TECHNICAL ASSESSMENT METHOD

Water Category	Rivers, Lakes, Transitional and Coastal waters
Significant Pressure	Alien Species

1. PURPOSE

This method provides an assessment of the risk of not achieving Good Ecological status due to the presence of alien species. The method uses the distribution of alien species to determine the risk that the species is likely to be in a specific water body (river, lake, transitional or coastal).

There is growing evidence world-wide that alien species constitute a major threat to native biota and habitats in aquatic ecosystems. Many cases are documented from regions as far apart as North America, southern Africa, Australia and New Zealand. The impacts of alien species on native biodiversity are many and varied, including displacement of indigenous species through competition or predation, structural damage to aquatic habitats, and loss of genetic integrity.

In the UK, there are many well-documented cases of alien species becoming established both in marine and freshwater systems.

In addition to the threat posed by alien species to native biodiversity, there may often be an unquestionably significant economic impact, although it is not surprising that this is difficult to quantify. The potential magnitude and economic costs of the alien species problem have been emphasised in the recent review of non-native species policy in Great Britain, which also refers to the need for the signatories to the Convention on Biological Diversity to address these threats. In terms of the WFD, the promotion of '*sustainable water use*' as one of the purposes described in Article 1 may be at risk in certain water bodies through the impact of alien species.

2. CONCEPTUAL MODEL

Whilst the text of the Directive does not explicitly mention alien species, Annex II lists specific pressures to which water bodies may be subjected, including '*...other significant anthropogenic impacts on the status of surface water bodies*'. In the knowledge that many alien species have been deliberately or accidentally introduced, it seems reasonable, therefore, to consider them as a potential 'anthropogenic impact' on the biological elements listed in Annex V.

It could be argued, of course, that the presence of alien species makes it difficult to achieve '*a taxonomic composition that corresponds totally or nearly totally to undisturbed conditions*' (Annex V, Table 1.2.1). In other words, the presence of alien species detracts from the concept of 'naturalness' that underlies the Directive. Indeed, some ecological and conservation assessment systems evaluate the presence of established alien species (reducing naturalness) separately from the impact that they may exert. Nevertheless, it is the degree of damage that alien species cause to native biota that is the focus of concern in WFD assessments.

For the purpose of risk assessment under the WFD (i.e. the risk of failing one or more of the environmental objectives), alien species are assigned to one of three categories: 'high', 'low' and 'unknown' impact. These categories are based on concepts in the Defra review and in the IUCN strategy, from which the following definitions have been taken and amended.

High Impact: alien species, known to be invasive, which have caused documented harm in habitats where they have become established.

Low Impact: alien species known on the basis of stringent criteria to have a low probability of becoming invasive, and where field observations have shown no adverse impacts over many years of establishment.

Unknown Impact: alien species whose probability of becoming invasive is unknown, and for which a full risk assessment is required.

High-impact species are likely to become established and cause problems in any habitat in which they appear. Their propensity to spread rapidly means that prevention is the only effective way of dealing with problems, as control is likely to be prohibitively expensive and/or unsuccessful.

Species assigned to the low-impact category will have been subject to a comprehensive evaluation. If conditions change (e.g. through climate change) then species on the low-impact list may be moved to the high-impact list until there is sufficient evidence to support a continued low-impact classification.

Unknown-impact species (the great majority of alien species) are those for which adequate ecological information is unavailable and where the potential impacts on recipient habitats and biota are not yet known. Species will remain on this list until there is sufficient scientific justification to classify them as either high or low impact.

Assessing the risk from alien species is complicated by three other factors: (a) some species native to the UK (not listed in the Appendix) may be considered as aliens when introduced into other parts of the country where they were previously absent (e.g. ruffe); (b) some alien species have been present in the UK for many decades and are now usually considered as naturalised species that form part of the native fauna and flora (e.g. Canadian pondweed); and (c) some alien species may constitute a threat to achieving **high** ecological status rather than **good** ecological status (e.g. Japanese knotweed).

Factors such as dispersal rate and the ability to invade are important in classifying individual alien species according to impact. *Crassula helmsii*, for example, can

disperse widely and invade rapidly and destructively when it is introduced to a water body, suggesting that it should be assigned to the high-risk category. Slowly dispersing alien species might also be assigned to the high-risk category where their introduction or arrival at a new site could result in rapid invasive behaviour leading to ecological impacts. The Chinese mitten crab (*Eriocheir sinensis*) provides an example of this.

Alien species in the low-risk category are known in general to be less ecologically damaging than high-risk species but may, under certain circumstances or in certain locations, cause problems equivalent to those of a high-risk species.

Many species may be alien and widely dispersed but their ecological impact is at present unclear. Such species (e.g. the soft-shelled clam *Mya arenaria*) have been assigned to the unknown impact category.

A provisional list of aquatic alien species and their impact category can be found in Appendix 1 of this paper.

3. METHODOLOGY

The risk assessment focuses on the following 10 'high impact' species. They have been selected because of the known severity of their impact and because it is likely that information will usually be available for the water bodies in which they occur:

Australian swamp stonecrop	*Crassula helmsii*
Floating pennywort	*Hydrocotyle ranunculoides*
Water fern	*Azolla filiculoides*
Parrot's feather	*Myriophyllum aquaticum*
Common cord-grass	*Spartina anglica*
Japanese weed	*Sargassum muticum*
North American signal crayfish	*Pacifastacus leniusculus*
Zebra mussel	*Dreissena polymorpha*
Chinese mitten crab	*Eriocheir sinensis*
Slipper limpet	*Crepidula fornicata*

Some of these species (e.g. *Crassula helmsii*) are widespread whilst others (e.g. *Eriocheir sinensis)* have severe impacts but their distribution is at present restricted.

Given the limited data on the **impacts** of alien species in specific sites, the **presence** of the 10 established invasive alien species highlighted in the Appendix were used in this method to indicate water bodies at risk. This is considered a reasonable approach as there is sufficient ecological understanding of these species to demonstrate the severe threat they pose to the integrity of aquatic ecosystems. In the longer term, further work will be required to assess the impacts of alien species on specific water bodies, both to enable an accurate assessment of ecological status and to design appropriate programmes of measures.

Records for the above species were provide by the Conservation Agencies (English Nature and the Countryside Council for Wales). These locations (grid references) were compared with the location of water bodies as described below.

- Rivers – a water body was identified in terms of its catchment
- Transitional – the actual water body boundary
- Coastal – the actual water body boundary
- Lakes – the area of the lake (not its catchment)

The assessment of risk is based on the combination of a pressure/risk score and a confidence score. Where the any one of the ten alien species identified above was found within a water body, it was considered to be at MODERATE risk. This is based on the combination of a moderate pressure and a moderate confidence. Therefore just one record for an alien species in a water body would be sufficient to identify it as being at risk.

Within lakes a modified method was adopted. The risk was considered to be MODERATE if any of the above species were found within a lake water body (since 1970). A risk class of MODERATE was also used where the record was within 5km, but not inside of the lake boundary. However this moderate assessment is based on the combination of a moderate pressure and a low confidence. Further details on the combination of risk and confidence scores can be found in the paper titled *Generation and combination of risk outputs*.

Where no records were found within a water body an assessment of NO DATA is given. This is because we were not provided with data highlighting where the ten alien species were surveyed for, but not recorded.

No allowance has been made for the likelihood that any of these species would be able to colonise adjacent water bodies.

4. FURTHER DETAILS

UKTAG guidance on the assessment of alien species pressures can be found at:

http://www.wfduk.org/tag_guidance/Article_05/Folder.2004-02-16.5332/view

APPENDIX. ***Provisional classification of aquatic alien species found in the UK in terms of their impact on native habitats and biota. Species highlighted in bold will form the principal focus of the 2004 risk assessment exercise***

Habitat classification: R, rivers; L, lakes; T, transitional waters; C, coastal waters

	Species		Plant/ Animal	Habitat	Reason for impact classification level
HIGH	**Australian swamp stonecrop**	***Crassula helmsii***	P	L	Well documented impacts, very invasive
	Floating pennywort	***Hydrocotyle ranunculoides***	P	R	Spreads rapidly
	Water fern	***Azolla filiculoides***	P	R/L	
	Parrot's feather	***Myriophyllum aquaticum***	P	L	Spreads rapidly
	Monkey-flowers	*Mimulus cupreus, M. guttatus* and hybrids	P	R	
	Canadian pondweed[2]	*Elodea canadensis*	P	R/L	Well documented impacts
	Nuttall's pondweed	*Elodea nuttallii*	P	R/L	Well documented impacts
	Japanese knotweed[1]	*Fallopia japonica*	P	R	Well documented impacts, very invasive
	Himalayan balsam[1]	*Impatiens glandulifera*	P	R	Well documented impacts, very invasive
	Giant hogweed[1]	*Heracleum mantegazzianum*	P	R	Well documented impacts, very invasive
	Rhododendron	*Rhododendron ponticum*	P	R	
	Common cord-grass, Townsend's grass or ricegrass	***Spartina anglica***	P	T/C	Spreads rapidly, very invasive. Well documented adverse ecological impacts.
	Japanese weed	***Sargassum muticum***	P	T/C	Spreads rapidly. Well documented impacts: ecological and economic consequences.
	North American signal crayfish	***Pacifastacus leniusculus***	A	R/L	Evidence of major impacts
	Red swamp crayfish	*Procambarus clarkii*	A	R/L	
	Freshwater copepod	*Lernaea cyprinacea*	A	R/L	
	Freshwater amphipod	*Crangonyx pseudogracilis*	A	R/L	
	Chinese mitten crab	***Eriocheir sinensis***	A	R/T/C	Evidence of major impacts: ecological and economic consequences
	Barnacle species	*Elminius modestus*	A	T/C	Spreads rapidly, very invasive. Well documented impacts, evidence of ecological impacts.

	Slipper limpet	***Crepidula fornicata***	A	T/C	Spreads rapidly. Well documented impacts. Considered a pest on commercial oyster beds and competes with other filter-feeding inverts.
	Zebra mussel	***Dreissena polymorpha***	A	R/L	
	Swim bladder nematode	*Anguillicola crassus*	A	R/L/T/C	Spreads rapidly. Well documented impacts: ecological and economic consequences.
	Leathery sea squirt	*Styela clava*	A	T/C	Spreads rapidly. Well documented impacts: ecological and economic consequences.
	American oyster drill	*Urosalpinx cinerea*	A	T/C	Slow and limited natural dispersal. But has shown well documented impacts: ecological and economic consequences.
	Jenkin's spire shell	*Potamopyrgus antipodarum*	A	R/L/T/C	Spreads rapidly. Well documented impacts: ecological and economic consequences.
	Common carp	*Cyprinus carpio*	A	R/L	
	Crucian carp	*Carassius carassius*	A	R/L	
	Danube catfish	*Silurus glanis*	A	R/L	
	Goldfish	*Carassius auratus*	A	R/L	
	Pikeperch (zander)	*Stizostedion lucioperca*	A	R/L	
1	Sweetflag	*Acorus calamus*	P	R	
	Montbretia	*Crocosmia x crocosmiiflora*	P	R	
	Orange balsam	*Impatiens capensis*	P	R	
	Lupin	*Lupinus nootkatensis*	P	R	
	Pink purslane	*Montia sibirica*	P	R	
	Cape pondweed	*Aponogeton distachyos*	P	L	
	Giant butterbur	*Petasites japonicus*	P	R/L	
	Tapegrass	*Vallisneria spiralis*	P	R	
	Captain Pike's weed	*Pikea californica*	P	T/C	Very restricted distribution and limited by temp.
	Bitterling	*Rhodeus sericeus*	A	R/L	
	Brook charr	*Salvelinus fontinalis*	A	R/L	
	Largemouth bass	*Micropterus salmoides*	A	R/L	
	Orfe	*Leuciscus idus*	A	R/L	
	Pumpkinseed	*Lepomis gibbosus*	A	R/L	
	Rainbow trout	*Oncorhynchus mykiss*	A	R/L	

	Grass carp	*Ctenopharyngodon idella*			
	Rock bass	*Ambloplites rupestris*	A	R/L	
	Marine amphipod	*Corophium sextonae*	A	T/C	Well dispersed but with apparently negligible effects.
	Bamboo worm	*Clymenella torquata*	A	T/C	Long established with very restricted distribution.
	Marine polychaete	*Marenzellaria viridis*	A	T/C	
	Pacific oyster	*Crassostrea gigas*	A	T/C	Although well dispersed this is due to human activity and the species would theoretically not sustain itself in the UK otherwise.
	New Zealand flat oyster	*Tiostrea lutaria*	A	T/C	Very restricted distribution. Very slow dispersal rate.
	Magellan mussel	*Aulacomya ater*	A	C	Very restricted distribution.
	American hard-shell clam	*Mercenaria mercenaria*	A	T/C	Long established. Well documented. But current populations are thought to be very low.

UNI	Large-flowered water-thyme	*Egeria densa*	P	L	
	Curly water-thyme	*Lagarosiphon major*	P	L	
	Least duckweed	*Lemna minuta (minuscula)*	P	R/L	
	Narrow-clawed (Turkish) crayfish	***Astacus leptodactylus***	A	R/L	
	Noble crayfish	*Astacus astacus*	A	R/L	
	Freshwater coelenterate	*Craspedacusta sowerbyi*	A	R/L	
	Freshwater triclads	*Dugesia tigrina* *Phagocata woodworthi* *Planaria torva*	A	R/L	
	Freshwater molluscs	*Corbicula fluminea* *Ferissia wautieri* *Marstoniopsis scholtzi* *Menetus dilatatus* *Musculium transversum* *Physa acuta* *Physa gyrina* *Physa heterostropha*	A	R/L	

Freshwater oligochaetes	*Branchiura sowerbyi* *Limnodrilus cervix*	A	R/L	
Freshwater copepods	*Achtheres percarum* *Ergasilus briani* *Neoergasilus japonicus* *Tracheliastes polycolpus*	A	R/L	
Other freshwater malacostracans	*Asellus communis* *Corophium curvispinum*	A	R/L	
Belica	*Leucaspius delineatus*	A	R/L	
Black bullhead	*Ameirus melas*	A	R/L	
False harlequin	*Pseudorasbora parva*	A	R/L	
Water primrose	*Ludwigia grandiflora*	P	L	Known to cause significant problems in continental Europe but not yet widespread in UK

Diatoms	*Odontella sinensis* *Pleurosigma simonsensii* *Thalassiosira punctigera* *Thalassiosira tealata* *Coscinodiscus wailesii*	P	C	Some are well dispersed. Unknown impacts.
Red seaweeds	*Asparagopsis armata* *Bonnemaisonia hamifera* *Grateloupia doryphora* *Grateloupia filicina* var. *luxurians* *Agardhiella subulata* *Solieria chordalis* *Antithamnionella spirographidis* *Antithamnionella ternifolia* *Polysiphonia harveyi*	P	T/C	Well dispersed – unknown impact Well dispersed – unknown impact Spreads slowly – unknown impact. Spreads slowly – unknown impact. Spreads slowly – unknown impact. Spreads slowly – unknown impact. Well dispersed – unknown impact. Well dispersed – unknown impact. Well dispersed – unknown impact
Japanese kelp	*Undaria pinnatifida*	P	T/C	Unknown impact.
Green seaweeds	*Codium fragile* subspp. *atlanticum* and *tomentosoides*	P	T/C	Well dispersed – known to have a displacement effect but impact unknown.
American piddock	*Petricola pholadiformis*	A	T/C	Very long established and well dispersed. Unknown impact.
Soft-shelled clam	*Mya arenaria*	A	T/C	Very long established and very well dispersed. Unknown impact.
American jack knife clam	*Ensis americanus*	A	T/C	Recent introduction that has the capacity to spread rapidly. Unknown impact.
Oyster thief	*Colpomenia peregrina*	A	T/C	Well dispersed – unknown/negligible impacts.
Zebra mussel sp.	*Mytilposis leucophaeta*	A	C	Recent introduction – unknown impact.
Barnacle sp.	*Balanus amphitrite*	A	T/C	Well dispersed – unknown impact.
Marine copepod	*Acartia tonsa*	A	T	Well dispersed – unknown impact.
Marine amphipod	*Caprella mutica*	A	T	Recent introduction – unknown impact.
Marine ostracod	*Eusarsiella zostericola*	A	T	Restricted dispersion, spreads slowly but unknown impact.
Zuiderzee or dwarf crab	*Rhithropanopeus harrisii*	A	T	Recent introduction – unknown impact.
Marine hydrozoan	*Gonionemus vertens*	A	T/C	Patchy distribution – unknown impact.

	Orange-striped sea anemone	*Haliplanella lineata*	A	T/C	Well dispersed. Now very common but with unknown impact.
	Marine polychaete	*Goniadella gracilis*	A	C	Restricted distributions - unknown impact.
	Marine hydroid	*Clavopsella navis*	A	T	Very restricted distribution, i.e. single site, but been there since the 1970s. Unknown impact.
	Marine tubeworms	*Hydroides ezoensis,* *Hydroides dianthus,* *Janua brasiliensis,* *Pileolaria berkeleyana* *Ficopomatus enigmaticus*	A A A A A	T/C T/[C]	Restricted distributions. Unknown ecological impacts, although some suggestion that commercial impacts may occur. Well dispersed – ecological impact unknown but possible negative commercial impact.
	Sea spider	*Ammothea hilgendorfi*	A	T	Very restricted distribution. No dispersive phase in species' life cycle. Unknown impact.