

Ireland

Red List No. 5



Amphibians, Reptiles & Freshwater Fish





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EXECUTIVE SUMMARY

- A new Red List of Irish amphibians, reptiles & freshwater fish is presented. This updates and replaces the previous assessments completed by Whilde in 1993.
- All 15 native species of freshwater fish were assessed using the latest IUCN categories. Of these, one was found to be Critically Endangered (European eel *Anguilla anguilla*), five achieved a threat status of Vulnerable, pollan (*Coregonus autumnalis pollan*), Arctic char (*Salvelinus alpinus*), twaite shad (*Alosa fallax*), Killarney shad (*Alosa fallax killarnensis*) and Atlantic salmon (*Salmo salar*), and one species (sea lamprey *Petromyzon marinus*) was found to be Near Threatened.
- Of the five amphibians and reptiles assessed, one was found to be Endangered, the natterjack toad (*Epidalea calamita*).
- The status of non-native fish species was also reviewed. This was done because the composition of fish communities is assessed to determine the ecological quality of waters for the EU Water Framework Directive, and so it is important to have an understanding of their threat status. None of these species were found to be threatened. However, two species were identified as invasive species in need of management.
- A number of widespread threats such as water pollution, the spread of invasive species, over-fishing, unsympathetic river management and climate change are identified as being of concern for all freshwater fish species. The importance of maintaining, or in some cases restoring, suitable conditions for our native fish communities is highlighted.
- Barriers to migration, such as weirs, were identified as being of major importance to the migratory fish species, several of which are listed on Annex II of the Habitats Directive.
- Habitat loss is recognised as the main concern for the natterjack toad.
- Extensive monitoring programmes to assess the conservation status of amphibian and fish species are underway.
- The designation as Natural Heritage Areas of waters containing important fish assemblages is recommended.
- The need for a clear framework within which the processes for Annex V fish protection and management are developed and implemented is highlighted.

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INTRODUCTION

Ireland is comparatively poor in terms of vertebrate biodiversity. It is a relatively small island with limited habitat diversity, which in itself restricts the available niches for vertebrate species to occupy (MacArthur & Wilson, 1967). The paucity of species can also be explained by our glacial history. Rising sea levels isolated Ireland from the rest of Europe relatively soon after the ice retreated following the last period of glaciation. As a result, few amphibians, reptiles or freshwater fish were able to colonise before this island was cut off from Britain and mainland Europe. Of the 151 reptiles and 85 species of amphibians known in Europe (Temple & Cox, 2009; Cox & Temple, 2009), only 2 reptiles and 3 amphibians are native to Ireland. We fare slightly better with the freshwater fish fauna, with populations of 29 species (of which 15 are native) in Ireland out of a European total of c. 236 in Europe and 55 in Britain (Kelly *et al.*, 2007).

There has been much speculation as to which members of the current fish fauna are native and which were introduced. The term 'native' tends to be linked back to the period following the last glaciation, when retreating ice-caps would have permitted natural colonisation of waters. The initial fish fauna is considered to be composed of diadromous or migratory species, such as the Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), eel (*Anguilla anguilla*), lampreys (Petromyzonidae), shads (*Alosa* spp.), coregonids (pollan; *Coregonus autumnalis pollan*) and Arctic char (*Salvelinus alpinus*). The loss of land bridges from Ireland to Britain, and subsequently from Britain to mainland Europe ultimately impeded natural dispersal and colonisation by a range of species of stricter freshwater habit.

Fitzmaurice (1984), reviewing the freshwater fish introductions into Ireland during historical times, counted twenty species, of which eight had arrived naturally since the last glaciation. Whilde (1993) listed 27 freshwater fish species (the sturgeon *Acipenser sturio* was discounted and chub *Leuciscus cephalus* had not yet been introduced), while Kelly *et al.* (2007) report 29 species in Ireland (Table 1). This total of 29 includes a series of diadromous species – both those spawning in freshwater and spending their adult lives at sea and those whose juvenile stages were born at sea and moved into estuarine and freshwater as they developed. Some on the list, such as the smelt (*Osmerus eperlanus*), shads and flounder (*Platichthys flesus*) are more traditionally associated with estuarine waters but all can move into freshwater. The sturgeon is also included in Kelly *et al.* (2007), although there is only a single Irish record known from the last 100 years (Helvic Head, 1975, T. Champ pers. comm.) and the species appears to occur here as a vagrant.

Table 1: Checklist of freshwater fish species of Ireland (scientific and common names) after Kelly *et al.* (2007).

Native species are in Bold type.

Common Name	Scientific Name
<i>Species which spend their entire life or the major part thereof in freshwater</i>	
River lamprey	<i>Lampetra fluviatilis</i> (Linnaeus 1758)
Brook lamprey	<i>Lampetra planeri</i> (Bloch 1784)
Sea lamprey	<i>Petromyzon marinus</i> (Linnaeus 1758)
Killarney shad	<i>Alosa fallax killarnensis</i> (Regan)
Atlantic salmon	<i>Salmo salar</i> Linnaeus 1758
Brown trout/Sea trout	<i>Salmo trutta</i> Linnaeus 1758
Rainbow trout	<i>Oncorhynchus mykiss</i> (Walbaum 1792)
Arctic char	<i>Salvelinus alpinus</i> (Linnaeus 1758)
Pollan	<i>Coregonus autumnalis pollan</i> (Pallas 1776)
Pike	<i>Esox lucius</i> Linnaeus 1758
Common carp	<i>Cyprinus carpio</i> Linnaeus 1758
Gudgeon	<i>Gobio gobio</i> (Linnaeus 1758)
Tench	<i>Tinca tinca</i> (Linnaeus 1758)
Common bream	<i>Abramis brama</i> (Linnaeus 1758)
Minnow	<i>Phoxinus phoxinus</i> (Linnaeus 1758)
Rudd	<i>Scardinius erythrophthalmus</i> (Linnaeus 1758)
Roach	<i>Rutilus rutilus</i> (Linnaeus 1758)
Dace	<i>Leuciscus leuciscus</i> (Linnaeus 1758)
Chub	<i>Leuciscus cephalus</i> (Linnaeus 1758)
Stoneloach	<i>Barbatula barbatula</i> (Linnaeus 1758)
European eel	<i>Anguilla anguilla</i> (Linnaeus 1758)
Three-spined stickleback	<i>Gasterosteus aculeatus</i> Linnaeus 1758
Ten-spined stickleback	<i>Pungitius pungitius</i> (Linnaeus 1758)
Perch	<i>Perca fluviatilis</i> Linnaeus 1758
<i>Species which enter freshwater to spawn near the upstream limit of tidal influence</i>	
Twaite shad	<i>Alosa fallax</i> (Lacepede 1803)
Smelt	<i>Osmerus eperlanus</i> (Linnaeus 1758)
<i>Species which may enter freshwater for variable periods but principally occur in marine or estuarine waters</i>	
Allis shad	<i>Alosa alosa</i> (Linnaeus 1758)
Sturgeon	<i>Acipenser sturio</i> (Linnaeus 1758)
Flounder	<i>Platichthys flesus</i> (Linnaeus 1758)

The dates of introduction are not known for many of the species; in some cases introductions may have been multiple and may be traceable back to post-Norman Ireland (post 1169 A.D.). While some species may be considered 'native' and can be traced back to the last glaciation, many have now been resident over some hundreds of years and have essentially naturalised. Some species are considered to be still expanding their range. A dramatic example of this is the roach (*Rutilus rutilus*) which was confined to the Munster Blackwater catchment following a deliberate introduction in 1889 (Fitzmaurice, 1984). Some fish were introduced from here to a lake in the

Foyle system in County Tyrone in 1905 and following a flood event they escaped and became widespread in the catchment. Specimens subsequently transferred to ponds in the Erne catchment also escaped following flooding events and the species expanded through the Erne system and into the Shannon. Roach are now widespread in Ireland and have populated all but the most isolated of catchments. The current expansion of dace (*Leuciscus leuciscus*), introduced in the Blackwater with the roach, is following a similar but less rapid course.

Man has had a significant role in Ireland in the dispersal of fish species, sometimes unwitting, but often deliberate and frequently on the grounds of developing leisure angling resources. In the early 1960s the Inland Fisheries Trust (IFT) had a policy of developing focussed waters as tench (*Tinca tinca*), common carp (*Cyprinus carpio*) or rainbow trout (*Oncorhynchus mykiss*) fisheries. The former species has developed self-sustaining populations and is considered to be ecologically benign in the waters it inhabits. Although neither the common carp nor the rainbow trout have populations that consistently spawn in the wild, the common carp is considered to be ecologically damaging in waters where it has been introduced. The recent introduction of chub in the R. Inny system is indicative of an attitude of scant concern for environmental, fish health or legal issues.

Thus, the current fish fauna is considered to be a consequence of natural 'immigration' following the ice age, of historical introductions dating over several hundreds of years, of recent well-intentioned fisheries oriented selective introductions and finally, of illegal releases and dispersal of species, some of which have capacity for major ecological conflict with the requirements of long-established species.

The three amphibians established in Ireland are all thought to be native. Earlier suggestions that natterjack toads (*Epidalea (Bufo) calamita*) had arrived in the sand ballast of ships (Frazer, 1983) have been proven wrong by genetic studies (Beebee, 2002; Beebee & Rowe, 2000; May & Beebee, 2008; Rowe *et al.*, 2006). Similarly, recent genetic investigations have demonstrated that common frogs (*Rana temporaria*) have been established in Ireland for thousands of years, although some later introductions may also have occurred (Teacher *et al.*, 2009). There are no molecular studies or fossil records to support the native status of the smooth newt (*Lissotriton (Triturus) vulgaris*) in Ireland, but this is a cold-tolerant species, found within the Arctic Circle and it is generally considered that it would have been capable of re-colonising naturally in the wake of the retreating ice (Marnell, 1996a).

Two of our three reptiles are also native: the common lizard (*Zootoca (Lacerta) vivipara*), which has an even more northerly distribution than the smooth newt, and the leatherback turtle (*Dermochelys coriacea*) which is now known to migrate annually through Irish waters (Doyle *et al.*, 2008). The slow-worm (*Anguis fragilis*), however, is a recent introduction (McGuire & Marnell, 2000). Recent, popular accounts of the amphibians and reptiles found in Ireland have been penned by Inns (2009) and Beebee & Griffiths (2000).

The International Union for the Conservation of Nature (IUCN) coordinates the Red Listing process at the global level and also at the European level (e.g. Temple & Cox, 2009; Cox & Temple, 2009). However, they encourage individual countries and regions to produce their own Red Lists and have published guidelines on the application of the Red Listing criteria and categories at the regional level to facilitate this (IUCN, 2003).

The first Irish Red Data Book was published in 1988 and covered vascular plants (Curtis & McGough, 1988). In 1993, the second Irish Red Data Book brought together information on Ireland's threatened vertebrates: mammals, birds, amphibians and fish, (no reptiles were included) (Whilde, 1993). These publications took several years to prepare and were costly to print. In recent years the emphasis in Ireland and elsewhere has changed to the production of Red Data Lists. Although subject to the same rigorous assessment procedures (IUCN, 2001, 2003, 2010a) the focus has been on making the ensuing publications available online, rather than in hard copy. This has allowed a faster turn around as evidenced by the recent flurry of new Red Lists for Ireland (FitzPatrick, *et al.*, 2006; Foster *et al.*, 2009; Byrne *et al.*, 2009; Regan *et al.*, 2010; Nelson *et al.*, 2011). Progress has also been made on revising and updating the original Red Data Books; a new Red List of terrestrial mammals was published in 2009 (Marnell *et al.*, 2009) and the current volume updates Whilde's (1993) assessments of amphibians, reptiles and fish.

Aim

The Ireland Red List of amphibians, reptiles and freshwater fish aims:

- to provide a full and objective assessment of Ireland's native species of amphibian, reptile and fish inhabiting freshwaters, using the IUCN categories and criteria (IUCN, 2001) and guidance on regional assessments (IUCN, 2003).
- to allow for direct comparisons with the European (Temple & Cox, 2009; Cox & Temple, 2009) and Global assessments (IUCN, 2010b).
- to update the assessment carried out by Whilde (1993) to provide a current and easily revised list.
- to identify those species most in need of conservation interventions.
- to identify the major threats to Ireland's fish, amphibians and reptiles so that mitigating measures can be implemented.
- to provide an objective assessment of the status of non-native fish which have become naturalised in Ireland.

Taxonomic and geographic scope

All amphibians, reptiles and freshwater fish which have been recorded in the wild in Ireland were initially considered. Following the approach adopted by the European Red Lists of Amphibians and Reptiles (Temple & Cox, 2009; Cox & Temple, 2009), five species of reptiles and one of fish were excluded on the basis that they were either post-1500 introductions (i.e. the slow-worm; see McGuire & Marnell, 2000), or only occur as vagrants in Ireland (i.e. four species of vagrant marine turtle and the sturgeon; see Table 2). The sturgeon is represented by individual specimens in the Natural History Museum in Dublin, taken adjoining the Boyne and Liffey coasts in the 19th century, and, most recently, a single specimen taken off Helvic Head in December 1975 (T. Champ pers. comm.). It is generally agreed to be "a vagrant to freshwaters in the British Isles since it never breeds here" and "only very occasionally does one venture into freshwater here" (Maitland & Campbell, 1992).

Table 2: Fish and Reptile species which have been recorded from Ireland, but have not been included in this assessment and the reasons why.

Species name	Common name	Reason
<i>Acipenser sturio</i>	Sturgeon	Vagrant, rarely recorded
<i>Anguis fragilis</i>	Slow-worm	Non-native, recent introduction
<i>Chelonia mydas</i>	Green turtle	Vagrant, occasional records
<i>Eretmochelys imbricata</i>	Hawk's-Bill turtle	Vagrant, occasional records
<i>Lepidochelys kempii</i>	Kemp's Ridley turtle	Vagrant, occasional records
<i>Caretta caretta</i>	Loggerhead turtle	Vagrant, occasional records

All of the native freshwater fish species were assessed using the standard IUCN categories and criteria. The non-native freshwater fish species were also assessed using the IUCN criteria to identify whether the species were 'threatened' in Ireland. While this is not the approach recommended by the IUCN, it was adopted here in recognition of the fact that the status of the established non-native fish species is relevant to the conservation of native fish and also to the conservation of freshwater systems under the Water Framework Directive [2000/60/EC]. Furthermore, all 29 freshwater fish species in Ireland (Table 1) are included when monitoring the ecological quality of waters under the Water Framework Directive. None of the non-native species obtained a threat category. They were then examined again and assigned to new categories, based on the assessment by Kelly *et al.* (2008) of the ecological impact of individual non-native species on native biodiversity. The non-native categories used in this Red List are as follows:

- **Domesticated species [dsp]** – requiring human interference and inputs in order to maintain the species in Ireland. Probably would not survive without these inputs.
- **Non-native benign [ben]** - not requiring specific management to maintain the population, and not impacting on the ecology of the habitats in which it is found. Management of these species is not required in order to protect native species. These species may be of importance for recreational fisheries.
- **Non-native non-benign [nbn]** – introduced species which influences the ecology of the areas in which it has been introduced. In some cases it may pose a threat to the native species, but it is also considered important for recreational fisheries.
- **Invasive Requiring Management [IAS]** – posing a serious threat to the ecology of the areas in which it was introduced and a priority for eradication or control, as appropriate.

The geographic scope of this assessment covers the whole island of Ireland.

Nomenclature for reptiles follows Uetz *et al.* (2011), and for amphibians follows Frost (2011).

The nomenclature and authorities used for fish in this review broadly follow Wheeler (1969) and Maitland (1972). The stone loach, previously allocated to the Cobitidae as *Noemachilus barbatulus* (L.) has been re-allocated to the family Balitoridae as *Barbatula barbatula* (L.) (Maitland & Herdson, 2008).

Red list categories & criteria

The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk (IUCN, 2001). Adoption of the IUCN system also ensures consistency across taxonomic groups and regions.

Although initially developed to assess risk of global extinction, more recently the IUCN have provided guidance on how to apply the red list categories and criteria on a regional level (IUCN, 2003). Assessments for a geographically defined sub-global area assist in conservation prioritisation at a regional level.

Various versions of the IUCN system have been in use for over 40 years, but since the late 1990s the categories and criteria have undergone an extensive review to produce a clearer, widely applicable, open, and easy-to-use system. Consequently, the categories used by Whilde (1993) are no longer applicable although some comparison is possible. For the purposes of the current assessment the additional category of Regionally Extinct was included, as recommended by the IUCN regional guidelines (IUCN, 2003). This category was not used in the 1993 assessment. The full list of categories used in this assessment are given in Figure 1.

The IUCN guidelines provide five criteria against which species data is assessed (IUCN 2010a; see Appendix 1). In order to complete the red list, each species was evaluated systematically against each criterion A-D. Criterion E was not used, as sufficient data for a fully quantitative assessment was not available for any of the species under study. Where a species met any one of the criteria it was noted, and the highest level of threat achieved by a species became its qualifying category. All of the criteria met at the highest level of threat were listed for each species.

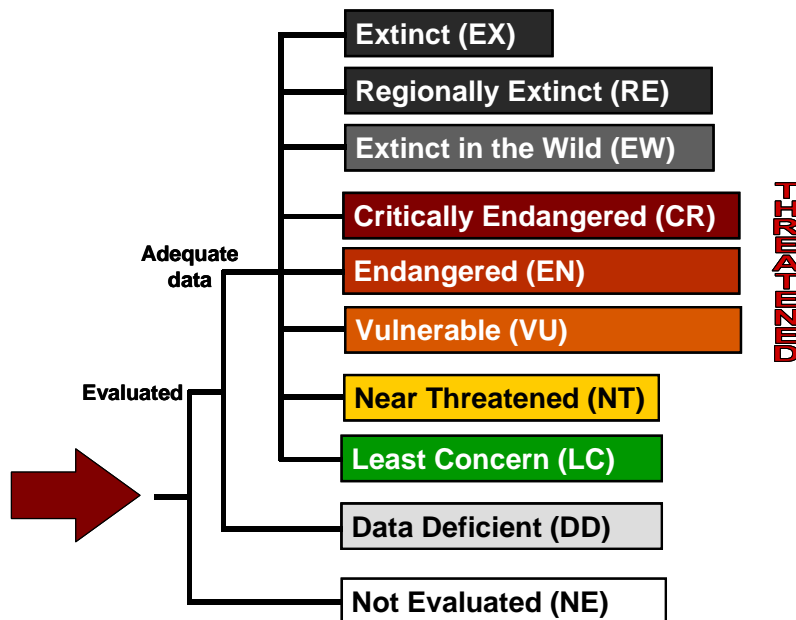


Figure 1: Red List categories used for this assessment. Further details and definitions for these categories and the criteria for achieving them are available in IUCN (2001, 2003) and are summarised in Appendix 1.

Workshops

Assessments for the species were all carried out as part of a workshop with experts on the 20th October 2010, with additional analyses of the salmon data carried out in January 2011. Workshop participants who completed the assessments were Paddy Boylan (Loughs Agency), Donna Cassidy (Northern Ireland Environment Agency), Úna FitzPatrick (National Biodiversity Data Centre), Jimmy King and Willie Roche (Inland Fisheries Ireland; IFI), Naomi Kingston and Ferdia Marnell (National Parks & Wildlife Service; NPWS), and Robert Rosell (Agri-Food and Bio-Sciences Institute for Northern Ireland).

Complete reassessment of this list is recommended in 2020.

SUMMARY OF FINDINGS

The Red List assessment found that of the 20 native species evaluated, 1 species (European eel) was assessed as Critically Endangered (CR); 1 species (natterjack toad) was assessed as Endangered (EN); 5 achieved a threat status of Vulnerable (VU), pollan, Arctic char, twaite shad, Killarney shad and Atlantic salmon; 1 species (sea lamprey) was found to be Near Threatened, 11 were of least concern, and 1 species (allis shad) was data deficient (Appendix 2; Figure 2).

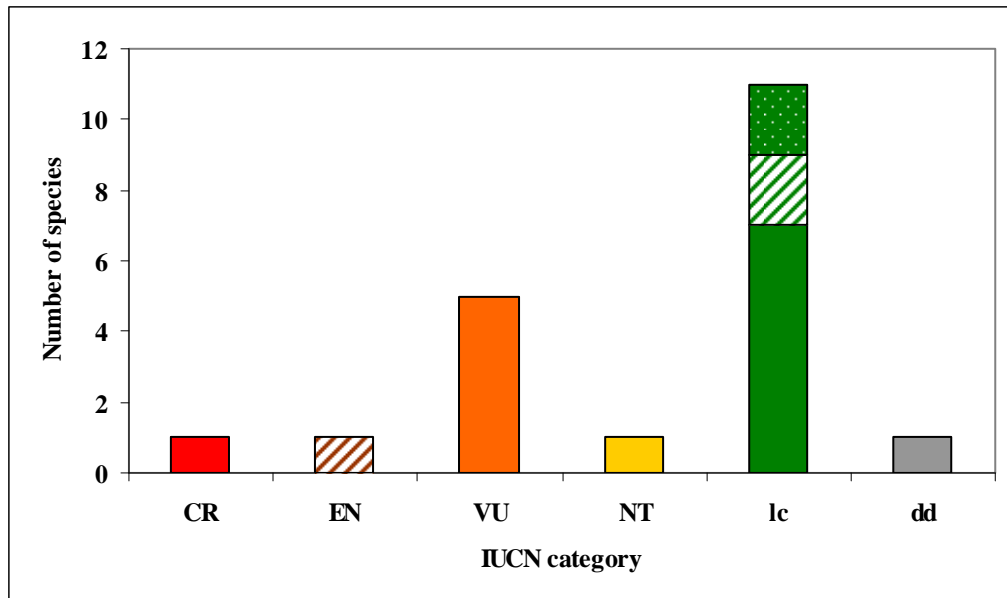


Figure 2: The number of native species in each of the IUCN categories following the assessment. Solid fill – Fish; Diagonal lines – Amphibians; Dots – Reptiles.

The classification of the European eel as Critically Endangered, is a reflection of its significant decline in Ireland and the Europe-wide decline in eel populations. This concern has recently led to the implementation of an ‘Eel Management Plan’ which includes significant mitigation actions against turbine-inflicted mortalities and a ban on all commercial eel netting in Ireland to at least 2012 (DCENR, 2009).

The natterjack toad, was assessed as Endangered because its distribution range is now severely fragmented following a range contraction of 50-60% in the first half of the 20th Century.

Species in the Vulnerable category include several of our longest established fish species (i.e. pollan, char, twaite and Killarney shad and Atlantic salmon). The first two are lake residents requiring areas of deep, cold water unimpacted by nutrient enrichment. Char populations have been lost from a number of lakes over the last 40 years and, while on-going surveys have located previously-unrecorded populations for the species, the loss of char from large lakes such as L. Corrib and L. Conn is very significant (Igoe, *et al.* 2001; 2003). While a new population of pollan has recently been confirmed for L. Allen on the Shannon (Harrison *et al.* 2010) the extant populations in L. Ree, L. Derg and L. Erne Lower are considered to be small. The Killarney shad is naturally confined to a single location, an inherently vulnerable predicament. Despite eutrophication pressures, however, the population in L. Leane has been shown to be healthy in two surveys during the 1990s and by recent Water Framework Directive (WFD) Surveillance Monitoring (Kelly *et al.*, 2009). The twaite shad is restricted to the lower reaches of a handful of rivers in the south,

with evidence of recruitment only from the Barrow, Suir and Munster Blackwater (King & Linnane, 2004; King & Roche, 2008). The salmon is still found throughout the country, but it has shown significant declines since the 1970s. Coastal and marine mixed stock fisheries ceased in 2006 in the south of Ireland and fishing is now confined principally to single stocks which have been shown to be exceeding river-specific conservation limits. In the Loughs Agency area marine commercial exploitation of salmon was confined to the tidal reaches of Lough Foyle in 2007 and in 2009/2010 no commercial fishery licences were issued. Angling is now restricted to rivers with healthy populations.

The sea lamprey was the only species allocated to the Near Threatened category. This species has been recorded in a number of catchment-wide surveys (e.g. King & Linnane, 2004; O'Connor, 2004, 2006, 2007) but generally in small numbers and in locations focussed at the downstream end of the main stem channel and below major weirs.

The allis shad was the sole species catalogued as 'data deficient' (dd). This species has been found, along with hybrid allis x twaite shad, in the large SAC estuaries in the southeast (King & Roche, 2008). The occurrence of hybridisation is often associated with pressures on a species. The reduced capacity to escape far into freshwater due to barriers, or a paucity or absence of mates for spawning, may force allis and twaite shad to spawn together. More recent genetic investigations of these Irish shad indicates a more 'mixed' situation than can be discerned from morphological characters alone (Coscia *et al.*, 2010).

Comparison with previous Red List

Our knowledge base for most species has improved significantly since the first Vertebrate Red Data Book was published (Whilde, 1993). And while direct comparisons between that 1993 review and the current assessment are confounded by the change in IUCN categories, a general evaluation of the differences and similarities is of interest. One further change is that the new IUCN approach involves listing all species, even those assessed as least concern, whereas the approach taken by Whilde (1993) involved filtering out the species of least concern at an earlier stage and producing a list of Threatened species only.

In the current assessment six of the 15 native fish species received a threat category (40%). One more was considered Near Threatened. The previous Red Data Book (Whilde, 1993) considered nine of these species to be in threatened categories (60%): the three lampreys, three shads, pollan, char and smelt. The salmon was seen as a 'species of international importance' whose status was in decline over much of its range but remained common in Ireland.

Whilde (1993) categorised the three lamprey species as Indeterminate (I). This category was reserved for species "known to be 'Endangered' or 'Vulnerable' or 'Rare' but where there is not enough information to say which of the three categories is appropriate." The current review has the advantage of a substantial body of survey work since 2000, including a number of catchment-wide surveys of juvenile lamprey distribution and status (e.g. King & Linnane, 2004; O'Connor, 2006). These have shown that juvenile river/brook lamprey (the two species are indistinguishable at juvenile stage) are widely distributed in catchments where suitable habitat is available and, on this basis, both river and brook lamprey have now been classified as of 'least concern'. The same survey programmes have also demonstrated that sea lamprey can be found in many of our larger

river systems. However these surveys have shown that sea lampreys are normally scarce, with low densities of juveniles where they do occur and a tendency for migrating adult fish to be concentrated downstream of major weirs in rivers. This species is now listed as Near Threatened.

The twaite shad was considered Vulnerable by Whilde in 1993 and is still considered Vulnerable. The Killarney shad and allis shad were both previously assessed as Endangered, however, recent surveys suggest that the Killarney shad is holding its own, although its severely limited distribution still merits an assessment of Vulnerable. The surveys of our southern rivers over recent years have shed some doubt on the status of the allis shad in Irish waters. It is now listed as data deficient. Further work is required to determine whether this species breeds in Ireland and how it interacts with twaite shad.

As in 1993, both the char and pollan remain a major cause for concern in regard to status and threats, although a further population of pollan has been discovered since Whilde did his assessment (Whilde, 1993) and this species is now listed as Vulnerable rather than Endangered. In the case of smelt, survey work since 2000 has generated a body of information that moves the species from a status of Vulnerable to one of 'least concern'. The altered status is justified by confirmation of populations of smelt in estuaries in the southeast, as well as in the Shannon and Foyle (Quigley *et al.*, 2004; Doherty & McCarthy, 2004). Subsequent sampling (IFI, Loughs Agency and Northern Ireland Environment Agency unpublished data) has confirmed the presence of spawning populations in these waters.

The natterjack toad was assessed as Endangered in 1993 and, despite some evidence of population stabilisation in recent decades, it still qualifies as Endangered in the current Red List. The frog, previously assessed as Internationally Important (a category that no longer exists) is now considered to be least concern. Whilde (1993) did not include the leatherback turtle in his Red Data Book; that species is assessed here as least concern.

A comparison of all the old and new assessments is provided in Appendices 2, 3 and 4. These changes in IUCN status from Whilde's 1993 review to the present indicate the importance of building up an information base that permits informed, consistent and dispassionate status allocations. However, a reduction in status or threat level for a species does not remove the need for on-going monitoring of that species.

None of the non-native fish species received a threat category in the original Red Data Book (Whilde, 1993). We reached the same conclusion in this review. Their designation in this Red Data List relates to their impact on the ecology of the water in which they occur. Some, such as tench, gudgeon and rudd, are considered 'benign' as they have no obvious adverse impact on waters or native species. Others, such as pike, roach and perch are classified as 'non-benign', signifying an adverse impact on the ecology of the water in which they occur. Of significance is the very rapid range expansion of roach. The roach has demonstrated a capacity to occupy a wide range of habitat niches and has been particularly successful in eutrophic waters. The rapid expansion of populations in some lakes has been matched by substantial declines in others, attributed to improvement in water clarity arising from zebra mussel populations. The dace and chub are listed as 'Invasive requiring management' to signify the concern in relation to any further introduction or expansion of range of these species. When a new species is introduced it finds itself in a situation where, if it has the capacity to cope with the temperature and water chemistry regimes present, it

may have no competitors and no predators. Successful 'invaders' frequently have a generalist feeding habit and habitat requirement. This enables them to colonise widely and compete successfully with species that may have more specific or specialist requirements. The chub is a recent arrival and significant attempts are being made to prevent its further spread and to extirpate the current population and any of its progeny. The rainbow trout and common carp are resident in a number of waters on the island. Their status is maintained largely by repeated stocking of fish, particularly in the case of rainbow trout. As such, the two species are considered here as 'Domesticated Species'.

Threats

Whilde (1993) identified a series of threats to the Irish fish fauna and many of these remain valid. An overview of threats (Table 3) identifies water pollution and non-native fish introductions as having the potential to impact on all members of the fish fauna. Water quality reporting by the EPA in the last two decades or so has documented a general decline in incidents of gross point-source pollution. However, diffuse source pollution continues to remain problematic, particularly in regard to the application of slurries and fertilisers in agricultural and silvicultural practises. The most recent EPA review (McGarrigle *et al.*, 2010) identified Local Authority waste water treatment facilities and land management practises as two of the major and on-going contributors to water pollution.

Dredging and associated river works can impact by removal of, or damage to, available niche habitats and by generation of suspended solids. These works are generally undertaken in order to retain or improve the conveyance capacity of the channels. Instream vegetation growths and deposits of fine sands and silt are frequently targeted for removal in such operations. This can lead to loss of age classes of juvenile lamprey that may be resident in the silt banks and to loss of spawning habitat for a range of coarse fish. Any 'simplification' of the river corridor habitat, in its totality, may impact adversely on fish community composition and size. Land management practises may also impact on lake and river habitats, even when the waters are at a remove from the site of activity. Over-grazing in uplands has led to substantial siltation in gravel beds in rivers in the west. Likewise, forestry practises have contributed to silt loadings, in addition to contributing to nutrient enrichment. These impacts can occur in remote and poorly-buffered habitats on hard rock, where lakes and streams might otherwise be expected to be in 'pristine' condition due to the absence of any other anthropogenic impacts. Localised forestry mediated acidification leading to fishless streams in poorly buffered upland catchments has also been observed (Kelly-Quinn *et al.*, 1996a & 1996b).

Barriers to passage are a particular threat to diadromous species - those using both fresh and sea water during their life cycle. It is apparent from surveys that sea lamprey are regularly encountered downstream of major weirs in the large rivers that they ascend. Such weirs are, frequently, the first barrier to be encountered and preclude the sea lamprey from use of a large area of catchment upstream. Low flow conditions can exacerbate the impact of barriers, with significant numbers of Atlantic salmon being corralled downstream of obstructions that, in normal or elevated flow, they would have no difficulty in ascending. Barriers can prevent or delay spawning migration and, even where passage has been successful, the stress and energy loss to fish may impact adversely on quality and quantity of spawning. The size of barrier is also an important

issue. Thus, salmon and sea lamprey passage may be impeded by large weirs associated with traditional milling operations on such rivers as the Liffey, Nore and Blackwater. However, barriers with a low head height, culverts with a vertical drop and insensitive construction of bridge aprons can all impede passage of smaller fish species. Upstream migrating elvers are particularly vulnerable to disruption by a variety of weirs and obstacles such as culverts, fish counter crump weirs and flow gauging weirs.

Table 3: Threats (potential or actual) that may impact on the Irish fish fauna.

	Pollution	Dredging: timing of works & impacts	Barriers to passage	Commercial harvesting/by-catch	Large-scale abstraction/entrainment	Abstraction/fluctuating lake levels	Siltation of spawning gravels	Aquaculture	Land mgmt. practises	Introduction of non-native fish species	Eutrophication	Competition/hybridisation	Climate change/Ocean current impacts
<i>Native species</i>													
Sea lamprey	x	x	x				x			x			
River lamprey	x	x	x				x			x			
Brook lamprey	x	x	x				x			x			
Allis shad	x		x	x	x		x			x		x	
Twaite shad	x		x	x	x		x			x		x	
Killarney shad	x					x	x			x	x		
Atlantic salmon	x	x	x		x		x	x	x	x	x		x
Brown trout/Sea trout	x	x			x		x	x	x	x	x		
Arctic char	x					x	x			x	x		
Pollan	x					x	x			x	x		
Smelt	x		x	x	x					x			x
European eel	x	x	x		x					x			x
Three-spined stickleback	x	x				x				x			
Ten-spined stickleback	x									x			
Flounder	x									x			
<i>Non-native species</i>													
Pike	x	x								x			
Tench	x	x								x			
Common bream	x	x								x		x	
Rudd	x	x								x		x	
Roach	x	x								x			
Dace	x	x								x			
Minnow	x	x								x			
Gudgeon	x	x								x			
Stoneloach	x	x								x			
Perch	x	x								x			

Natural and artificial weirs may serve as locations for installation of small-scale electricity generators. This can create further pressure on fish species, such as adult salmon, due to loss of flow for ascent, or salmon smolts, due to entrainment issues during downstream descent. Large hydroelectric schemes, such as those on the Shannon, Erne, Lee and Liffey, have had a substantial

impact on the ascent of large fish species such as salmon and sea lamprey leading to a significant underproduction from these catchments (McGinnity *et al.*, 2003).

Water abstraction, for potable supply, agricultural and industrial use (production processes, cooling water etc.) is undertaken from both rivers and lakes. Many such abstractions are not licensed. In lakes, fluctuation in water surface levels caused by large-scale abstraction can lead to ecological instability in the littoral zone. In upland lakes with genetically-unique populations of char and brown trout such fluctuations can lead to drying out of gravelled shoreline areas used by these fish species for spawning. Irrigation of tillage crops frequently involves pumping water directly from an adjoining channel. The intensive and large-scale nature of many tillage operations can create a major demand for water, with consequent adverse impacts on the fish communities in the channels impacted. Appropriate management strategies can offset such problems.

Commercial harvesting has now been severely curtailed for salmon. Similarly, commercial fishing has been discontinued for eel since 2009 (DCENR, 2009), in view of the decline in recruitment of glass eel and elvers back into our rivers. This is a Europe-wide issue and is also being addressed at EU (EC No. 1100/2007) and global (CITES Annex II) levels. By-catch from commercial marine fishing may lead to entrapment of allis and twaite shad, particularly of young, pre-spawning adults. Overfishing for local domestic consumption led to decline and extinction of smelt populations from a number of estuaries in Scotland in the 19th century, indicating the vulnerability of this species to exploitation (Maitland & Lyle, 1996). The use of smelt, shad and lamprey as prime pike bait is now common in Ireland. This bait is sold vacuum packed and is identified as imported. It is not considered that the Irish populations of these species could sustain harvesting for this purpose.

The declines in eel and salmon may both be associated, in part, with climate change and ocean warming issues (Boylan & Adams, 2006; Kennedy & Crozier, 2010). Changes in ocean water thermal regimes and shifts in patterns of currents may be impeding migration to and from spawning and feeding grounds, be impacting on growth and survival and, in the case of eel, may be affecting spawning and the return of the larvae to the continent. Increased temperature has led to loss of the smelt from waters in the Gironde, in France. However, such ocean thermal shift is also associated with the recent sustained appearance of the golden-grey mullet and gilt-head bream in Irish coastal and estuarine waters (c.f. Irish Specimen Fish Committee annual reports) and may, in turn, be conducive to increase in shad use of Irish estuarine and freshwater habitats. In inland fisheries, global warming may be beneficial, in the immediate term, to the cyprinid species e.g. roach, bream. On the other hand, increasing water temperatures, particularly in rivers, would be detrimental to the salmonids and coregonids – all of whom are post-glacial colonisers of Irish waters. A combination of abstraction from a channel in summer conditions with elevated water temperatures would compound such difficulties.

Eutrophication or nutrient enrichment has impacted on many Irish lakes and rivers. The process is linked with increased plant plankton growth, reduced water clarity and depletion of oxygen levels in lakes during thermal stratification. These chemical and physical impacts are not conducive to the ecological requirements of the salmonid and coregonid species. In lakes, thermal stratification will warm the upper layers of the water column, driving char and pollan down into deeper water. If these deeper layers show a reduction in oxygen levels the species are 'squeezed' between two

undesirable habitat circumstances. On the other hand, the cyprinid species can cope with elevated water temperatures and the spread of roach is considered to have been facilitated by increasing eutrophication pressures in many Irish lakes. The combination of chemical and physical impacts along with introduced species (e.g. roach, zebra mussel) may have significant ecological impacts changing, for example, the plankton communities to such an extent that food sources for certain salmonids and coregonids become unavailable leading to extinctions.

The current Irish fish fauna is a composite of native and introduced species. Many of the non-native species have been in Irish waters for hundreds of years and may be in some ecological balance with the other fish species and their habitats. Of the more recent arrivals, roach has spread dramatically in the last 40 years and has impacted substantially in those lakes and rivers where it now occurs. It is a highly 'plastic' species and can occupy a range of feeding niches and habitat niches, ousting resident species that might otherwise use these niches. The dace would appear to be undergoing a similar expansive phase. The linking of major catchments, such as the Barrow, Shannon and Erne, via canals and waterways, facilitates such rapid expansion of range.

A consequence of the roach expansion, and of its adaptive capacity, is the appearance of large populations of hybrid forms. Hybridisation of roach with bream and rudd is common, as is the rudd X bream hybrid. These forms are of leisure angling and tourism importance in coarse angling fisheries. The development of hybrid forms, all of which are fertile and produce viable offspring, may be an indication of 'pressure' on one of the species in question. Rudd populations have declined substantially with the roach expansion due to competition and are not generally found as 'pure' rudd populations in the open water of lake systems in Northern Ireland, being confined to backwater systems. Hybridisation has also been recorded among the two anadromous shad species (King & Roche, 2008, Coscia *et al.*, 2010). In that case the impact of barriers to migration may constrain the allis shad and oblige it to spawn with the more numerous twaite shad.

Ireland has been considered to be at the thermal edge for a range of fish species and this situation will change as ocean and freshwater temperatures rise (Fealy *et al.* 2010). The post-glacial native fish, such as char and pollan, are most endangered and long-term strategies may now be required to try and address thermal impacts. The opportunities to address thermal issues in lakes may be extremely limited, although management of abstractions and retention of high water volumes in lakes would be of some value in curtailing any warming. The retention of tree lines along rivers and streams may serve to provide shading and cooler thermal regimes for instream salmon and brown trout. However, this will require management of the current riparian tree resource – which is very patchy – and a specific policy of tree planting to facilitate shade into the future.

Habitat loss, in particular wetland drainage and infilling is the major threat to Irish amphibians. Terrestrial habitat is also important for these species and excessive clearance of vegetation around breeding sites, removal of hedgerows and scrub can have a deleterious impact on local breeding populations. Introduction of fish into ponds can lead to extirpation of newts and recent reports of invasive, non-native species such as terrapins and turtles gives further cause for concern. The main threats facing the leatherback turtle in the north-east Atlantic are accidental ingestion of plastic waste at sea and by-catch in long-line fisheries.

Conservation actions

The threats above highlight the issue of 'change', essentially a change in habitats – generally towards a less stable, more enriched status, where a simplification occurs and where generalist species with high fecundity may have an advantage; one where the cold-water, post-glacial native fish species are completely disadvantaged.

Salmon and eel are two commercially-important species and measures have already been undertaken to address the decline in stocks of both. Coastal and marine mixed stock commercial fishing for salmon has been terminated and salmon exploitation is now restricted to single-stock fisheries with quantifiable surpluses. Annual data gathering by IFI and the Marine Institute generates an information base on adult salmon escapement and this determines which, if any, salmon rivers are open for commercial and/or rod angling in the following season. Many rivers have remained closed to exploitation over several years. In others, catch-and-release angling, only, is permitted. Within the Foyle and Carlingford catchments the Loughs Agency operates similar monitoring programmes but operates a system of real time management to control exploitation whereby fishing may be suspended in the event of non achievement of conservation limits largely based on an extensive fish counter programme. In relation to the eel, the decline in status is considered alarming at European level and Ireland moved quickly to fully implement its 'Eel Management Plan' under the EU Regulation. This aims to significantly reduce eel mortality from fishing, turbines, obstructions to migration and poor water quality.

Both the Habitats and Water Framework Directives should act as instruments for species conservation and environmental improvement. The former has led to the establishment of Special Areas of Conservation (SACs) for the Annex II listed species – Atlantic salmon, the three lamprey species and the twaite and Killarney shads. Annex IV of the Habitats Directive lists species requiring special protection e.g. the natterjack toad, while Annex V lists species whose exploitation may be subject to management measures, including the frog and several of the native fish species (shads, salmon, pollan and river lamprey). Further work is required to develop a clear framework within which the processes for Annex V fish protection and management are developed and implemented. Furthermore, some Irish waters contain important fish assemblages which may not be protected under the Habitats Directive or WFD. In some of these cases designation as a Natural Heritage Area (NHA) under the Wildlife Acts would be an appropriate step to highlight the conservation significance of these waters and provide legislative support for their protection.

Monitoring the status of each of the species listed on each Annex is a requirement of the Habitats Directive. A detailed NPWS-funded national frog survey is underway and this should answer many outstanding questions regarding habitat use and population size. In particular it should shed light on whether the frog has adapted to changes in wetland availability, the expansion of forestry and the continuing loss of peatlands. Another NPWS monitoring scheme is also underway for the natterjack toad and IFI has initiated an extensive programme of Habitats Directive fish monitoring. This latter is complimented by the ongoing work on fish assemblages under the Water Framework Directive. Over time, these monitoring schemes should help identify changes in species' habitats and range, shed light on population trends and provide robust data on impacts and threats.

The WFD can contribute to fish conservation through programmes of measures aimed at water chemical quality and at hydromorphology. Water quality must be retained at 'high' levels, where

such currently exist, and must be raised to 'good' status in all other waters by 2015. Measures to improve water quality should address issues of nutrient enrichment and dissolved oxygen levels. Such measures would be pertinent to improving living conditions for fish. 'Continuity' is one of a series of elements under the 'hydromorphology' criteria in WFD. Artificial barriers to movement are one of the major threats to fish species and measures to address discontinuity will be conducive to a wider dispersal of diadromous fish species into catchments, particularly the salmon, shads, eel and migratory lamprey. As the island is a single ecoregion under the WFD it is desirable to have a consistent strategy of sampling and monitoring for status assessment. This is the case for WFD assessment and consistency should also be strived for, among relevant state agencies north and south, under Habitats Directive.

There is also the potential for conservation action under the National Biodiversity Plan (DAHGI, 2002). One mechanism provided for is Species Action Plans (SAPs). An SAP was written for the natterjack toad in 2002 (Beebee, 2002) and an all-Ireland SAP has also been developed for the pollan (Anon. 2005). The Natterjack toad SAP identified a number of high priority actions and in particular the need for more ponds in certain areas to compensate for previous wetland losses. After some ad-hoc pond digging failed to address the issue, a large pond creation scheme was initiated in 2008 and under this 94 ponds have been dug to date. The pollan SAP recognised that solving the complicated water quality problems causing the pollan's decline could take a significant amount of time. It recommended, as a fall back, that expertise in husbandry for the species be developed as well as the identification of potential 'reservoir' locations for pollan from donor lakes under severe threat. To date, stripping of wild pollan and on-rearing of the fertilised ova has been successfully undertaken in the Movanagher hatchery in Northern Ireland.

Legal protection is also in place, to varying degrees, for all the species included in this Red List. The NI Wildlife Order and, in the Republic, the Wildlife Acts provide some protection for the native amphibians and reptiles. The primary legislation covering fish is the Fisheries Acts 1959 to 2006 in the Republic of Ireland and the Fisheries Act (Northern Ireland) 1966. General provisions (e.g. regarding prohibited means of fishing) are similar North and South and apply to all freshwater fish. More specific and restrictive legislation (e.g. relating to closed season and bag limits) are in place for some species e.g. the bye-laws relating to pike [809 of 2006] and coarse fish [806 of 2006]. The situation with fish is slightly complicated by the fact that the Loughs Agency have responsibility for fish protection in the Foyle and Carlingford catchments. The primary legislation here is the Foyle Fisheries Act 1952, Foyle Fisheries Act (NI) 1952 and Foyle and Carlingford Fisheries Act 2007.

Current and future research priorities

Further research is needed on the management and control of invasive non-native species, an issue that was also highlighted in the recent Terrestrial Mammals red list (Marnell *et al.*, 2009). In the aquatic environment, this requirement extends beyond fish to include plant and invertebrate invasives.

Among the less 'commercial' species, both pollan and char are considered to be under significant threat. A major programme is required to investigate the biology and ecology of the pollan in the five large lake systems in which it now occurs. The study must investigate the size of populations,

interactions of the populations with thermal stratification and food use, the locations and timing of spawning activity and must endeavour to use, primarily, non-destructive sampling strategies.

The data deficient status for allis shad highlights the need for further research on the biology and ecology of this species, as well as the need for a better understanding of its interactions with twaite shad.

The application of genetic techniques has brought the concept of 'uniqueness' to a new level (Coscia *et al.*, 2010; Massa-Galluci *et al.*, 2010, McKeown *et al.*, 2010). Investigations must be continued on the genetics of 'brown trout' to assess the degree of uniqueness, and hence requirements for specific conservation and management measures, of such forms as 'gilaroo', 'ferox', 'croneen', sea trout and others. Similar application of genetic strategies may help further elucidate the conundrum of the brook and river lamprey – with distinct adult forms but no apparent distinction between species at the juvenile stage (Maitland, 2003). This problem at the juvenile stage precludes a full assessment of distribution or conservation status for either species.

It is understandable that substantial investigations have been carried out on many of the 'large' or 'interesting' fish species – frequently being the commercially important forms, the major angling species or those with a conservation appeal. Equally, little research has been done on the 'small' fish species such as minnow and stone loach. Geraghty (unpublished data) undertook studies on gudgeon in the Suck catchment and investigations on the ecology and evolution of the three-spined stickleback were underway in 2009 – 10 (Ravinet, 2009). Information on ten-spined stickleback was scant from fisheries sources or surveys for this red list assessment and much valuable comment was gleaned from aquatic biologists more accustomed to sampling in small water bodies. There is a clear area warranting investigation in relation to the small fish species and a monograph series would be welcomed. This may be an area where university departments might take a lead. In regard to monographs, it is approximately 40 years since the Royal Irish Academy published a series of seminal monographs on brown trout, rudd, tench and bream by Michael Kennedy and Patrick Fitzmaurice of the then Inland Fisheries Trust, now within Inland Fisheries Ireland (IFI). A review would be timely.

Notwithstanding a number of distribution surveys (Marnell, 2002; Meehan, 2007; Farren *et al.*, 2010), the common lizard has received little attention from research institutes in Ireland and much of our understanding of its ecology and habits in Ireland is based on extrapolation from studies elsewhere (e.g. Beebee & Griffiths, 2000). This species would benefit from some focused research in coastal and upland habitats in Ireland. An examination of the genetics of the species in a European context would also be of interest.

The early work of Gabriel King (King & Berrow, 2009) highlighted the importance of Irish coastal waters for the leatherback turtle. Hays *et al.* (2004) and, more recently, Doyle *et al.* (2008) have given some insights into the migratory behaviour of this species in the north Atlantic. However, a better understanding of the breeding and feeding ecology of the leatherback turtle in the north-east Atlantic will be necessary before this species can be fully protected. The impacts of climate change are of concern world-wide for amphibians. Coastal species, such as the natterjack toad, are particularly vulnerable given the potential for sea-level rise to impact their breeding habitats. Inter-disciplinary investigations on coastal species and their ecosystems and their potential to cope with sea-level rise and shifts in temperature and rain-fall patterns would be highly informative.

NATIVE SPECIES ACCOUNTS

The native species accounts have the following headings:

- **Species name** and taxonomic authority
- **Synonyms** in current or historical use for the species in Ireland
- **English** language common name
- **Irish** language common name
- **Irish status** – Red list status for Ireland identified during this assessment and using the IUCN categories and criteria (IUCN, 2001; 2010a).
- **European status** – Red list status for Europe if available, see Temple & Cox (2009) and Cox & Temple (2009).
- **Global status** – global Red List status if available, taken from IUCN Red List of Threatened Species (IUCN, 2010b)
- **Legal Status** – Any legal protection afforded to the species. This will be one or more of the following: EU Habitats Directive [92/43/EEC], Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007; Wildlife Act, 1976, Wildlife (Amendment) Act, 2000 or Wildlife (N.I.) Order of 1985. Where the species is covered by international laws (e.g. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)) this is also included. For species listed on Annex II of the EU Habitats Directive, the number of Special Areas of Conservation (SACs) for which the species is listed as a qualifying interest is also included.
- **Rationale for assessment** – a description of how the IUCN category was determined. This will include details of any previous red list status for Ireland, and the rationale behind any population estimates. This section should be read in conjunction with the IUCN guidance documents that were referred to for this assessment (IUCN, 2001; 2003; 2010a) and the previous Irish assessment (Whilde, 1993).
- **Distribution** – a general description of the global distribution of the species, followed by a more detailed description of its distribution in Ireland.
- **Population in Ireland** – an estimate of the effective population size (i.e. breeding population) in Ireland, where available, and a description of whether the population is stable, increasing or declining.
- **Ecology and habitat in Ireland** – a brief summary of the available ecological information for the species, including a description of the species broad habitat preferences in Ireland.
- **Threats** – a brief outline of any significant threats to, or activities impacting on, the species conservation status in Ireland.

Petromyzon marinus Linnaeus, 1758

Common name: Sea lamprey

Irish name: loimpre mhara

Irish status: Near Threatened [A2c, B1ab(iii)]

Global status: least concern

Photo: Seán Roorney, IFI



Legal status: EU Habitats Directive [92/43/EEC] Annex II. 10 SACs listed in RoI; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Indeterminate (Whilde, 1993). Extensive survey work since then (e.g. Kurz & Costello, 1999; King & Linnane, 2004; and IFI unpublished data) points to widespread penetration of adult fish into rivers. However, the concentration of redds downstream of weirs points to problems of accessibility and inability to colonise to its capacity (Kelly & King, 2001; Igoe *et al.*, 2004). Very low levels of occurrence and density of juvenile fish listed in published catchment-wide surveys (O'Connor, 2004; King, 2006) give rise to concerns for the long-term future of this species and it is now listed as Near Threatened.

Distribution: The sea lamprey is found on the Atlantic coasts of Europe and North America, where it has penetrated to the Great lakes (landlocked populations). It also extends into the eastern Mediterranean (Economidis *et al.*, 1999).

The species has been reported from the lower reaches of many of the large river catchments in the Republic (Kurz & Costello, 1999) and in Northern Ireland (Goodwin *et al.*, 2009). Limited investigations in the 1960s (Kennedy unpub.) and recent findings point to the likely presence of non-migratory populations in L. Derg and L. Conn.

Population in Ireland: Based on unpublished redd counts, the distribution of spawning effort and number of redds is low in the SAC channels surveyed (IFI unpublished data). Very low numbers of sea lamprey juveniles have been recorded in the Barrow (King 2004) and Suir (O'Connor, 2007). However, mean numbers in both the Feale (O'Connor, 2006) and Moy (O'Connor, 2004) exceeded the proposed target level for favourable conservation status (>0.1 juveniles/m²), based on Harvey and Cowx (2003).

Ecology and habitat in Ireland: Adults are external parasites at sea on a range of fish species (Kelly & King, 2001; Maitland, 2003). Adults migrate from the sea into freshwater and appear in late May. Spawn in groups in May – July in shallow water, constructing large, salmon-sized redds

in gravel/cobble beds, generally in main stems of large rivers. Adults die after spawning. Juveniles spend several years in fine-grained sediment prior to transforming into young, free-swimming adults. The young adults can feed parasitically as they descend through estuaries into the sea. Spends its adult life in the sea for about 20 to 30 months.

Threats: Pollution, causing fish kills, leads to loss of both adult and juvenile forms. Dredging or desilting operations in rivers can lead to loss of habitat and to resident populations of juveniles (King *et al.*, 2008). Weirs are seen as a major factor in impeding upriver penetration of this species (Goodwin *et al.*, 2009) and this has adverse consequences on dispersal and resource use in any catchment. It is considered of little long-term survival value to the species to have spawning sites in the upper tidal reaches of rivers.

Lampetra fluviatilis (Linnaeus 1758)

Common name: River lamprey; lamper eel

Irish name: loimpre abhann

Irish status: least concern

Global status: least concern

Photo: Inland Fisheries Ireland



Legal status: EU Habitats Directive [92/43/EEC] Annex II and Annex V. Nine SACs listed in RoI; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Indeterminate (Whilde, 1993) but there has been extensive survey work since then and now known to occur in all major catchments in Northern Ireland, in estuaries of east and south-east and in the Shannon estuary. Although the adult form can be easily distinguished from the brook lamprey on size, the juveniles cannot be distinguished. Nonetheless adult data show the species to be sufficiently widespread to be assessed as least concern.

Distribution: Ranges from western Mediterranean northward to Finland (Kelly & King, 2001). Recent records from the Shannon (Igoe *et al.*, 2004) and from many east coast rivers, with evidence of a large population in the Slaney (King & Linnane, 2004; IFI unpublished data). Also known from the Erne system and in other major catchments in the North (Goodwin *et al.*, 2009).

Population in Ireland: No quantitative investigations have been undertaken on adult river lamprey populations. Observations have pointed to substantial numbers of fish running some of the rivers of the southeast – Slaney, Owenavarragh and Avoca. The fact that river and brook lamprey ammocoetes cannot be distinguished renders it impossible to assess the status of either species at this most accessible life history stage.

Ecology and habitat in Ireland: It is considered a twin species or paired species with the non-migratory brook lamprey. River lampreys spawn in groups in spring - late March to mid May - in shallow riverine areas, constructing simple redds in gravel/sandy beds (Maitland, 2003). Juveniles spend several years in fine-grained sediment prior to transforming into young, free-swimming adults. Adults live in the sea, but not as far from the coastline as sea lamprey. Adult river lamprey are external parasites on other fish species. In autumn, adults undergo reproductive migration from the sea to rivers, although recent studies have identified a non-migratory ('land-locked') population in Lough Neagh (Goodwin *et al.*, 2006; Inger *et al.*, 2010).

Threats: Pollution, causing fish kills, leads to loss of both adult and juvenile forms. Dredging or desilting operations in rivers will lead to loss of habitat and to resident populations of juveniles (King *et al.*, 2008). Barriers to passage of migrating adult fish will impede dispersal into catchments. However, adults can ascend barriers in elevated flow conditions. The autumn timing of the adult migration may be adaptive for the survival of this species. Commercial harvesting is significant in Finland and Baltic states.

Lampetra planeri (Bloch 1784)

Common name: Brook lamprey

Irish name: loimpre shrutháin

Irish status: least concern

Global status: least concern

Photo: Frank Green



Legal status: EU Habitats Directive [92/43/EEC] Annex II. Ten SACs listed in RoI; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Indeterminate, but there has been extensive survey work since then. Sampling since 2003, on a catchment-wide basis, has indicated presence of this species in a series of designated SACs in the Republic. Additional catchment-wide surveys undertaken in period 2004 – 2010 has confirmed a widespread distribution in channels in the Republic (IFI unpublished data) and in Northern Ireland (Goodwin *et al.*, 2009). This species is therefore listed as least concern.

Distribution: Range extends from northwest Mediterranean to Scandinavia, Britain and Ireland (Kelly & King, 2001). Widely spread throughout Ireland (e.g. O'Connor, 2004; 2006 a & b).

Population in Ireland: No population estimate available. Current programme of ammocoete surveys will provide a platform for future comparative studies and will permit assessment of population trends. The fact that river and brook lamprey ammocoetes cannot be distinguished renders it impossible to assess the status of either species at this most accessible life history stage.

Ecology and habitat in Ireland: Lives exclusively in freshwater, in channels ranging in size from small streams to large rivers (Maitland, 2003). Within-catchment distribution can be very patchy and is related to availability of suitable habitat i.e. fine sandy/gravelled areas for adult spawning and areas of deposition of fine sediments for the juvenile or ammocoete stage (Maitland, 2003; Goodwin *et al.*, 2009). Spawn in groups in spring - late March to mid May - in shallow water, constructing simple redds in gravel/sandy beds. Juveniles spend several years in fine-grained sediment prior to transforming into young, free-swimming adults. This is a non-migratory, non-parasitic form. It is considered a twin species or paired species with the anadromous river lamprey. The adult forms can be easily distinguished on size but the juveniles cannot be distinguished. Communal spawning of brook and river lamprey has been reported in France (Lasne *et al.*, 2010). Present in a range of water quality conditions, from Q 3 to Q5, based on EPA Q-rating scheme (King & Linnane, 2004).

Threats: Pollution, causing fish kills, leads to loss of both adult and the juvenile forms. Dredging or de-silting operations in rivers will lead to loss of habitat and to resident populations of juveniles (King *et al.*, 2009). Concrete bridge floors with a shallow covering of water and vertical drops from culvert pipes and bridge aprons create discontinuities in water passage and can impede brook lamprey dispersal. Recent genetic studies point to unique population units or ‘conservation units’ within same-river populations (Pereira *et al.*, 2010).

Alosa alosa (Linnaeus, 1758)

Common name: Allis shad

Irish name: sead alósach

Irish status: data deficient

Global status: least concern



Photo: Jimmy King, IFL

Legal status: EU Habitats Directive [92/43/EEC] Annex II. No SACs listed for allis shad. Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Endangered. Sampling since 2000 has indicated presence of this species in some southern estuaries, but numbers are very low, even relative to twaite shad, and evidence of hybridization has been reported (King & Roche 2008; Coscia *et al.*, 2010). The status of this species in Ireland is unclear and further work on interactions with twaite shad is required. This species is listed as data deficient.

Distribution: Found from Scandinavian coastal waters and the Baltic Sea through Bay of Biscay and in to Mediterranean, as well as Britain and Ireland (Maitland & Hatton-Ellis, 2003).

Bracken & Kennedy (1967) reported the species from Dingle Bay and the Ilen estuary. More recently, individual fish reported from around the coast, and there are individual records from freshwater Foyle system in 2009-10. Records from the large southern rivers are presented in King & Roche (2008), who also reported twaite x allis hybrids.

Population in Ireland:

Only confirmed in the Slaney, Barrow-Nore, Suir and Munster Blackwater, with information collected since 2000 pointing to a very low population size. Hybridisation makes simple field identification problematic. No evidence of unique spawning populations. Increased reporting of allis shad from Foyle system in period 2009 – 2010.

Ecology and habitat in Ireland: Spends most of its life at sea. Pelagic in deep waters down to 300m. Juveniles reside close to the shore and in estuaries. Schooling and strongly migratory species, it has a capacity to penetrate far up rivers but impeded by weirs or other obstructions to passage – as found in samples from the Foyle (2009, 2010), Munster Blackwater (2003, 2005) and Slaney. Ripe allis shad have been found in transitional waters in twaite shad SACs. Spawning takes place over gravelled areas with a range of flow features, including pools and swirling waters. Timing of spawning unknown but presence of hybrids may point to spawning at same time as

twaite shad. Allis shad reported to spawn only once but a small degree of repeat spawning was found in Irish fish examined (King & Roche, 2008). No juvenile allis shad recorded to date.

Threats: Appear to be present in low numbers only. Marine by-catch in commercial fishing may be significant. Barriers in lower reaches of rivers may impede spatial separation of spawning allis and twaite shad, leading to hybridization. This may be more critical for allis shad, shown to have a strong capacity to ascend long distances into freshwater to spawn. Restricted migration may oblige spawning fish to hybridise with twaite shad. The spreading invasions of alien bivalves (e.g. *Corbicula* sp.) may jeopardise spawning habitat of shad.

Alosa fallax (Lacepède, 1803)

Common name: Shad; Twaite shad (Bony horseman)

Irish name: sead fhallacsach

Irish status: Vulnerable [D2]

Global status: least concern



Photo: John Lucey, EPA

Legal status: EU Habitats Directive [92/43/EEC] Annex II and V. Four SACs listed for twaite shad in RoI. Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Vulnerable and still considered Vulnerable due to its very restricted distribution. Sampling since 2000 has indicated presence of this species in the Slaney, Barrow-Nore, Suir and Munster Blackwater (King & Roche, 2008), but comparison with anecdotal reports of commercial fishermen point to major reduction in numbers in Slaney and Suir. Hybridisation has been recorded by King and Roche (2008) and this is considered an indication of pressure (Coscia *et al.*, 2010).

Distribution: Found from Scandinavian coastal waters through Bay of Biscay and in to Mediterranean, as well as Britain and Ireland (Maitland & Hatton-Ellis, 2003).

Have been reported from marine locations around the entire coast, but spawning movements into upper tidal waters and freshwater have only been reported from the Munster Blackwater, Suir, Barrow – Nore and Slaney. Individual samples were reported from the Boyne estuary in 2009 and 2010. Was known from the Liffey within Dublin city from mid 1960s but none reported here in last 20 years, despite improvements in water quality.

Population in Ireland: Angling returns point to a relatively well-established population of repeat-spawning twaite shad in the R. Barrow. Comparable continuous information is not available for the other SACs. Anecdotal reports point to substantial decline in shad populations in the R. Suir and R. Slaney over the past 30 years.

Ecology and habitat in Ireland: Adults at sea and in estuaries feed on fish and shrimp species but do not feed during the spawning run. Spawning occurs at the top of tidal waters in May – June. Catch-and-release angling at St. Mullins on the Barrow acts as barometer for size of spawning population ascending. Spawns in large, noisy schools at night near the surface – as anecdotally reported for the Barrow and Suir. Adults drop down to lower reaches of estuaries and to open sea after spawning. Examination of scales shows that repeat spawning is the norm (King & Roche

2008). Young of year spend first year, at least, in estuarine waters. Sub-adults have been recorded in the Barrow and Suir (King & Roche, 2008) and in the Munster Blackwater (King & Linnane, 2004). Parasitology examined by Doherty and McCarthy (2002).

Threats: Apart from the Barrow, small populations ascend the various SAC waters to spawn. Water quality in the estuaries of the SACs has been classified as eutrophic (McGarrigle, 2010). Marine by-catch of commercial fishing may be significant. Barriers in lower reaches of rivers may impede spatial separation of spawning allis and twaite shad, leading to hybridization.

Alosa fallax killarnensis Regan, 1916

Common name: Killarney Shad; goureen

Irish name: gabhairín Chill Airne

Irish status: Vulnerable [D2]

Global status: Critically Endangered [B1ab(iii)]
(assessed by Freyhoff & Kottelat (2008a) as *A. killarnensis*)



Photo: Willie Roche, IFI

Legal status: EU Habitats Directive [92/43/EEC] Annex II and Annex V. Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966.

Rationale for assessment: Previously assessed as Endangered. This is a unique taxonomic entity, confined to a single Irish location in L. Leane, Killarney. However, no sign of decline; site surveys in 1990s and 2003 recorded good population status in terms of numbers and age classes. It is now assessed as Vulnerable based on its limited distribution.

The global assessment for *A. killarnensis* was justified as follows: “The species is only found in one location, Lough Leane (19 km²) in Ireland where it is threatened by eutrophication, and may potentially be impacted by introduced species (cyprinids such as *Rutilus rutilus* and *Abramis brama*)”. The current regional assessment differs from the global assessment as it is based on recent information that shows that despite previous eutrophication in L. Leane, the Killarney shad population continues to thrive and water quality in the lake is now improving. In addition, roach and bream have not been recorded from the lake.

Distribution: Restricted to Lough Leane, in Killarney. There are analogous freshwater, non-migratory taxonomic isolates in the Italian alpine lakes and in locations in Greece. However, this Irish taxon is genetically unique and is geographically isolated.

Population in Ireland: Whole-lake fish surveys have been undertaken in a number of years (1991; 1998; 2003; 2008) by IFI on L. Leane and this lake is on the 3-year cycle for Surveillance Monitoring under WFD. Previous surveys have shown the population to be extant and robust. An acoustic survey in 2003 estimated the population at *circa* 20,000 individuals (Roche & Rosell, 2003).

Ecology and habitat in Ireland: Non-anadromous shad, living exclusively in freshwater. Although closely related genetically to the anadromous twaite shad, it is much smaller and lives entirely in freshwater (O’ Maoleidigh, 1990). Thought to spawn in the lake, possibly on or over gravelled bars extending out from islands. May possibly traverse inflowing rivers to spawning areas. Feeds mainly on zooplankton.

Threats: The population has survived significant eutrophication pressures. However, it is highly likely that good water quality with high oxygen levels is conducive to good population health.

Salmo salar Linnaeus, 1758

Common name: Atlantic salmon

Irish name: Bradán

Irish status: Vulnerable [A2abcde]

Global status: least concern



Photo: Mike Brown

Legal status: EU Habitats Directive [92/43/EEC] Annex II and Annex V. Salmon listed as qualifying feature in 5 SACs in NI and in 26 SACs in RoI; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Internationally Important. Significant declines have been observed since the 1970s (Figure 3), largely driven by reduced marine survival attributed to climate effects (Friedland *et al.* 2009) justify the species assessment as Vulnerable. However, the species remains widespread in all major river systems on the island. Good penetration by adult fish and widespread populations of juvenile fish at satisfactory levels.

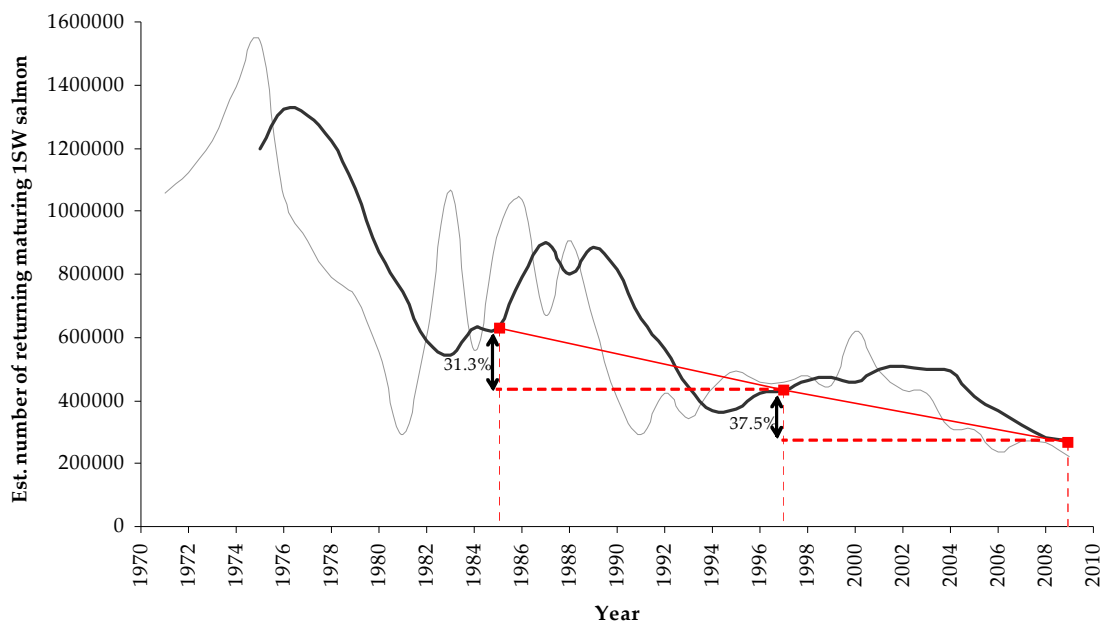


Figure 3 – Decline in estimated number (median values) of returning salmon for Ireland by year (data: Irish Standing Scientific Committee for salmon; see also ICES, 2009). The grey line shows the raw data, the black line shows calculated four year prior moving averages, and the red shows the decline over 3 generations (taken as 12 years). Maturing 1SW – adult fish returning to spawn after spending one winter at sea.

Distribution: Occurs in freshwater on both coasts of the Atlantic Ocean. European populations extend from Spain to northern Norway and Russia.

Known to occur in over 150 rivers in Ireland; found in all major and most medium-sized river systems.

Population in Ireland: Can vary from large runs in some systems to small numbers of individuals. Population of returning maturing 1SW salmon, the primary component of the stock, estimated at approximately 250,000 individuals in recent years (Figure 3), has been declining since the mid-1970s.

Ecology and habitat in Ireland: Spawning occurs in freshwater in channels of suitable gradient and cobble/gravel bed type in the November - MARCH period. Juvenile stages live for two years, generally, in freshwater and descend to sea as smolts in the spring period of their third year. The smolts undertake major ocean migration to feeding grounds in the North Norwegian Sea, off the Faroe Islands or off the West Greenland coast. Adults may return after one winter at sea ('grilse', 1SW) or after two or more years (multi-sea winter fish, MSW). Adults can recover after spawning, primarily females, and may spawn more than once in their lifetime, although the return rate of repeat spawners to freshwater is likely to be <5% (Hubley *et al.*, 2008).

Threats: Major commercial hydroelectric schemes have had a substantial impact on the salmon populations on four major Irish rivers. Artificial barriers remain an issue on many catchments and this can be compounded when some of these also have small-scale hydroelectric or milling facilities. Barriers may act adversely in terms of impeding up- and downstream passage while impingement or entrainment may lead to physical damage or mortality. Good water quality will always be a requirement – for oxygenation of intra-gravel life stages as well as for general ecology of the free-swimming stages. Agricultural and municipal pollution and impacts from afforestation and over-grazing have impacted on salmon stock status. Gross pollution will lead to mortalities. Commercial exploitation is now managed on a single-catchment basis and, in many angling fisheries that are opened, catches are regulated by quotas. Illegal fishing or poaching can be damaging, particularly at a local level, with removal of ripe or near-ripe fish from the spawning grounds. Declining marine survival has become a major concern (Boylan & Adams, 2006; Peyronnet *et al.*, 2007; ICES, 2009)

The escape of farmed Atlantic salmon can lead to loss of genetic integrity in wild stocks. Stocking salmon, even from native wild broodstock, also leads to reduced genetic fitness and threatens the integrity of the locally adapted stocks. Preliminary data has shown that sea lice (*L. salmonis*) can impact on migrating salmon smolts in bays with salmon rearing cages (Hazon *et al.*, 2006). Finally, although it has not been identified from Irish rivers, the skin parasite *Gyrodactylus salaris* has had devastating effects on wild salmon stocks in affected rivers (e.g. in Norway) and its arrival here would pose a significant threat. Despite improvements in the management of the species, many of the threats and problems identified by O'Grady and Gargan (1993) are still relevant.

Salmo trutta Linnaeus, 1758

Common name: Brown trout; Sea trout; trout

Irish name: Breac

Irish status: least concern

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as not threatened. There are serious concerns about the declines in sea trout stocks, particularly in the mid-west. Nonetheless, trout remain widespread in all major river and lake systems on the island, at satisfactory levels in terms of population structure, for the water in question, and of stock density, justifying a conservation assessment of 'least concern'.

Distribution: World-wide distribution, having been introduced successfully into New Zealand and South American countries. Widely distributed in Europe.

Brown trout occur in almost every rivulet, brook, stream, river and lake in Ireland (Kennedy & Fitzmaurice, 1971). Populations occur in the upper reaches of estuaries (slob trout) and anadromous (sea trout) populations occur in many river systems all around the coast.

Population in Ireland: Brown trout populations have been impacted in some waters via altered growth rates or decline in population size as a result of nutrient enrichment. Localised extinctions have occurred (e.g. in some small lakes in south Donegal (Kelly *et al.*, 2008)), but no evidence of substantial decline in population size over the national territory.

Ecology and habitat in Ireland: Spawning occurs in late autumn – early spring in channels of suitable gradient and cobble/gravel bed type. Juveniles may spend entire life in natal stream, or may descend to lower reaches. In lake systems, spawning generally occurs in tributary channels and young fish descend to mature in lakes after one or two years. Trout feed primarily on a range of invertebrates and on small fish e.g. stickleback and minnow.

The 'species' has a great plasticity of form. Advances in genetic analysis suggests several unique species within the 'brown trout suite'. Unique forms relate to feeding habits e.g. 'ferox', 'gilaroo' and 'sonnaghan', and to migratory habits e.g. 'croneen'. Some have specific spawning grounds.

Ferguson (2004) established the presence of 3 sympatric brown trout forms in L. Melvin which he regards as separate species. Distinct spawning groups have also been identified in L. Corrib and L. Mask (Massa-Gallucci *et al.*, 2010; Massa-Gallucci pers. com.). Current genetic work (Mc Keown *et al.*, 2010) identifies the importance of the biological characteristics of local populations in determining conservation priorities. Clearly brown trout stocks in Ireland must now be regarded as a “family of fishes” and not a single species.

The anadromous form of trout, sea trout, spends up to four years in freshwater before spending a number of years in the sea as adults. A combination of environmental and genetic factors are likely to trigger initiation of this life history strategy. The strategy of split-age smolt migrations combined with split-age adult spawning migrations and repeat spawning is more robust than that for salmon by spreading the risks across multiple age classes. Younger age classes tend to inhabit near shore and coastal habitats while older fish may travel further afield to feed before homing to their natal river to spawn.

Threats: Good water quality will always be a requirement – for oxygenation of intra-gravel life stages as well as for general ecology of the free-swimming stages. Gross pollution will lead to mortalities. The introduction of other fish species, in particular pike, but also roach and dace can threaten brown trout populations, especially in small shallow lakes. The invasive weed *Lagarosiphon* is currently impacting on the trout fishery in L. Corrib. Arterial drainage has impacted on the physical habitat in many rivers, reducing their carrying capacity for, primarily, large adult brown trout. The migratory form, sea trout, has been impacted by water quality issues including overgrazing and afforestation. Sea louse infestations linked to salmon aquaculture in the west of Ireland have devastated the marine survival of the local sea trout stocks. A bye-law prohibiting the retention of rod caught sea trout from Galway Bay to Achill Head is in place to limit impact of fishing on vulnerable western populations.

Salvelinus alpinus (Linnaeus, 1758)

Common name: Arctic char

Irish name: ruabhreac Artach

Irish status: Vulnerable [A2ace]

Global status: least concern



Photo: Martin O'Grady, IFI

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as Vulnerable and still considered Vulnerable. Area of occupancy much reduced with loss from large lowland lakes since 1979 (Igoe *et al.*, 2001; 2003). Pollutants and eutrophication implicated (Champ, 1998). Predation/competitors may also be relevant, with possible predation on char eggs by the alien species *Gammarus tigrinus* in L. Conn. Water drawdown in lakes reducing spawning areas also problematical.

Distribution: This species is found in both fresh and saltwater. It is native to arctic, sub-arctic and alpine lakes and coastal waters. No other freshwater fish is found as far north. It is found in deep mountainous or glacial lakes in Britain, where it is rare, in Ireland and in the Alps, occurring at an altitude of 2,500 m. It is common in Scandinavia and is also found in Siberia.

The species consists of non-migratory lake populations in Ireland and is largely confined to small lakes in western seaboard coastal and upland areas. It continues to be recorded in previously unsurveyed waters in such locations but has been lost from lowland lakes such as L. Owel (1925), L. Conn and L. Corrib. Char disappeared from L. Neagh and L. Erne in the early 1970s.

Population in Ireland: No population estimate available, but population loss has occurred from large lakes such as L. Corrib and L. Conn within the past 30 years. A large population continues to occur in L. Mask.

Ecology and habitat in Ireland: Occurs in upland lakes (to 238 m altitude), frequently corries, as well as lowland small and larger lakes with areas of deep water. The latter provides refuge in warm weather conditions, particularly if thermal stratification occurs. Any degree of enrichment can lead to reduction in oxygen in hypolimnion, with adverse impacts for char. They migrate up and down the water column while feeding on plankton. The physical isolation of many char lakes contributes to morphological uniqueness of many populations and also to a degree of genetic isolation. Spawning occurs on lake shores on gravelled areas in the shallow littoral zone.

Threats: Extremely susceptible to water pollution. Apparent susceptibility to eutrophication and oxygen depletion. Genetic isolation may create unique populations but these may suffer from a lack of gene flow and heterogeneity. Water abstraction in upland lakes, with fluctuating littoral zone levels, could lead to loss of habitat and feeding in the littoral. In addition, this may also lead to loss of spawning habitat and to desiccation of redds and deposited eggs. Introduction of other fish or alien species, native or long-time resident, may cause severe ecological disruption, especially in conjunction with changes in trophic status. Climate change may serve to increase water temperatures in confined lake systems where char are resident. Lake acidification is also considered a threat to char populations.

Coregonus autumnalis pollan (Pallas, 1776)



Photo: Robert Rosell

Common name: Pollan

Irish name: pollán

Irish status: Vulnerable [B2ab(iii,v), D2]

Global status: Endangered [B1ab(iii),B2ab(iii)] (assessed by Freyhoff & Kottelat (2008b) as *C. pollan*).

Legal status: Habitats Directive Annex V; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966.

Rationale for assessment: Previously assessed as Endangered. One new population discovered since then (Harrison *et al.*, 2010), and large population persists in Lough Neagh. However, distribution still restricted to five known lakes on the island justifying assessment as Vulnerable. Anecdotal reports, commercial by-catch and focused surveys – netting and hydro-acoustic – all report low level of population and declines over time.

The current assessment differs from the global assessment for the following reason: The global assessment refers to four of the populations being artificially maintained through stocking, and discounts them from the species range as a result. No stocking has in fact taken place and all five populations were therefore considered in this assessment.

Distribution: The Arctic cisco (*Coregonus autumnalis*) is an anadromous species of whitefish that inhabits the Arctic parts of Siberia, Canada and Alaska. The pollan is closely related but is confined to a small series of large lakes in Ireland. There is argument as to the specific uniqueness, but it is clear that the pollan is unique to the Irish vertebrate fauna (Anon., 2005).

Found in three Shannon basin lakes – L. Derg, L. Ree and L. Allen (Harrison *et al.*, 2010). Also in Lower L. Erne (Rosell, 1997) and L. Neagh. The species is considered to be extinct in L. Erne Upper. The coregonids are a cold-water group and, in Ireland, the species is at the southern limit of the range for coregonids or whitefish.

Population in Ireland:

No population estimate available for Lough Neagh, but sufficiently large to support some commercial exploitation. Repeat surveys on L. Erne point to a low population level there although most recent survey in 2010 recorded all year classes from 0+ (circa 15 cm) to 5+ (35 cm) and produced the largest CPUE since regular checks began in 1991. No population estimates from Shannon lakes, but numbers thought to be very low. The monitoring under WFD, using

hydroacoustic and conventional netting, will provide a more accurate assessment of population status.

Ecology and habitat in Ireland: Apart from L. Neagh, the other lakes are characterized by large size and significant areas of deep water. Enrichment of these lakes, combined with thermal stratification, can lead to depletion of oxygen in the deep waters of the hypolimnion. If this occurs, pollan are squeezed between warmer surface water areas and deeper areas which, though cooler, may have reduced oxygen concentrations. L. Neagh, in contrast to the other lakes, is relatively shallow but is strongly wind-mixed. It is also highly enriched but supports a limited commercial fishery for pollan. The species feeds on a mix of plankton, insect larvae and some benthic food items, depending on site. In calm conditions in Lough Neagh they will feed on surface insects. They may make diurnal feeding movements up and down the water column in feeding. The physical isolation of the large pollan lakes contributes to the likelihood of genetic uniqueness of the populations. Spawning is considered to occur on exposed lake shores on gravelled areas in the shallow littoral in the December – January period.

Threats: Apparent susceptibility to eutrophication and oxygen depletion. Genetic isolation may create unique populations but these may suffer from a lack of gene flow and heterogeneity. Introduction of other fish species, native or long-time resident, may cause severe ecological disruption. Similarly, alien aquatic species may cause significant changes to lake ecology and thereby impact on the pollan.

Osmerus eperlanus (Linnaeus, 1758)

Common name: Smelt; cucumber fish; stink fish

Irish name: smealt

Irish status: least concern

Global status: least concern



Photo: Jimmy King, IFI

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously listed as Vulnerable (Whilde, 1993) when only known from the Shannon. Fish surveys, since 2000, have established presence of series of age groups and ripe males in several major estuaries along south coast as well as in the Foyle. . This sampling indicates established spawning populations and possible expansion of range into new water (Slaney), justifying the listing as least concern.

Distribution: The smelt occurs in coastal European waters from the Bay of Biscay to the Baltic Sea. Originally, only known from the Shannon (Kennedy, 1948; Quigley *et al.*, 2004). More recently also recorded in Waterford Harbour (Doherty & McCarthy, 2002; 2004). Latest surveys by IFI and the Loughs Agency have reported populations in the Foyle, Munster Blackwater, Barrow, Nore, Suir and Slaney (unpublished data).

Population in Ireland: No national population estimate available, but repeat surveys point to substantial spawning populations in the Suir and Nore. Large populations have also been recorded in the Shannon.

Ecology and habitat in Ireland: Inhabits marine waters and estuaries. A mid-water species, rarely found far from shore. Adults migrate upstream into the upper tidal freshwater reaches of a small number of Irish rivers annually to spawn. Spawning occurs in spring, primarily March, with eggs adhering to stones and instream vegetation. Many fish are reproductive at end of second year. Feed on plankton and shrimps when young before turning piscivorous. Shoals during spawning season.

Threats: Climate change and sea temperature rise have led to loss of smelt from Gironde (France). Spawning populations are vulnerable to pollution (Quigley *et al.*, 2004) and also to exploitation. Smelt is much prized as pike-angling bait. There are no controls on exploitation, on any scale. Commercial exploitation is not considered sustainable. Such activity has been blamed for major decline in smelt populations in Scotland (Maitland & Lyle, 1996).

Anguilla anguilla (Linnaeus, 1758)

Common name: European eel; eel

Irish name: Eascann

Irish status: Critically Endangered [A2bd; A4bd]

Global status: Critically Endangered [A2bd; A4bd]



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007; Conservation of Eel fishing bye-law No. C.S. 303, 2009; EC Regulation (Council Regulation 1100/2007) for the recovery of the eel stock, CITES Annex II.

Rationale for assessment: Previously assessed as least concern and still widespread in fisheries surveys of rivers and lakes of all sizes in Ireland. However, recruitment into Irish catchments has declined dramatically, in line with experience along the Atlantic seaboard. The assigned status of Critically Endangered also reflects the status of the pan-European stock and the overall decline in recruitment of that stock. Density-dependent compensation in lifetime survival rates, sex ratio and biomass may cause the scale of reduction in freshwater populations to be less than that in recruitment. However, it is expected that freshwater populations will continue to decline as the history of low recruitment feeds through the long lifecycle.

Distribution: Occurs in Europe and north Africa, the Canary islands and the Azores, and eastwards throughout the Mediterranean region and the Black Sea. Current information indicates a single panmictic stock.

Eel occur in almost every rivulet, brook, stream, river and lake in Ireland to which they can gain access (Kennedy & Fitzmaurice, 1971).

Population in Ireland: Eels are widespread in fisheries surveys of rivers and lakes of all sizes in Ireland. Recruitment of juveniles into Irish catchments has declined dramatically, in line with experience along the Atlantic seaboard.

The Irish Eel Management Plans (DCENR, 2008) contain an assessment of the estimated historic production, current production and the silver eel escapement with reference to the EU target (40%). Irish eel production in 2001-2007 was estimated to be in the order of 336t and escapement was estimated at 140t or 23% of historic levels – below the target required to achieve a recovery of the stock.

Ecology and habitat in Ireland: Demersal and catadromous species. Irish populations spawn in the Gulf of Mexico. The larvae, known as glass eels, migrate from the Sargasso Sea to Irish coastal waters. These juveniles become progressively more pigmented as they grow and migrate up estuaries into freshwaters. Immature adult fish are known as brown or yellow eel while the downward-migrating maturing adults are known as silver eel. A very long-lived species, emigrating freshwater as reproductive adults, on average, 10 to 20 years after recruitment from the ocean, but eels up to 50+ years have been recorded. Adult fish feed widely on a range of invertebrates and on small fish species. Inhabits all types of benthic habitats from coastal and estuarine saline waters to small streams, large rivers and lakes.

Threats: Recruitment into freshwater has declined dramatically. A dramatic pan-European decline in glass eel returning from the sea occurred in the early 1980s and glass eel numbers are now at <7% of pre 1980s averages (ICES, 2010). Suggested causes of this decline include climate change and shift in ocean currents, overfishing, habitat loss in the freshwater range, mortality in hydropower plants, disease and parasites, and chemical contamination affecting reproductive ability. Due to the shared nature of the eel stock, continental threats also impact on recruitment of eel to Ireland. A ban on commercial fishing has now been imposed in Ireland with a review in 2012, and a significant programme of turbine mitigation is underway - two of the management measures in the Irish Eel Management Plan (DCENR, 2008).

Gasterosteus aculeatus Linnaeus, 1758

Common name: Three-spined stickleback

Irish name: garmachán

Irish status: least concern

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as least concern and still considered of least concern as it is widely distributed in fishery surveys in rivers of all sizes and in lakes and transitional waters around the coast.

Distribution: Native to northern Europe, North America and northern Asia

The species has a wide distribution in Ireland. It is commonly recorded in fish surveys in rivers, lakes and transitional waters in all parts of the country.

Population in Ireland: No population estimates have been undertaken but there is no evidence of major national or local decline.

Ecology and habitat in Ireland: Benthopelagic. Anadromous and non-anadromous populations. They occur in a variety of habitats in freshwater from small streams to lakes. In the sea they are confined to coastal areas. Commonly found in upper reaches of estuaries and in tidal freshwater zone. Spawning takes place in spring, with the males building a nest. Young fish feed on zooplankton while adult fish feed on a range of invertebrates and cannibalism is also known. Daoud *et al.* (1985b) reported on aspects of the ecology of this species from upland lakes in Wicklow. Fish there spawned in June – July, later than in other studies. Relatively high abundance in waters with poor water quality (Kelly *et al.*, 2007). Commonly predated on by other fish species and also by otters (Gormally & Fairley, 1982). However, Kennedy (1969b) demonstrated that sticklebacks, in aquarium tanks, would readily devour the eggs and young fry of pike. The genetics and evolutionary history of the species is being investigated by Ravinet (2009).

Threats: Water pollution with associated fish kill is a constant possibility in the aquatic environment although this is a relatively pollution tolerant species. Daoud *et al.* (1985b) found that spawning took place in littoral vegetation in the reservoir they examined. Fluctuations in water level would severely impact on spawning success in such habitats.

Pungitius pungitius (Linnaeus, 1758)

Common name: Ten (nine)-spined stickleback

Irish name: garmachán deich gclipe

Irish status: least concern

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Previously assessed as least concern and still considered to be of least concern. While rarely encountered in fisheries surveys over a range of lotic and lentic habitats this species has been found in backwater and still-water habitats in a range of locations on the island.

Distribution: Circumarctic: Arctic and Atlantic drainages across Canada and Alaska, and as far south as New Jersey, USA; Pacific coast of Alaska; Great Lakes basin; also in Eurasia. Coastal areas of northern Europe, from Netherlands to northern Russia, including southern Norway and Baltic basin. Extends eastward to Siberia and Japan, but remains to be confirmed that East Asia populations are conspecific with European ones.

No targeted survey for this species has been carried out, but numerous incidental records from various habitat types are reported e.g. in flooded cutaway bogs in the midlands (O'Connor, 2000); in Craughwell and tributaries (St Clerens and Rafford), Burren and Tully stream (Barrow), Pinkeen (Tolka), Ward, Omaun (Grange), Knocknagar (Clare), Maghera (Sheelin), Robe, Lough Bane and Lough Derravaragh (IFI unpublished data). Anderson (unpublished data) recorded *Pungitius* at a series of sites in the Lagan and Bann catchments. His view was that the species was expanding its range in Ulster but was rarely encountered in fisheries surveys, as per the experience in the Republic. Sympatric populations of 3- and 10- spined stickleback have been reported from turloughs by Williams *et al.* (2006).

Population in Ireland: No information on population size in Ireland, but not thought to be declining.

Ecology and habitat in Ireland: Benthopelagic. No specific information for Ireland. The species is generally recorded in weedy channels and ditches, shallow vegetated areas of lakes, ponds and slow flowing areas of streams and rivers. During the breeding season (April to July), the male builds a nest to which the female is attracted. She lays eggs inside the nest and the male guards these eggs and the young fry when they hatch. The body is more elongated than the three-spined stickleback with a thinner and longer caudal peduncal. Feeds on small invertebrates, aquatic insects and their eggs and larvae. It is preyed upon by fish-eating birds (such as kingfisher) and fish.

Threats: Water pollution with associated fish kill is a constant possibility in the aquatic environment. Focussed distributional work would be welcomed for this species.

Platichthys flesus (Linnaeus, 1758)

Common name: Flounder

Irish name: leith

Irish status: least concern

Global status: least concern



Photo: Jimmy King, IFI

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Primarily an estuarine species, the flounder is found in several fully-freshwater locations in Ireland but its presence at these locations is not considered essential to the survival of the species. It is widespread and one of the most common species in the estuaries examined by IFI since 2000, justifying assessment of least concern.

Distribution: Widespread along coastal regions of north and north-western Europe. Introduced into the USA and Canada accidentally through transport in ballast water.

One of the most commonly recorded fish species in Irish estuaries or transitional waters, in terms of both numbers and frequency of occurrence. The flounder is known to penetrate freshwater and in some systems occurs a considerable distance upstream of the tidal influence. The species is also present in a number of lakes in Ireland - Lough Leane (Killarney) and Lough Neagh (Wood, 1998) - and more recently has been recorded in a number of small coastal lakes - Lough Meela, New Lake (Co. Donegal) and Carrowmore Lake (Mayo). Like the bass and the mullets, this species is perhaps more accurately described as a fish of transitional (estuaries) and coastal waters.

Population in Ireland: There is no information on population size or trends in Ireland.

Ecology and habitat in Ireland: Demersal and catadromous. Migratory fish found in freshwater, brackish and marine habitats. Favours muddy substrata. Feeds on a range of invertebrates. Spawning occurs at sea but the eggs and larvae are surface floating and the young post-larval fish can be carried into estuarine and tidal lagoon waters where they grow. Fully-freshwater habitats in which flounder occur include the R. Dargle in Wicklow (0.5km. above high tide level), R. Suir at Clonmel (22 km upstream of high tide), L. Leane in Killarney and L. Neagh, where samples have been taken up to 80 km from marine waters (McCurdy, 1977).

Threats: Apart from water pollution, no specific threats are known.

Zootoca vivipara Jacquin, 1787

Synonym *Lacerta vivipara* Jacquin, 1787

Common name: Common lizard

Irish name: laghairt; earc

Irish status: least concern

European status: least concern

Global status: least concern



Photo: Eddie Dunne

Rationale for assessment: Not previously assessed. Widespread distribution, no evidence of any significant decline, and European status of least concern, justify current Irish assessment.

Legal status: Wildlife Act, 1976; Wildlife Amendment Act, 2000; The Wildlife (NI) Order, 1985 as amended.

Distribution: Widely distributed across Europe and Asia. Found up to 70° North in Norway, making it the northernmost reptile in the world (Gasc *et al.*, 1997).

Widespread in Ireland, with recent records from all counties, bar Laois and Westmeath (Meehan, 2007). Records from sea level to mountains (Farren *et al.*, 2010; Marnell, 2002).

Population in Ireland: While there is no population estimate available for Ireland, there is no evidence of a population decline.

Ecology and habitat in Ireland: Long active season in Ireland with emergence from hibernation as early as the first week in March and autumn records as late as the end of October (Marnell, 2002; Meehan, 2007). Associated with coastal and heathland habitats, but also locally in rural gardens, stone walls and roadside verges (Farren *et al.* 2010; Marnell, 2002). Needs good habitat structure with open patches for basking and foraging and areas of cover for protection from predators (Beebee & Griffiths, 2000). Feeds on a wide range of invertebrates.

Threats: Habitat loss and habitat fragmentation. Subject to predation by many predators including kestrels, stoats, foxes and cats.

Dermochelys coriacea (Vandelli, 1761)

Common name: Leatherback turtle

Irish name: Turtar; turtar dromleathair

Irish status: least concern

European status: NA

Global status: Critically Endangered [A1abd]



Photo: Tom Doyle

Rationale for assessment: Not previously assessed. Assessed as non-breeding visitor (IUCN, 2003). Globally rare because Pacific population has crashed, but Atlantic population appears relatively stable. No evidence of a decline in Irish waters; numbers of records may be expected to increase due to climate change.

Legal status: EU Habitats Directive [92/43/EEC] Annex IV; Wildlife Act, 1976; Wildlife Amendment Act, 2000; The Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995 as amended.

Distribution: The most widely distributed reptile species, with populations in both the Pacific and the Atlantic. Nests in tropics and undertakes lengthy migrations through temperate waters (Hays *et al.*, 2004; Doyle *et al.*, 2008).

Under-reported in north-east Atlantic, but known to migrate through Irish waters each summer, with records of live animals and strandings from all coasts, but mainly the west and south-west (King & Berrow, 2009). Irish populations thought to breed in southern Caribbean.

Population in Ireland: Stable or increasing. Estimated at 2,500 migrants per year, approximately 2-5% of the North Atlantic population (NPWS, 2007a)

Ecology and habitat in Ireland: Irish populations thought to breed in southern Caribbean, with females nesting on beaches on northern coast of South America (e.g. French Guiana) and some Caribbean islands (e.g. Trinidad), before migrating northwards and eastwards into cooler waters to feed. Feed exclusively on jellyfish. Various migration routes have been mapped, with some animals travelling >7000km from nesting beaches to reach Irish waters (Hays *et al.*, 2004; Doyle *et al.*, 2008). Peak numbers seen in Irish waters in July – August, corresponding to period of maximum jellyfish biomass.

Threats: Bycatch, particularly in long-line fisheries (regional and extraregional) (e.g. Hays *et al.*, 2004). Exploitation at breeding sites (extra-regional). Accidental consumption of marine pollution (e.g. plastic bags).

Rana temporaria (Linnaeus, 1758)

Common name: Common frog

Irish name: frog; loscán

Irish status: least concern

European status: least concern

Global status: least concern



Photo: Mike Brown

Rationale for assessment: Previously assessed as “Internationally important”. Better data, which give no indication of significant decline, different IUCN categories and European status of least concern, justify the current Irish assessment.

Legal status: EU Habitats Directive [92/43/EEC] Annex V; Wildlife Act, 1976; Wildlife Amendment Act, 2000. In Northern Ireland sale of frogs alive or dead at any time is prohibited under the Wildlife (Northern Ireland) Order 1985 as amended.

Distribution: Very widespread species, occurring from Greece and Spain in the south to the far north of Norway; found in all European countries bar Portugal (Gasc *et al.*, 1997).

Widespread and common throughout Ireland. Found in every county and from sea level to uplands (Marnell, 1999).

Population in Ireland: First national survey underway; population thought to be stable – Increasing (NPWS, 2007b).

Ecology and habitat in Ireland: Adaptable species with broad range of habitats used and catholic diet (Marnell, 1998a). Have adapted well to garden ponds in UK. Spawns in early spring and then spends rest of the year on land. Tadpoles metamorphose in early summer and may spend 2 or 3 years on land before reaching sexual maturity. Hibernates, typically from November to February. Tadpoles, young frogs and adult frogs all subject to significant levels of predation and populations subject to local booms and declines (Beebee & Griffiths, 2000).

Threats: Some evidence of habitat loss (particularly pond loss) in Ireland, but no evidence of population decline. Concerns in UK and elsewhere arising from disease-related mass mortality – Ranavirus and chytrid fungal disease (Teacher *et al.*, 2010). No evidence of causative agents from Ireland.

Epidalea calamita Laurenti, 1768

Synonym: *Bufo calamita* Laurenti, 1768

Common name: Natterjack toad

Irish name: buaf

Irish status: Endangered [B2a,b(iii)]

European status: least concern

Global status: least concern



Photo: Mike Brown

Rationale for assessment: Previously assessed as Endangered (Whilde, 1993). While the species' range has been relatively stable since mid-70s, range contraction between 1900 and 1970s estimated at 50-60% (Beebee, 2002; NPWS 2007c). Despite recent efforts to improve pond networks around Castlemaine Harbour, the range remains severely fragmented with continuing declines in the quality and extent of habitat in some areas.

Legal status: EU Habitats Directive [92/43/EEC] Annex IV; Wildlife Act, 1976; Wildlife Amendment Act, 2000.

Distribution: Widespread throughout Iberia becoming more local further north in Europe; restricted to coastal sites in southern Sweden, UK and Estonia (Gasc *et al.*, 1997).

In Ireland, restricted to small number of coastal sites on the Dingle and Iveragh peninsulas in west Kerry. Current range estimated at 76km² (NPWS, 2007c). Also small introduced population in Wexford. Does not occur in Northern Ireland.

Population in Ireland: Following significant declines in first half of 20th century, now thought to be relatively stable. Estimates of c. 9,000 breeding adults based on recent intensive three year monitoring study (Bécart *et al.*, 2007).

Ecology and habitat in Ireland: Typical r-selected species adapting quickly to new breeding sites; producing large numbers of juveniles in good years and suffering high spawn and tadpole mortality in bad years.

Mainly nocturnal, sheltering in burrows and under logs and stones during day. Feeds on small invertebrates which it captures on land. Hibernates October to end March. Spawns April-June. All breeding sites within 1.5km of the seashore; most within 500m. Breeds mainly in shallow seasonal ponds, but also some permanent lakes. Tadpoles develop rapidly with metamorphosis typically complete by mid-July. Spend 2-3 years on land before reaching sexual maturity and returning to ponds to breed (Beebee & Griffiths, 2000).

Threats: Loss of aquatic and terrestrial habitats (e.g. drainage, agricultural intensification), but also deterioration of habitat quality (e.g. reed encroachment of ponds; undergrazing of terrestrial habitats around ponds leading to rank vegetation and poor foraging conditions).

Lissotriton vulgaris Linnaeus, 1758

Synonym: *Triturus vulgaris* (Linnaeus, 1758)

Common name: Smooth newt; common newt

Irish name: earc luachra

Irish status: least concern

European status: least concern

Global status: least concern



Photo: Eddie Dunne

Rationale for assessment: Not previously assessed. Widespread distribution, no evidence of any significant decline and European status of least concern justify current Irish assessment.

Legal status: Wildlife Act, 1976; Wildlife Amendment Act, 2000; The Wildlife Order (Northern Ireland) 1985 as amended.

Distribution: Commonest tailed amphibian in Europe; found throughout, bar Iberian peninsula, from sea level to >1300m (Gasc *et al.*, 1997).

Widespread in Ireland, but locally distributed and under-recorded. May be more common in midlands, but found in coastal counties too (Marnell, 1998b; O'Neill *et al.*, 2004).

Population in Ireland: No population estimate available but thought to be stable. Although locally distributed, can be abundant where it occurs.

Ecology and habitat in Ireland: Breeds in ponds and still-water ditches where pH >5. Shows preference for vegetated water bodies with surrounding terrestrial habitats that provide cover for foraging and hibernation (Marnell, 1996a; 1998a). Elaborate courtship display. Eggs are laid individually, rather than in clumps or strings, leading to protracted breeding season (March-July) during which adults remain in breeding ponds (Marnell, 1996b). They are often main predators there. Egg and tadpole development is temperature dependent. Forage on land for invertebrate prey July to October. Hibernate November – February (Beebee & Griffiths, 2000).

Threats: Habitat loss, in particular wetland drainage and infilling; also excessive clearance of vegetation around breeding sites. Introduction of fish into ponds can lead to extirpation of newts. Recent reports of invasive, non-native species such as terrapins and turtles may lead to local extinctions.

NON-NATIVE FISH SPECIES ACCOUNTS

The non-native species accounts have the following headings:

- **Species name** and taxonomic authority
- **Synonyms** in current or historical use for specimens of the species in Ireland
- **English** language common name
- **Irish** language common name
- **Irish status** – status of the species in Ireland using the categories as described on pages 5 and 6.
- **Global status** – global Red List status, taken from IUCN Red List of Threatened Species (IUCN, 2010b)
- **Legal Status** – Any legal protection afforded to the species. This will be one or more of the following: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007; Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI].
- **Rationale for assessment** – a description of how the status was determined. This will include details of the introductions where known. The threats these species pose to native biodiversity is also highlighted, where appropriate.
- **Distribution** – a general description of the global distribution of the species, followed by a more detailed description of its distribution in Ireland. Where available, an estimate of the species range in Ireland (in square kilometres) is given.
- **Population in Ireland** – an estimate of the effective population size (i.e. breeding population) in Ireland, where available, and a description of whether the population is stable, increasing or declining.
- **Ecology and habitat in Ireland** – a brief summary of the available ecological information for the species, including a description of the species broad habitat preferences in Ireland.
- **Threats** – a brief outline of any significant threats to, or activities impacting on, the species conservation status in Ireland.

Oncorhynchus mykiss (Wallbaum, 1792)

Common name: Rainbow trout

Irish name: breac dea-dhathach

Irish status: Domesticated species

Global status: Not Evaluated



Photo: Inland Fisheries Ireland

Legal status: May be protected under local bye-laws.

Rationale for assessment: Non-native species, originally introduced from USA in 1899-1901 (Fitzmaurice, 1984). Rainbow trout are bred in fish farms throughout Ireland. Up to 100 waters have been stocked with this species, as sport fisheries. However populations are only sustained by continuous stocking programmes and this species is considered to be effectively domesticated.

Distribution: Originally a species of the Pacific Ocean, on both Asian and North American sides, in freshwater. Has been introduced into over 40 other countries, on all continents, for sport or food.

Found in lakes throughout Ireland where stocking occurs for put-and-take angling.

Population in Ireland: Populations in Ireland are maintained, for the most part, through stocking in of material of fish farm origin.

There were numerous rainbow trout “escapees” from commercial fish farms into rivers which support wild Atlantic salmon and brown trout stocks in the 1980s. Electro fishing surveys subsequently (1983 to 2005) failed to find any rainbow trout which might have been the direct offspring of these escapees.

Ecology and habitat in Ireland: The Irish populations are confined to small lakes where stocking occurs annually. Fitzmaurice (1984) reported self-sustaining populations from L. Shure (Aran Island, Donegal), L. na Leibe (Sligo) and White Lake (Westmeath), but subsequent surveys did not find any self-sustaining populations, even at those previously reported (Champ and Kelly, unpublished report). However, small numbers of naturally spawned juvenile rainbow trout have recently been recorded in some artificially stocked gravel pit waters (Gargan pers. comm.)

Threats: Genetic inbreeding and total failure of populations are two threats when a species is so confined geographically and ecologically. As the species is non-native, it may be questioned whether Ireland should be sustaining populations, naturally or through stocking. This point is made in the context of preservation of native biodiversity and in the context of the Water Framework Directive, where introduction of a non-native species to a waterway serves to reduce the ecological status of that water.

Esox lucius Linnaeus, 1758

Common name: pike

Irish name: liús; Gaill iasc (“foreign fish” – Fitzmaurice, 1984)

Irish status: Non-native non-benign

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007; Conservation of Pike Bye-Law No. 809 (2006) [RoI].

Rationale for assessment: An introduced species although already well-established in the southern part of the country by the late 16th century (Fitzmaurice, 1984). In certain lake types, where refuges are limited, pike can pose a significant threat to native fish stocks in particular brown trout.

Distribution: The pike is a member of the *Esocidae*, a small group of predatory species with similar body form. The pike is widespread in Western Europe and also occurs in North America and northern Asia.

The species is commonly recorded in fish surveys of lakes, rivers and canals in the Republic and Northern Ireland. Absent from Co. Kerry, Co. Mayo west of Crossmolina and from Co. Donegal, except for a few lakes in the south of this county where they were recently introduced by anglers.

Population in Ireland: There is no population estimate for Ireland. Populations are subject to natural fluctuations in many waters but there is no evidence of major decline or expansion.

Pike numbers are remarkably poor in a number of our large more productive salmonid riverine catchments (Slaney, Nore, Suir and Cork Blackwater). The “bottleneck” for pike in these systems would appear to be a paucity of quality spawning and nursery areas.

Ecology and habitat in Ireland: It occupies a range of lake sizes of moderate to enriched trophic status. Pike spawn in the spring in reeds and vegetated areas, in both rivers and lakes (Kennedy, 1969b). The newly-released eggs adhere to the vegetation. Younger fish, up to c. 50 cm, have a diet of invertebrates and of small fish e.g. minnow. Larger pike have an increasing tendency towards a piscivorous diet. In lakes, pike of all sizes will live in the more shallow littoral areas, using vegetation as cover as they lie in wait for prey (Rosell & MacOscar, 2002). Pike appear to occupy defined territories in rivers, where they have a similar habit to lake pike. In rivers, they are to be

found primarily in relatively large, low-gradient channels where water velocity is reduced. Some Irish studies have shown a strong homing instinct in pike (Caffrey unpublished data; Fitzmaurice, 1983a). Pike is a 'top carnivore' in the aquatic systems where it occurs. Long considered to feed preferentially on brown trout, the species can switch to any available prey species. This species is an important specialist angling quarry in Ireland with 'specimen' weight of 9 kg for rivers and of 13.5 kg for lakes (Irish Specimen Fish Committee, 2010).

Threats: The pike has no natural competitors or predators in aquatic ecosystems in Ireland. Pike populations have been controlled over many years in managed brown trout fishery lakes. Pike populations in the Shannon system came under heavy angling pressure, necessitating the introduction of bye-laws. In Northern Ireland "trophy fish" are protected. A major reduction in pike stocks was noted in L. Sheelin, Co. Cavan following the collapse of a very large roach population there. The demise of roach stocks appears to have been triggered by the establishment of a large zebra mussel population. Given the widespread distribution of zebra mussel populations in Irish waters in the last decade it is likely that there has been a widespread decline in lentic Irish pike stocks.

Tinca tinca Linnaeus, 1758

Common name: Tench

Irish name: cúramán

Irish status: Non-native benign

Global status: least concern



Photo: Paul McLoone, IFI

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: An introduced species in Ireland, with early references going back to the 17th century (Fitzmaurice, 1984). Currently found in many lowland rivers and lakes and throughout the canals network in Ireland. The species is known to breed successfully in the wild in most years, but considered benign as no significant impact on native species or ecosystems has been noted.

Distribution: The species is found from western Europe to central Asia. Distribution in Ireland is patchy. Was introduced into approximately 80 waters by the Inland Fisheries Trust (1955 – 1980), with a view to developing specialist angling waters. IFI's Surveillance Monitoring Programme for WFD showed the species to occur at a number of lake sites in the upper Shannon and Erne catchments in 2008. It was absent from lakes examined in Donegal, Mayo and Galway. Is widespread throughout the canals network.

Population in Ireland: There is no population estimate for tench in Ireland.

Ecology and habitat in Ireland: This is a species of slow-flowing rivers and still-water canals and lakes, with a clay-type bed and abundant vegetation. Tench feed on the bottom on algae and benthic invertebrates. Spawning occurs in early summer, with the small eggs adhering to aquatic vegetation. Kennedy & Fitzmaurice (1970) published a major monograph on tench biology and ecology in Ireland and this remains the primary Irish reference source.

Threats: As with other fish species, the tench is susceptible to water pollution. Summer water temperatures of c. 20^o are required for spawning. This temperature may not be reached in all years. However, failure to spawn would not be anticipated to be an issue, year on year, as self-sustaining populations are usual in Irish waters where tench occurs.

Abramis brama (Linnaeus, 1758)

Common name: Common bream (Carp bream)

Irish name: bran fionnuisce

Irish status: Non-native non-benign

Global status: least concern



Photo: Sean Rooney, IFI

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: A non-native species of lakes, canals and large rivers commonly recorded in fisheries surveys over many years. The bream's bottom feeding behaviour can lead to the disturbance of sediments and increased water turbidity which in turn impacts on native flora and fauna.

Distribution: The species is native to western and central Europe with range extending east to the Caspian and Black Seas. In Ireland, it has a fairly widespread distribution in relatively-enriched waters, occupying lakes, canals and the deeper reaches of large rivers in many Irish catchments. The IFI's Monitoring Programme for WFD (Central & Regional Fisheries Boards, 2008) showed the species to occur in lakes of the drumlin belt extending from east Sligo across to Monaghan. It was also present in the reservoirs on R. Lee.

Population in Ireland: There is no population estimate for Ireland.

Ecology and habitat in Ireland: The bream is a laterally-compressed species that occurs in lakes and in rivers with deep areas such as the R. Suck, R. Barrow and R. Inny. They often shoal and invariably remain on the bottom. They are benthic feeders, eating chironomid larvae and other organisms bedded in the substratum. Bream in excess of 20 years of age have been recorded in Irish waters. They spawn between April and June with water temperatures at c. 17°C. Migration of spawning shoals has been reported in the R. Suck (Whelan, 1983). The eggs adhere to plant material and to stones.

Kennedy & Fitzmaurice (1968) published a major monograph on bream biology and ecology in Ireland and this remains the primary Irish reference source. Studies relating to the growth of bream in Irish canals (Tierney *et al.*, 1999) and their migration patterns in these artificial watercourses (Caffrey *et al.*, 1996) have been published.

Threats: The bream is susceptible to water pollution. Major bream mortalities occurred in L. Derg on the Shannon in the 1990s, attributed to a species-specific viral infection. Competition from roach has impacted on bream in terms of hybridization and in terms of growth. 'Specimen' bream now tend to come from those waters that do not contain roach.

Scardinius erythrophthalmus (Linnaeus, 1758)

Common name: Rudd

Irish name: ruán

Irish status: Non-native benign

Global status: least concern



Photo: Sean Rooney, IFI

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: An introduced species, but considered benign as no significant impact on native species or ecosystems has been noted.

Distribution: Widely spread across Europe and eastward to the Black and Caspian Seas.

Widespread and naturalised in Ireland by 1900 although often limited to smaller isolated lakes.

Population in Ireland: No population estimate for Ireland, but populations have been impacted, in size or in extent of distribution, through introduction of roach.

Ecology and habitat in Ireland: Benthopelagic and potamodromous. A non-native species of lakes and back water areas of larger rivers. Favours habitat with large amounts of aquatic vegetation. Rudd spawn in May – early June in weedy situations. Young fish feed on zooplankton. The diagnostic upturned mouth facilitates surface feeding by adult fish on emerging and adult insects. Hybridisation with roach and bream, with back-crossings, can render species identification problematic. Kennedy and Fitzmaurice (1974) published a major monograph on rudd biology and ecology in Ireland and this remains the primary Irish reference source.

Threats: The greatest threat in Ireland is competition and hybridization with roach (*Rutilus rutilus*) as evident from long-term fish surveys on L. Conn where a very large rudd stock disappeared as roach stocks increased. This is also seen as a problem for the species in other regions (Crivelli, 1996). The species has been lost from open water habitats in the Erne and Bann catchments over the last 40 years. It thrives best in waters that do not contain roach.

Rutilus rutilus (Linnaeus, 1758)

Common name: Roach

Irish name: róiste

Irish status: Non-native non-benign

Global status: least concern

Photo: Paul McLoone, IFI



Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: The species has dramatically expanded its range since it was introduced. Its flexible biological and ecological capacities enable it to occupy a range of niches, often used by other fish species, and to out-compete these species.

Distribution: Widely spread across Europe and eastward to the Black and Caspian Seas.

The species has dramatically expanded its range since it was first introduced to Ireland in 1889 to the Munster Blackwater. It was initially transferred to two enclosed waters in Northern Ireland - a pond in Co. Tyrone in 1905 and a site in the Erne system in the 1930s. Roach escaped from there to the main Erne catchment c. 1960 and spread throughout that system. Roach were translocated into the Neagh-Bann system, Shannon, Lough Corrib and many other waters from 1970s onwards. Now found in most of the major river systems of the Shannon, Erne and Bann / Blackwater systems as well as the Boyne, Dee, Liffey, Moy and Corrib (Fitzmaurice, 1984).

Population in Ireland: An invasive species that can generate large populations in waters which it colonises. The species has dramatically expanded its range and numbers since it was introduced.

Ecology and habitat in Ireland: Benthopelagic and potamodromous. Found in a variety of freshwater habitats mainly in lowland areas. The roach can occupy all of the habitats and niches available in the waters it colonises. This includes riffles, glides and pools in rivers. Highly fecund, its spawning season lasts from April to June with eggs attaching to aquatic vegetation. Hybridisation with rudd and bream, with back-crossings, can render precise species identification problematic. Most abundant in nutrient rich lakes and large to medium sized rivers and backwaters. Feeds mainly on zooplankton, benthic invertebrates and plant material. Can shift from littoral to pelagic habitats and between benthic food and zooplankton (captured in benthic and pelagic nets during lake surveys). It is an important coarse angling species in Ireland.

Threats: As with other fish species, the roach is susceptible to water pollution, while also being an indicator of nutrient enrichment. Populations in lakes have been shown to decline with a reduction in eutrophication pressure and increase in water clarity (O'Grady *et al.*, 2008).

Leuciscus leuciscus (Linnaeus, 1758)

Common name: Dace

Irish name: déas

Irish status: Invasive requiring management

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Non-native species. The species has a high fecundity and plasticity of habits. Thus it can occupy a range of niches, generally used by other species, and has the capacity to outcompete these species for space and food. Adults can predate on juvenile cyprinids and salmonids. Management is required to control the impact of this species on native biodiversity.

Distribution: Widely spread across Europe in rivers and streams north of the Alps and eastward to the Black and Caspian Seas.

First introduced to Ireland in 1889, along with roach, to the Munster Blackwater and confined to that system until 1950. Major expansion in range in Irish waters in recent years (Caffrey *et al.*, 2007) including Barrow/Nore systems as well as the R. Maigue, R. Shannon and lakes in Clare.

Population in Ireland: Currently undergoing an invasive phase, with increase in populations in the waters impacted.

Ecology and habitat in Ireland: Benthopelagic and potamodromous. Inhabits moderate to fast flowing large streams and rivers with rock or gravel bottom. It occurs in the freshwater tidal reaches of the R. Barrow and R. Nore and this capacity to live in such waters may serve as a dispersal mechanism (Caffrey *et al.*, 2007). The dace spawns in spring in shallow gravelled areas, shedding its eggs onto aquatic vegetation or onto the graveled bed (Kennedy, 1969a). Its torpedo-shape renders it suitable for life in fast flowing water. The dace is omnivorous, with a highly varied diet. Adult fish can be piscivorous and feed on small cyprinids and salmonids. Dace to 10 years of age have been recorded in the Munster Blackwater, although the average life span of Irish dace is 6 years.

Threats: As with other fish species, the dace is susceptible to water pollution.

Cyprinus carpio Linnaeus, 1758

Common name: Carp; Common carp

Irish name: carbán coiteann

Irish status: Domesticated species

Global status: Vulnerable [A2ce]

Photo: Inland Fisheries Ireland



Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: A non-native species, with original introductions dating back to 17th century. Spawning in the wild is very intermittent and populations are only sustained by continuous stocking programmes; this species is considered to be effectively domesticated.

Distribution: The species is native to Europe but has been introduced into other continents as a sport fish and for fish farming purposes.

Only known from three locations in Ireland as of 1950 (Fitzmaurice, 1983b). Since 1950, known stockings have taken place into 32 ponds for sport angling. Translocations and re-stocking at other lakes for angling purposes may also have occurred.

Population in Ireland: Populations largely maintained through human interventions.

Ecology and habitat in Ireland: Water temperature in excess of 20°C is required for successful spawning. These temperatures are higher than the national average and it is not envisaged that successful carp spawning would occur in the majority of waters. Successful spawning on a regular basis has been recorded from a small number of lakes in the south of the country and in one lake in the midlands. Carp require areas of deep water (>3m) for overwintering, shallow productive areas for feeding and shallow littoral areas with emergent vegetation for spawning (Fitzmaurice, 1983b). Carp feed on or in the bottom mud. They stir up the bed and, in water with silty bottoms, can penetrate the bed to a depth of 12 cm. This activity uproots submerged and emergent vegetation and the waters tend to be continually turbid (Fitzmaurice, 1983b).

Threats: Fitzmaurice (1983b) was of the view that the status of carp as a permanent member of the Irish freshwater fish fauna was “very precarious” and that it would likely have disappeared entirely but for the post-1950 stockings for sport angling. The principal threats relate to availability of suitable temperatures for spawning. As the species is non-native, it may be questioned whether Ireland should be sustaining populations, naturally or through stocking. This point is made in the context of preservation of native biodiversity and in the context of the Water Framework Directive, where introduction of a non-native species to a water serves to reduce the ecological status of that water.

Leuciscus cephalus (Linnaeus, 1758)

Common name: Chub

Irish name: plobán

Irish status: Invasive requiring management

Global status: least concern



Photo: Joe Caffrey, IFI

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Non-native species introduced illegally in 2001 into the Inny system in the Irish midlands. As a new arrival, the chub has no natural competitors or predators. It has the potential to penetrate a range of habitat niches where it would have the capacity to out-compete resident fish species. Management is required to control the impact of this species on native biodiversity and attempts at eradication are ongoing.

Distribution: Widely spread across Europe in rivers and streams and eastward to the Black and Caspian Seas, including Russia and Iran.

Only known in Ireland from the R. Inny.

Population in Ireland: Eradication work is ongoing and involves electric fishing operations to cull out specimens encountered. It is considered that the majority of the chub present in the R. Inny have been removed and no sustainable population exists.

Ecology and habitat in Ireland: Benthopelagic and potamodromous. The chub present in the R. Inny ranged in length from 15 to 41 cm and in weight from 33 to 1061 gm. They were aged between 3 and 10 years of age, although the majority were 6 years old. They displayed a fast growth rate in this river. No chub fry or juveniles were recorded in the R. Inny. In England, it is a species of relatively deeper and larger rivers. It can grow there to 30 – 50 cm, a size that would compete, in Ireland, with larger brown trout for space and food.

Threats: As with other fish species, the chub is susceptible to water pollution.

Phoxinus phoxinus (Linnaeus, 1758)

Common name: Minnow

Irish name: bodairlín

Irish status: Non-native non-benign

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: A non-native species of lakes and rivers commonly recorded in fisheries surveys over many years. Expansion of minnow populations has led to extinction of brown trout populations in oligotrophic Norwegian lakes (Museth *et al.*, 2007) and there are concerns that similar impacts could occur here.

Distribution: The minnow is found throughout much of Europe, from Ireland to eastern Spain and eastern Siberia. It is absent from the north of Scotland. It is found at altitudes up to 2000 m, and has been found in some lakes.

It has a relatively widespread but erratic distribution in Ireland, occupying lakes and rivers. It is infrequently recorded in canal habitats. IFI's WFD Surveillance Monitoring Programme found minnow to be widespread at river sites surveyed in the Shannon basin in 2008 and Marine Institute surveys of Carrowmore Lake indicated a large stock in 2004. Maitland and Campbell (1992) suggested that minnow (originally indigenous to south-east England) were used as live bait and this is a likely mechanism for their distribution. This may explain the somewhat random distribution in Ireland.

Population in Ireland: No population estimate has been compiled for Ireland, but can occur in large numbers where competition and predation are limited.

Ecology and habitat in Ireland: Demersal and potamodromous. The minnow lives in shoals and feeds on plant debris, algae, molluscs, insects and crustaceans. It inhabits clean streams and rivers that have either a sandy or stony bed; it also occurs in well oxygenated cold, running or still water. Very large numbers of minnow were found in the Tolka River (1993 to 1996), and a virtual absence of all other fish species, suggesting that minnow is very tolerant of polluted conditions even down to a Q2 level. The spawning season lasts from April to June; during this time they undertake short upstream migrations to spawn in shallow, gravelly areas. The minnow is an important component of the diet of larger fishes and of many water birds. Daoud *et al.* (1985) studied minnow populations in the Vartry lakes in the Wicklow mountains. Kennedy & Pitcher (1975) demonstrated homing activity among minnow in aquarium studies.

Threats: More tolerant than most species but still susceptible to severe water pollution.

Gobio gobio (Linnaeus, 1758)

Common name: Gudgeon

Irish name: brannóg

Irish status: Non-native benign

Global status: not assessed

Photo: Inland Fisheries Ireland



Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: A non-native species commonly recorded in fisheries surveys over many years, but rarely found in large numbers and no significant impact on native species or ecosystems noted.

Distribution: The species is native to Europe, being found in freshwater lakes and rivers. Populations known from drainage basins from Atlantic through central Europe and Asia to Korea.

In Ireland, the gudgeon is erratically distributed with few records from western or eastern sites. Large populations in the Bann, parts of the Erne and Lagan systems, also known from many river sites in the Shannon catchment and Monaghan Blackwater. Individual positive sites have been recorded on the Munster Blackwater, the Dee, the Liffey and the Grand Canal and adjacent mill streams (Lucan), and the Barrow (unpublished data from IFI WFD monitoring). Maitland and Campbell (1992) suggest that the use of gudgeon (originally indigenous to south-east England) as live bait is a likely explanation for their somewhat random distribution in Ireland.

Population in Ireland: No population estimate for Ireland is available. A focussed study on this species would be necessary in order to assess status of populations.

Ecology and habitat in Ireland: This is a very adaptable species, found in canals, ponds and moderately fast-flowing streams. They often shoal and invariably remain on the bottom, where their mouths are ideally adapted for grubbing for food in the silt. They feed on insect larvae, crustaceans and small molluscs. Gudgeon are small, barbel-like cyprinids (carp family) and rarely grow to more than 20cm in length and most mature at around half that size. The life span is generally c. 3 years although fish up to 7 years have been recorded. They spawn between April and July in shallow water at night. The eggs adhere to plant material and to stones.

Kennedy and Fitzmaurice (1972) published on aspects of gudgeon biology in Irish water and Geraghty (unpublished data) studied gudgeon in the Suck catchment of the Shannon basin.

Threats: As with other small fish species, the gudgeon is subject to predation by larger fish e.g. pike and brown trout. However, this is unlikely to be a major threat to status. The principal threat comes from water pollution.

Barbatula barbatula (Linnaeus, 1758)

Synonym: *Neomacheilus barbatulus* (Linnaeus 1758)

Common name: Stoneloach

Irish name: cailleach



Photo: Inland Fisheries Ireland

Irish status: Non-native benign

Global status: least concern

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: A non-native species, originally indigenous to south-east England. Now widespread in rivers of all sizes in Ireland, but no significant impact on native species or ecosystems noted.

Distribution: Widely spread across Europe to China and Japan.

Stoneloach is widely, but erratically, distributed throughout Ireland. Maitland and Campbell (1992) suggest that stoneloach were used as live bait and this may explain the somewhat random distribution in Ireland.

Population in Ireland: No data available on population size or trends. .

Ecology and habitat in Ireland: Demersal and potamodromous. Widespread in fisheries surveys in rivers and streams. Distributional information suggests a capacity to thrive in nutrient-enriched rivers and streams in Ireland, but no specific Irish studies are available. In the UK it can occur in hard- and soft waters, in both lakes and rivers. Fish up to 5 years of age are present in the English Lake District. It is nocturnal, living in gravelled and stony areas. It uses its distinctive barbels, present on the lower jaw, to forage for invertebrate food. Spawning takes place in May in the Lake District. Some fish attain 5.0 cm by the winter of their first year of life and spawn when 1 year old; others less than 5.0 cm do not spawn until the next season.

Threats: As with other fish species, the stoneloach is susceptible to water pollution but appears to tolerate moderate organic pollution. Also very sensitive to pollution by heavy metals.

Perca fluviatilis Linnaeus, 1758

Common name: Perch

Irish name: péirse

Irish status: Non-native non-benign

Global status: least concern



Photo: Inland Fisheries Ireland

Legal status: Conservation of and prohibition on sale of coarse fish by law No. 806 (2006) [RoI]; Fisheries Acts 1959 to 2006; Fisheries Act (Northern Ireland) 1966; Foyle Fisheries Act (NI) 1952; Foyle and Carlingford Fisheries Act 2007.

Rationale for assessment: Introduced species, now widespread in lakes, canals and larger rivers in Ireland. Perch are considered non-benign as they compete with brown trout for food, at all life stages.

Distribution: Found throughout Europe, north of the Pyrenees and Alps to the northernmost extremity of Scandinavia, and across northern Asia. Introduced into Australia, New Zealand and South Africa. The perch is indigenous to south-eastern England but has been widely redistributed “for their food value and ease of catch” (Maitland & Campbell, 1992).

First introduced to Irish waters adjacent to monastic settlements as a readily available source of food (Kennedy & Fitzmaurice, 1974; Maitland & Campbell, 1992; Moriarty & Fitzmaurice, 2000). Now widespread throughout the country, excepting Donegal, Mayo and Kerry, and recorded in large numbers in L. Corrib, Inniscarra Reservoir, Shannon-Erne river and lakes, the R. Barrow and all canal systems examined.

Population in Ireland: No national population estimates, but no evidence of major decline. Populations traditionally considered to undergo substantial fluctuations, with general dominance of a single year class.

Ecology and habitat in Ireland: Spawns in March – May, depositing long ribbons of egg mass onto surfaces including weeds and submerged branches of trees. A shoaling species. Inhabits a wide range of habitats, found in deeper slow-flowing rivers, in lakes, ponds and canals. Feed on zooplankton, invertebrates and other fish. Larvae and small juveniles usually feed on planktonic invertebrates. During the first summer, many juveniles move near shores to feed on benthic prey. Often feeds on fishes at about 12 to 14 cm length.

Threats: Rhabdovirus infections, often associated with aquaculture and collection of wild broodstock. Collection of wild stock for aquaculture.

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APPENDIX 1 – SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN A THREATENED CATEGORY; Critically Endangered, Endangered or Vulnerable (IUCN, 2010a).

Use any of the criteria A–E	Critically Endangered	Endangered	Vulnerable
A. Population reduction			
Declines measured over the longer of 10 years or 3 generations			
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
<p>A1. Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased, based on and specifying any of the following:</p> <p>(a) direct observation (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality (d) actual or potential levels of exploitation (e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.</p> <p>A2. Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible, based on (a) to (e) under A1.</p> <p>A3. Population reduction projected or suspected to be met in the future (up to a maximum of 100 years) based on (b) to (e) under A1.</p> <p>A4. An observed, estimated, inferred, projected or suspected population reduction (up to a maximum of 100 years) where the time period must include both the past and the future, and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible, based on (a) to (e) under A1.</p>			
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following:			
(a) Severely fragmented, OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals.			
C. Small population size and decline			
Number of mature individuals	< 250	< 2,500	< 10,000
AND either C1 or C2:			
C1. An estimated continuing decline of at least:	25% in 3 years or 1 generation	20% in 5 years or 2 generations	10% in 10 years or 3 generations
(up to a max. of 100 years in future)			
C2. A continuing decline			
AND (a) and/or (b):			
(a i) Number of mature individuals in each subpopulation:	< 50	< 250	< 1,000
or			
(a ii) % individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals.			
D. Very small or restricted population			
Either:			
Number of mature individuals	< 50	< 250	D1. < 1,000 AND/OR
VU D2. Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.			D2. typically: AOO<20 km ² or number of locations ≤ 5
E. Quantitative Analysis			
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations (100 years max.)	≥ 20% in 20 years or 5 generations (100 years max.)	≥ 10% in 100 years

APPENDIX 2 – RED LIST OF NATIVE FISH SPECIES

IRL 2011 - Red list status for Ireland based on this assessment; CR - Critically Endangered, VU – Vulnerable, NT - Near Threatened, dd - data deficient, lc – least concern; na– not assessed. **IRL 1993** - Red list status for Ireland based on Whilde, 1993; E – Endangered, V - Vulnerable, I – Indeterminate, II - Internationally important. **Global Status** - Red List status, taken from IUCN (2010b); categories as for IRL2011. **Protection** – EU – Listed on an EU Habitats Directive [92/43/EEC] Annex; CITES – Listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora; RoI – Protected under the Irish Fisheries Acts; NI – Protected under NI Fisheries Acts; Loughs – Protected under Foyle & Carlingford Loughs Acts.

Family	Scientific name	Authority	Common name	IRL 2011	IRL 1993	Global	Protection
Petromyzonidae	<i>Petromyzon marinus</i>	Linnaeus	Sea lamprey	NT [A2c,B1ab(iii)]	I	lc	EU; RoI; NI; Loughs
	<i>Lampetra fluviatilis</i>	Linnaeus	River lamprey	lc	I	lc	EU; RoI; NI; Loughs
	<i>Lampetra planeri</i>	Bloch	Brook lamprey	lc	I	lc	EU; RoI; NI; Loughs
Acipenseridae	<i>Acipenser sturio</i>	Linnaeus	Sturgeon	na		CR [A2cde;B2ab(ii,iii,v)]	EU; RoI; NI; Loughs
Alosidae	<i>Alosa alosa</i>	Linnaeus	Allis shad	dd	E	lc	EU; RoI; NI; Loughs
	<i>Alosa fallax</i>	Lacepede	Twaite shad	VU [D2]	V	lc	EU; RoI; NI; Loughs
	<i>Alosa fallax killarnensis</i>	Regan	Killarney shad	VU [D2]	E	CR [B1ab(iii)] as <i>A. killarnensis</i>	EU; RoI; NI; Loughs
Salmonidae	<i>Salmo salar</i>	Linnaeus	Atlantic salmon	VU [A2abcde]	II	lc	EU; RoI; NI; Loughs
	<i>Salmo trutta</i>	Linnaeus	Brown trout/Sea trout	lc		lc	RoI; NI; Loughs
	<i>Salvelinus alpinus</i>	Linnaeus	Arctic char	VU [A2ace]	V	lc	RoI; NI; Loughs
Coregonidae	<i>Coregonus autumnalis pollan</i>	Pallas	Pollan	VU [B2ab(iii,v); D2]	E	EN [B1ab(iii),B2ab(iii)] as <i>C. pollan</i>	RoI; NI
Osmeridae	<i>Osmerus eperlanus</i>	Linnaeus	Smelt	lc	V	lc	RoI; NI; Loughs
Anguillidae	<i>Anguilla anguilla</i>	Linnaeus	European eel	CR [A2bd;A4bd]		CR [A2bd;A4bd]	EU; CITES; RoI; NI; Loughs
Gasterosteidae	<i>Gasterosteus aculeatus</i>	Linnaeus	Three-spined stickleback	lc		lc	RoI; NI; Loughs
	<i>Pungitius pungitius</i>	Linnaeus	Ten-spined stickleback	lc		lc	RoI; NI; Loughs
Pleuronectidae	<i>Platichthys flesus</i>	Linnaeus	Flounder	lc		lc	

APPENDIX 3 – RED LIST OF AMPHIBIAN AND REPTILE SPECIES

IRL 2010 - Red list status for Ireland based on this assessment; VU – Vulnerable, NT - Near Threatened, dd - data deficient, lc – least concern; na– not assessed. **IRL 1993** - Red list status for Ireland based on Whilde, 1993; E - Endangered, II - Internationally important. **EU Status** - Red list status for Europe, based on Temple & Cox, (2009) and Cox & Temple (2009); categories as for IRL2011. **Global Status** – Red List status, taken from IUCN (2010b); categories as for IRL2011. **Protection** – EU – Listed on an EU Habitats Directive [92/43/EEC] Annex; RoI – Listed on the Irish Wildlife Acts; NI – Listed on NI Wildlife Order

Group	Scientific name	Authority	Common name	IRL 2010	IRL 1993	EU Status	Global Status	Protection
Reptiles	<i>Zootoca vivipara</i>	Jacquín	Common lizard	lc		lc	lc	RoI; NI
	<i>Anguis fragilis</i>	Linnaeus	Slow-worm	na		lc	na	
	<i>Chelonia mydas</i>	Linnaeus	Green turtle	na			EN [A2bd]	EU; RoI
	<i>Eretmochelys imbricata</i>	Linnaeus	Hawk's-Bill turtle	na			CR [A2bd]	EU; RoI
	<i>Lepidochelys kempii</i>	Garman	Kemp's Ridley turtle	na			CR [A1ab]	EU; RoI
	<i>Dermochelys coriacea</i>	Vandelli	Leatherback turtle	lc			CR [A1abd]	EU; RoI
	<i>Caretta caretta</i>	Linnaeus	Loggerhead turtle	na			EN [A1abd]	EU; RoI
Amphibians	<i>Rana temporaria</i>	Linnaeus	Common frog	lc	II	lc	lc	EU; RoI; NI
	<i>Epidalea calamita</i>	Laurenti	Natterjack toad	EN [B2a,b(iii)]	E	lc	lc	EU; RoI
	<i>Lissotriton vulgaris</i>	Linnaeus	Smooth newt	lc		lc	lc	RoI; NI

APPENDIX 4 – STATUS OF NON-NATIVE FISH SPECIES

IRL 2010 - Status for Ireland based on this assessment; dsp – domesticated species, ben – non-native benign, nbn – non-native non-benign, IAS – invasive requiring management.

Global Status - Red List status, taken from IUCN (2010b); VU – Vulnerable, lc – least concern. **Protection** – RoI – Protected under the Irish Fisheries Acts; NI – Protected under NI Fisheries Acts. Loughs – Protected under Foyle & Carlingford Loughs Acts.

Family	Scientific name	Authority	Common name	IRL 2010	Global Status	Protection
Salmonidae	<i>Onchorhynchus mykiss</i>	Wallbaum	Rainbow trout	dsp		
Esocidae	<i>Esox lucius</i>	Linnaeus	Pike	nbn	lc	RoI; NI; Loughs
Cyprinidae	<i>Tinca tinca</i>	Linnaeus	Tench	ben	lc	RoI; NI; Loughs
	<i>Abramis brama</i>	Linnaeus	Common bream	nbn	lc	RoI; NI; Loughs
	<i>Scardinius erythrophthalmus</i>	Linnaeus	Rudd	ben	lc	RoI; NI; Loughs
	<i>Rutilus rutilus</i>	Linnaeus	Roach	nbn	lc	RoI; NI; Loughs
	<i>Leuciscus leuciscus</i>	Linnaeus	Dace	IAS	lc	RoI; NI; Loughs
	<i>Cyprinus carpio</i>	Linnaeus	Common carp	dsp	VU [A2c,e]	RoI; NI; Loughs
	<i>Leuciscus cephalus</i>	Linnaeus	Chub	IAS	lc	RoI; NI; Loughs
	<i>Phoxinus phoxinus</i>	Linnaeus	Minnnow	nbn	lc	
	<i>Gobio gobio</i>	Linnaeus	Gudgeon	ben		RoI; NI; Loughs
Cobitidae	<i>Barbatula barbatula</i>	Linnaeus	Stoneloach	ben	lc	RoI; NI; Loughs
Percidae	<i>Perca fluviatilis</i>	Linnaeus	Perch	nbn	lc	RoI; NI; Loughs