

AQUATIC ALIEN SPECIES AND THE WFD: PROPOSED LIST OF 'LOCALLY NON-NATIVE' SPECIES AND GUIDANCE ON ITS INTERPRETATION

NB: In this paper the term 'translocated' is used to refer to species that are 'locally non-native'.

1. Background and Methodology

1.1 An important aspect of aquatic alien species introductions is the 'translocation' of species within a nation state, i.e. from waters in which a species occurs naturally to waters where it does not occur naturally (Copp *et al.*, 2005). In a broader sense, this refers to species (aquatic or terrestrial) that are 'locally non-native' (Usher, 2008). These terms acknowledge that species introductions are a biogeographical phenomenon (i.e. between hydrological catchments) rather than political. In a review of invasion biology terminology (Copp *et al.*, 2005), the term 'translocation' received the following definition:

'Translocation — the introduction of a species, i.e. 'translocated species', from one part of a political entity (country) in which it is native to another part of the same country in which it is not native.'

1.2 Translocations of species may pose an equally high risk to native species and ecosystems as the introduction of alien species from other countries, and this is recognized internationally (ICES, 2004; EIFAC, 2007). However, with the exception of the UK's Wildlife & Countryside Act 1981, the 'translocation' of aquatic organisms in Europe has not, historically, been subjected to much regulation, either in terms of legislation or in practice (Copp *et al.*, 2005). The need for tighter European regulation in this area was recognised in 2006 through the Council Regulation on the use of alien species in aquaculture (European Council, 2007). More recent measures to control the transport of species outside their native range more generally are contained in the 2014 Council Regulation on the prevention and management of the introduction and spread of invasive alien species (European Council, 2014).

Changes have also taken place within the UK, where the movement of plants and animals is regulated by Section 14 of the Wildlife & Countryside Act 1981, which makes it an offence to release a plant or animal that is "*not ordinarily resident in and is not a regular visitor to Great Britain in a wild state*" or those listed on Schedule 9 of the Act. Insofar as the 1981 Act relates to Scotland, however, the non-native species provisions contained in Section 14 were significantly amended (and strengthened) by measures included in the Wildlife and Natural Environment (Scotland) Act 2011. Now, Section 14 of the 1981 Act (as amended for Scotland) contains a presumption of 'no-release' for any species 'outwith their native range'.

Native range is defined as being: "*...the locality to which the animal or plant of that type is indigenous, and does not refer to any locality to which that type of animal or plant has been imported (whether intentionally or otherwise) by any person.*" Determining what is the 'native range' for most species is a difficult task, and this is especially true in situations where little, or in some cases no, historical survey or observational data exist. This task is particularly difficult for species that have little or no economic value, are not easily seen (cryptic), or are difficult to identify taxonomically to species level. Plants and animals in aquatic habitats are particularly 'data poor', perhaps reflecting the difficulty in surveying such habitats.

1.3 In order to assess the nature and extent of species translocations within the UK, the aim of the present paper is to attempt to reconstruct, based on available bibliographic reviews, the historical distribution in Britain of freshwater fishes known or suspected of having been translocated. Specifically, this paper will endeavour to clarify the interpretations of: 1) the meaning attributed to 'translocation' in a British context, and 2) the bibliographic information on species distributions. Although little information on original British distributions could be

gleaned from very early sources, some interesting information was discovered. For example, Pennant (1812) provides some insight on the origins of northern pike *Esox lucius* (pg. 424–426): “According to the common saying, these fish [pike] were introduced into England in the reign of Henry VIII in 1537. They were so rare, that a pike was sold for double the price of a house-lamb in February, and a pickerel for more than a fat capon.” Given the assumed ‘native status’ of pike in (at least some parts of) Britain, which is supported by archaeological evidence that dates back to the Pleistocene (Crossman, 1971 in Raat, 1988), these contrasting historical accounts highlight the difficulties that can be encountered in attempting to define the native range of fish species, in particular those that were not of culinary interest. Similarly, the crucian carp *Carassius carassius* was originally believed to have been introduced, presumably along with common carp *Cyprinus carpio* (Maitland, 1972, 2004a), then in the mid-1970s the crucian carp was treated as native based on archaeological evidence (Wheeler, 2000). However, recent genetic modelling (Jeffries *et al.*, 2015) indicates that crucian carp was introduced to England in the 15th century and therefore should be considered an introduced species.

The geographical scale used in the present paper is that of WFD river (or lake) basin districts (RBDs; Figure 1). However, as Scotland is largely covered by a single RBD (with the border rivers covered by the Solway & Tweed RBD), additional data are provided relating to the translocated species at a hydrometric area level. This reflects the need to identify species that have been translocated between hydrometric areas both within Scotland (Figure 2) and between Scotland and other parts of the UK. The translocation of fish within other parts of the UK is adequately served by the current distribution of RBDs within and between national administrations.

The present paper on translocated species is restricted to freshwater fish species. The reason for this is that there is even less information on the native distributions of other aquatic organisms than there is for fish. Perhaps the lone exception to this is *Nymphoides peltata*, a floating, water-lily-like plant, which is said to be native in the Humber RBD but alien to the other RBDs (Dee, Severn, West Wales) into which it was translocated (based on Preston *et al.*, 2002).

1.4 Because bibliographic information on the natural (i.e. post-glacial) distribution is variable between species, with popular or nuisance species more likely to be documented than other species, the level of certainty surrounding the translocation status of a species varies. Therefore, the native vs. translocated distribution profile of each species is attributed a ‘certainty rating’, which aims to aid interpretation by the reader. References and comments are given in support of the species distribution profiles.

2. Translocated species distribution profiles

2.1 The proposed lists of translocated native species for Britain (Table 1) and Scotland (Table 2) reveal the extent to which fishes have been moved beyond their native distributions. At the UK-level, the defined river basin districts may, in some instances, underestimate the extent of translocation. This is evident in recent translocations. For example, the south-eastern range limit of spined loach *Cobitis taenia* in East Anglia was previously the River Great Ouse, with no historical presence in rivers that drain into the North Sea south east of the Wash. However, this species was discovered in 2005 (Copp & Wade, 2006) in a reservoir that receives water from the River Stour (Essex), which itself receives water from the River Great Ouse via a water transfer scheme. This same ‘introduction pathway’ explains the appearance in the Essex Stour of non-native pikeperch *Sander lucioperca*, which was intentionally introduced into the Great Ouse catchment in the 1960s. So, although all these rivers fall within the ‘Anglia’ river basin district, they are not naturally connected but translocations are taking place between the river catchments within this RBD, not only by direct human introductions but also indirectly (e.g. through water transfers).

2.2 Of particular note in the translocated species distributions is the uncertainty surrounding a number of the small-bodied and more cryptic species. Large-bodied species, especially those of commercial interest (for consumption, sport or ornamental use), were more likely to be mentioned in early documentation (see Locker, 2010), resulting in a greater knowledge of these species distributions before the onset of active species translocations and introductions, which probably began in earnest about 150-200 years ago. An overall certainly level for a species is therefore complemented by '?' for those river basin districts for which it remains unsure whether the species was native or was translocated into the area at some point.

2.3 Also of note is that within a river basin district (or hydrometric area in Scotland), there may be water bodies or even parts of the RBD in which a given species did not naturally occur despite the species being native to other parts of that area. For example, roach *Rutilus rutilus* may have been native to some parts of the Northwest RBD but was alien to drainage basins such as those of lakes Bassenthwaite and Windermere, where they are known to have been introduced (e.g. Winfield *et al.*, 1996).

This form of split distribution is especially true of translocations that have been carried out for conservation purposes. In such instances, attempts are made to establish new populations of fishes (of high conservation value) as close to their native range as possible, and translocations are made outside the host catchment only if no other alternatives are available. A good example of such a conservation-driven translocation within Europe is that of the Danubian salmon (or huchen) *Hucho hucho* in Poland, where the species is native to, and threatened in, two small rivers of the Danube River basin due to over-exploitation (mostly illegal) and water pollution. To conserve the species, self-sustained populations were established in two Carpathian tributaries (Dunajec and Poprad) of the River Vistula through intensive stocking (see Copp *et al.*, 2005). Reviews of fish conservation translocations in Scotland and north-west England are provided by Adams *et al.* (2014) and Winfield *et al.* (2010), respectively.

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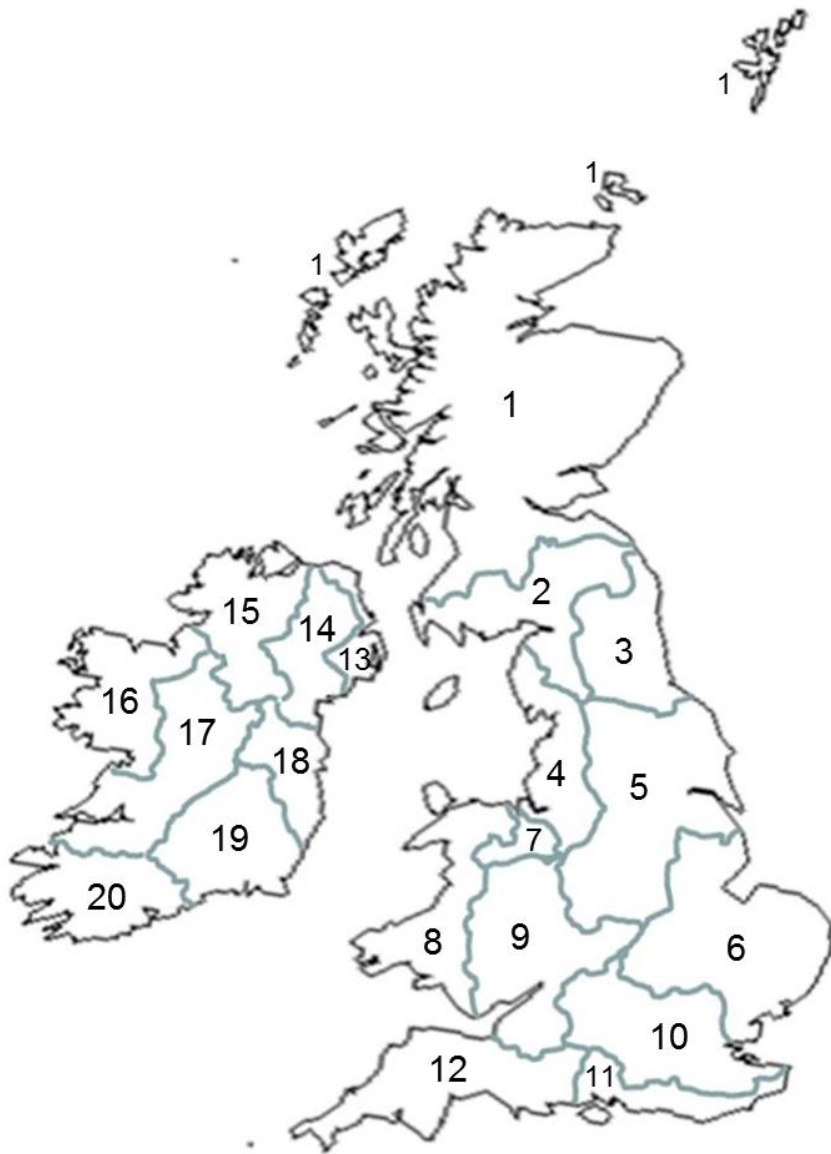
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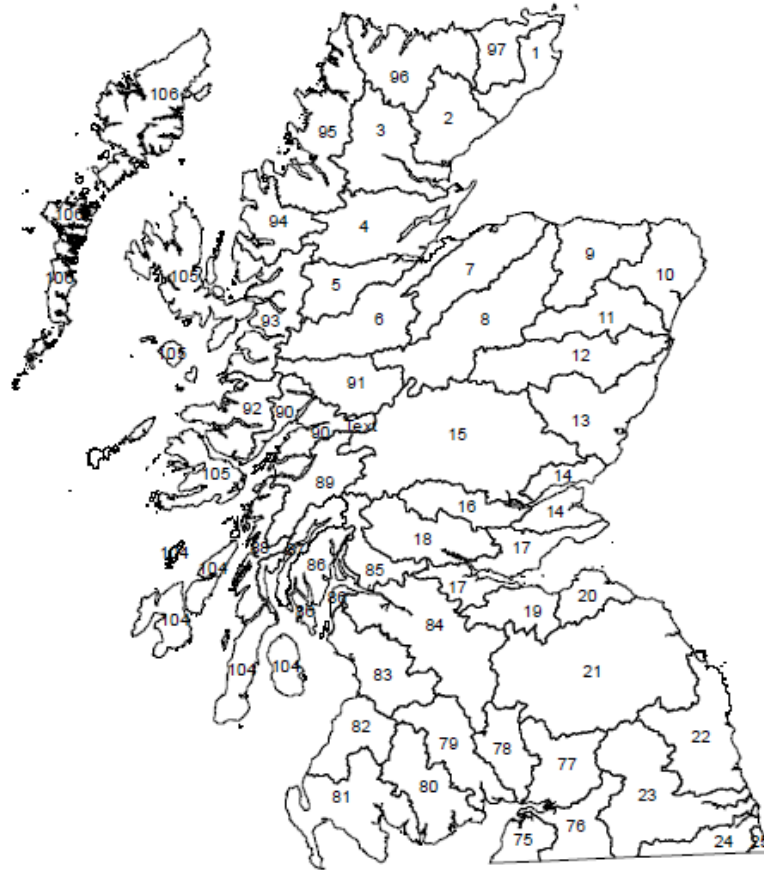
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No.	RBD Name	No.	RBD Name
1	Scotland	11	South East
2	Solway Tweed (Cross Border)	12	South West
3	Northumbria	13	North Eastern
4	North West	14	Neagh Bann (Cross Border)
5	Humber	15	North Western (Cross Border)
6	Anglian	16	Western
7	Dee (Cross Border)	17	Shannon
8	Western Wales	18	Eastern
9	Severn (Cross Border)	19	South Eastern
10	Thames	20	South Western

Figure 1. Map of river basin districts in the UK and Ireland (derived from www.wfduk.org/implementation/).



	Name		Name		Name		Name
1	Wicks Group	13	Esk Group	80	Dee (Galloway)	92	Loch Shiel Group
2	Helmsdale Group	14	Firth of Tay Group	81	Cree Group	93	Loch Aish Group
3	Shin Group	15	Tay	82	Doon Group	94	Loch Maree Group
4	Conon Group	16	Earn	83	Irvine & Ayr	95	Laxford Group
5	Beauly	17	Firth of Forth Group	84	Clyde	96	Naver Group
6	Ness	18	Forth	85	Leven (Strathclyde)	97	Thurso Group
7	Findhorn Group	19	Almond Group	86	Firth of Clyde Group	104	Kintyre Group
8	Spey	20	Tyne (Lothian) Grp	87	Fyne Group	105	Inner Hebrides
9	Deveron Group	21	Tweed	88	Add Grp (Knapdale)	106	Outer Hebrides
10	Ythan Group	77	Esk (Dumfries)	89	Awe and Etive	107	Orkneys
11	Don (Grampian)	78	Annan	90	Loch Linnhe Group	108	Shetlands
12	Dee (Grampian)	79	Nith	91	Lochy (Highlands)		

Figure 2. Distribution of hydrometric areas in Scotland. (Integrated Hydrological Units of the UK licensed from NERC – CEH copyright).

Table 1: List of ‘locally non-native’ freshwater fish species native to some parts of mainland Britain that are known or thought to have been introduced to other parts of the island (N = native within RBD; TS = species introduced into RBD from elsewhere in mainland Britain), including the level of certainty (Fairly high, Fairly low) and the distributions, by river basin district (RBD). Blank spaces indicate absence in that RBD, and ‘?’ indicates uncertainty as regards the species’ N and/or TS distributions (see notes for bibliographic references). (*) denotes species that are native to the Scottish RBD but with a restricted distribution.

Species name	Note No.	RBD: Certainty level	Scotland	Sol & Tweed	North-umbria	North West	Humber	Anglia	West Wales	Dee	Severn	Thames	South East	South West
Arctic charr	1	F. high	N	N	TS	N			N	TS?	TS?			
Barbel	2	F. high	TS	TS	TS	TS	N	N	TS	TS	TS	N	TS	TS
Bleak	1	F. high		TS	TS	TS	N	N	TS	TS	TS	N	TS	TS
Bullhead	3	F. low	TS	TS	N	N?	N	N	N?	N?	N	N	N	N
Chub	1	F. high	TS	TS	N	N	N	N	TS	TS	TS	N	N	N
Common bream	1	F. high	TS	TS	N	N	N	N	TS	TS	TS	N	N	N
Dace	1	F. low	TS	TS	N	N	N	N	TS?	TS?	N?	N	N	N
Grayling	1	F. high	TS	TS	N	N	N	N	TS	N	N	N	N	N
Gudgeon	1	F. low	TS	TS	N	N?	N	N	TS?	TS?	N	N	N	N
European minnow	1	F. low	N*	N	N	N?	N	N	N?	N?	N	N	N	N
Eurasian perch	1	F. high	N*	N	N	N?	N	N	N	N	N	N	N	N
Northern pike	4	F. high	N*	N?	N	TS	N	N	TS	TS	N?	N	N	N
Roach	1	F. low	N*	N	N	N?	N	N	TS	N?	N	N	N	N
Rudd	1	F. low	TS	TS	N	N?	N	N	N?	N?	N	N	N	N
Common ruffe	1	F. high	TS	TS	TS	TS	N	N	TS	TS	TS	N	N	N
Silver bream	1	F. high	TS	TS	TS	TS	N	N	TS	TS	TS	TS	TS	TS
Spined loach	5	F. high					N	N					TS	
Stone loach	1	F. high	N*	N	N	N	N	N	N	N	N	N	N	N
Tench	1	F. low	TS	TS	N?	N?	N	N	TS	TS	TS	N	N	N

Notes (BDW&M = Based on Descriptions of Wheeler (1977) and Maitland (1972, 1977, 2004a): 1) BDW&M and McCarthy (2007); 2) A notably large fish that has attracted mention in historical records — these are reviewed by Wheeler & Jordan (1990); 3) BDW&M, see also Hänfling *et al.* (2002) and Tomlinson & Perrow (2003); 4) Wheeler (1977) and Maitland (2000), also archaeological

