Area?

Response: GB

3 - What is the name of the organism (scientific and accepted common; include common synonyms and notes on taxonomic complexity if relevant)?

Response: *Urosalpinx cinerea* (Say, 1822). Common names: American oyster drill, American tingle, American whelk tingle, Atlantic oyster drill, Eastern oyster drill. Synonyms: none

4 - Is the organism known to be invasive anywhere in the world?

Response: Yes. This species has been described as invasive in many parts of the world, posing concern due to its ability to thrive in locations into which it has been introduced (Faasse and Ligthart, 2007).

5 - What is the current distribution status of the organism with respect to the Risk Assessment Area?

Response: The native range of *U. cinerea* is the Atlantic coast of north America from the Gulf of St Lawrence to Southeastern Florida (Cohen, 2011 and references therein).

U. cinerea has been introduced to the west (Pacific) coast of North America, initially reported in San Francisco Bay in 1890 (Cohen, 2011).

This species has also been introduced into European waters and more specifically GB waters. It was reported in Essex oyster beds in 1927 and then subsequently in estuaries of the rivers Colne, Blackwater, Crouch and Roach and in Kent: mouth of the River Swale (Cohen, 2011; Hancock, 1954 and references therein).

In addition, between 1960 to 1969 it was found in France, though establishment did not occur there (Cohen, 2011 and references therein). In 2007 it was found in the Netherlands, where it established a self-sustaining population (Faasse and Ligthart, 2009, 2007).

6 - Are there conditions present in the Risk Assessment Area that would enable the organism to survive and reproduce? Comment on any special conditions required by the species?

Response: Yes. *U. cinerea* inhabits the marine and brackish waters, in particular intertidal and shallow subtidal waters in bays and estuaries, favouring muddy bottoms. It can tolerate a wide range of environmental conditions. For example, it is abundant in the Mystic River on the Atlantic coast of North America which experiences seasonal temperature fluctuations between -1 and 25°C. Records indicate a salinity tolerance range between 15-37 ppt (Cohen, 2011; Faasse, 2017; van den Brink and Wijsman, 2010 and references therein).

7 - Does the known geographical distribution of the organism include ecoclimatic zones comparable with those of the Risk Assessment Area or sufficiently similar for the organism to survive and thrive?

Response: Yes. The species is already present within European Waters and within the risk assessment area itself.

8 - Has the organism established viable (reproducing) populations anywhere outside of its native range (do not answer this question if you have answered 'yes' to question 4)?

Response: N/A.

9 - Can the organism spread rapidly by natural means or by human assistance?

Response: Yes. *U. cinerea* is thought to spread via transport of contaminated shellfish (Cohen, 2011). Small juvenile and *U. cinerea* eggs are difficult to see, facilitating their spread with shellfish. Due to a lack of pelagic life-stage, this species is unlikely to spread rapidly and widely via natural means (van den Brink and Wijsman, 2010).

10 - Could the organism itself, or acting as a vector, cause economic, environmental or social harm in the Risk Assessment Area?

Response: Yes. *U. cinerea* predates on molluscs. It may therefore cause mortality of molluscs, including mortality of both native and commercial oyster populations, and therefore, have potentially large environmental and economic impacts (Faasse, 2017 and references therein). However, impacts are likely to vary and be affected, for example, by density of *U. cinerea* (Faasse, 2017 and references therein) and also temperature (as feeding is temperature dependent (Cohen, 2011; Cole, 1942; Hancock, 1954)).

Entry Summary

Estimate the overall likelihood of entry into the Risk Assessment Area for this organism (comment on key issues that lead to this conclusion).

Response: very *likely*
Confidence: *very high*

Comments (include list of entry pathways in your comments):

The pathway most strongly associated with introduction of this species is the import of contaminated shellfish, primarily oysters (Cohen, 2011; Cole, 1942; Eno et al., 1997), though risk of introduction with transported mussels may also be high (Faasse and Ligthart, 2007). For example, introduction of *U. cinerea* into GB waters is thought to have been as a result of import and laying of contaminated American Atlantic Oyster (*Gryphaea virginica*) in Brightlingsea and West Mersea in the early 1900s (Hancock, 1954).

Transport of other material from the marine environment, containing egg cases of *U. cinerea*, could also result in introduction. It addition, it may be possible for *U. cinerea* to attach to seaweed and marine debris and raft on these to new locations (Faasse, 2017).

An absence of evidence of attachment of this species, either in adult or egg form, to ships hulls has been stated and due to the lack of free living larval stage, uptake and transport via ships ballast is also unlikely. The introduction of this species via vessels movements is therefore unlikely (Faasse, 2017). However, Faasse and Ligthart (2007) do discuss the implications of the ban on tributyltin (TBT) on *U. cinerea* prevalence in the Netherlands, implying that attachment to vessel hulls may be important for the survival and spread of this species.

The drills have no pelagic phase so the risk of introduction via natural vectors (e.g. transport on ocean currents) is reduced (van den Brink and Wijsman, 2010).

Given that the species has already been introduced into the risk assessment area, the risk of introduction response is very high, with very high confidence.

Establishment Summary

Estimate the overall likelihood of establishment (comment on key issues that lead to this conclusion).

Response*:* *very likely*
Confidence: *high*

Comments (state where in GB this species could establish in your comments, include map if possible):

U. cinerea inhabits intertidal and shallow subtidal waters in bays, estuaries and marshes, favouring the muddy bottoms of estuarine areas over hard bottoms and hard sands of open sea coasts (Cole, 1942).

U. cinerea is very tolerant of a wide range of temperatures and salinities. For example, temperature ranges from -1-25° C have been reported , though a minimum temperature of 9-10° C is required for *U. cinerea* to feed and optimal temperature of 20° C has been documented for egg development (Cohen, 2011; Faasse, 2017; Hancock, 1954). A salinity range of 15-37ppt has also been documented (Cohen, 2011; Faasse, 2017; van den Brink and Wijsman, 2010 and references therein). Though higher salinities are preferred by this species it has been suggested that it is capable of withstanding dilution of its body fluids during periods of high salinity (Turgeon, 1976).

U. cinerea feeds primarily on molluscs so that the availability of such prey will determine its establishment success (Cohen, 2011; Faasse, 2017 and references therein).

This species has already established in multiple locations outside its native range, including within the risk assessment area. This suggests that conditions present in the risk assessment area are suitable and further establishment of this species, assuming its successful introduction, will be very likely. While the likelihood of establishment will be dependent on the specific location into which it is introduced, the habitat present, and the availability of prey, its close association with mollusc movement and laying suggests the introduction locations will be very suitable.

Spread Summary

Estimate overall potential for spread (comment on key issues that lead to this conclusion).

Response: *slow*
Confidence: *medium*

Sub scores:

Natural spread only:
Response: slow
Confidence: medium

Human facilitated spread only:
Response: intermediate
Confidence: medium

Comments (in your comments discuss how much of the total habitat that the species could occupy has already been occupied; also comment on how much of that currently unoccupied area is likely to be occupied within 5 years; also list all of the spread pathways):

This species lacks a free swimming larval stage. It is therefore unlikely that this species will spread and disperse rapidly by natural means (van den Brink and Wijsman, 2010). For example, Faasse and Ligthart (2009) found the population in the Netherlands dispersed less than 200m in a year and a half. However, a maximum dispersal distance of 50m in 48 hours has also been documented (Cole, 1942).

Newly hatched *U. cinerea* may crawl over hard substrates or clean sand, however their movement on soft sediment is very slow. In its native range, it has been documented that this species may be dispersed by crabs (onto which they crawl to feed on encrusting organisms). It addition, it may be possible for *U. cinerea* to attach to seaweed and marine debris, floating on these to new locations (Faasse, 2017 and references therein).

In addition to shellfish movements (as discussed in the entry section), anthropogenic movement of other material from the marine environment, containing egg cases of *U. cinerea* or small hidden animals, could result in the dispersal of this species (Faasse, 2017 and references therein).

Impact Summary

Estimate overall severity of impact (comment on key issues that lead to this conclusion)

Response: *major*
Confidence: *medium*

Sub-scores

Environmental impacts:
Response: *moderate*
Confidence**:** *medium*

Economic impacts:
Response: *major*
Confidence: *medium*

Social impacts:
Response: *minor*
Confidence: *low*

Comments (include list of impacts in your comments):
Environmental and economic impacts associated with the predation of molluscs, namely commercially produced oysters, by *U. cinerea* may be large. For example, it has been estimated that a single *U. cinerea* can consume on average 59 1-year old oysters per year (Cole, 1942) in certain areas and that *U cinerea* may consume 50% or more of commercial oyster spat (Cohen, 2011; Hancock, 1954). Pacific oysters produced in the GB excluding seed production, was estimated to contribute £10.137 million GVA based on 2011/2012 prices (Herbert et al., 2012). *U. cinerea* therefore has potentially large implications for the commercial oyster industry and GB economy with knock on social impacts for example on

communities heavily involved with oyster and shellfish production in the GB likely. Economic loss from shellfish movement restrictions (which may be enforced in order to manage the spread of the species) may also be incurred by the shellfish industry. Note that impacts associated with predation will depend on temperature as feeding rate is affected by temperature (Cohen, 2011; Faasse, 2017; Hancock, 1954).

The impact of this species may be lessened by adaptation by prey species. For example, evidence suggests that oysters may be able to adapt to the presence of *U. cinerea* and shift from lateral shell growth to shell thickening as a defence (Lord and Whitlatch, 2012).

Wider environmental impacts of *U. cinerea* are not well documented. *U. cinerea* competition with a native mollusc species (e.g. *Nucella lapillus*) in the Netherlands and native snail species (*Acanthinucella spirata*) in California has been documented (Global Invasive Species Database, 2018 and references therein) but no evidence of competition with the native snail was found in a study conducted by Faasse and Ligthart (2009) in the Netherlands. Reports of *U. cinerea* predation on the native Olympia oyster (*Ostrea lurida*) in Willapa Bay also exist (Buhle and Ruesink, 2009), though evidence of its predation on native oysters in the GB is absent.

Climate Change

What is the likelihood that the risk posed by this species will increase as a result of climate change?

Response: *moderate*
Confidence: *medium*

Comments (include aspects of species biology likely to be effected by climate change (e.g. ability to establish, key impacts that might change and timescale over which significant change may occur):

Conditions reflecting climate change did not influence the feeding behaviour of the *U. cinerea* but did impact the size of their prey (oyster). Therefore, under climate change, the impact of *U. cinerea* on native prey species could be exacerbated (Sanford et al., 2014).

Release of eggs may occur over a longer period in warmer temperatures and optimal temperature for development of eggs is 20°C (Faasse, 2017 and references therein), suggesting potential for larger population sizes in warmer temperatures which may result from climate change.

In addition, sea level rise associated with climate change may result in estuaries being flooded with salt water. The tolerance of *U. cinerea* to increased salinity will be advantageous and may result in an increase in population size and therefore an increase in impacts.

Conclusion

Estimate the overall risk (comment on the key issues that lead to this conclusion).

Response: *high*
Confidence: *medium*

Comments:

The risk of introduction, establishment and spread of this species may be high. The main pathway of introduction and spread of this species (i.e. import and movement of molluscs) is active and conditions present within the assessment area, for example, habitat availability, food source, salinity and temperature, are considered suitable for *U. cinerea*.

Environmental and economic impacts of *U. cinerea*, particularly with respect to commercially produced oysters in the GB may be high.

The potential for population sizes and impacts associated with *U. cinerea* to increase under climate change further increases the potential risk associated with this species.

Management options (brief summary):

1 - Has the species been managed elsewhere? If so, how effective has management been?

Response:
As with many marine invasive species, successful eradication of *U. cinerea* is likely to be very difficult. Small egg cases and juveniles of this species are hard to detect making eradication and management challenging.
Successful eradication of the species has not been documented. However, a number of management approaches have been trialled/suggested (see below).

2 - List the available control / eradication options for this organism and indicate their efficacy.

Response:

Dredging may be used to manage *U. cinerea*. For example, dredges, specifically designed to retain oyster drills, but not oysters, may provide means by which *U. cinerea* can be removed. However, given that the process may harm oysters, dredging following harvest is recommended (Faasse, 2017 and references therein).

Hand collection of snails and eggs is an option but only within the littoral zone (Faasse, 2017 and references therein).

Drill traps, which may take many forms, including tiles and pipes may provide a means by which to attract and remove *U. cinerea* (Cole, 1942).

Freshwater immersion has also been proposed as a possible management strategy. However, while immersion in freshwater resulted in detachment of *U. cinerea* from mussels it did not result in death of *U. cinerea*. Freshwater rinsing may therefore act to detach *U. cinerea* from mussels before movement of mussels, but as it does not kill the animals, if some remain, there is still risk of introduction into new locations (van den Brink and Wijsman, 2010).

Exposure to hot water (for example boiling water for 15 minutes) or desiccation are also options for the management of *U. cinerea* (Faasse, 2017 and references therein).

Biological control may also be an option. However, while the control of *Thais haemastoma* (the southern oyster drill) by its digenean trematode flatworm, *Parochis acanthus*, has been documented, the control of *U. cinerea* by it digenean trematode flatworm, *Parachis acitus*, has not be documented (Faasse, 2017 and references there in).

Chemical control methods are available. While use of insecticides and other chemical agents may not be permitted, chemical attractants may provide a viable chemical-based control strategy (Rittschof et al., 1983).

3 - List the available pathway management options (to reduce spread) for this organism and indicate their efficacy.

Response:
The main pathway associated with introduction and spread of this species is movement of contaminated shellfish species, namely oysters.
Pathway management should include awareness raising of *U. cinerea* in the shellfish industry. To reduce the likelihood of introduction of this species movement of shellfish from areas where *U. cinerea* is present should be avoided and restrictions put in place.
In addition, careful inspection and cleaning of shellfish should be undertaken prior to movement and on receipt of shellfish.

4 - How quickly would management need to be implemented in order to work?

Response:

Following establishment, eradication is almost impossible (Faasse, 2017). However, this species is known to spread slowly via natural means. Early detection of this species in new locations, and rapid implementation of management of the key anthropogenic vector (shellfish movement), will facilitate the prevention of the spread of this species to new locations.

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