Roach (*Rutilus rutilus*)
Ecological Risk Screening Summary

Web Version - 9/18/2012


Photo: Chinese Academy of Fishery Sciences, Information Center

1 Native Range, and Status in the United States

Native Range
From Froese and Pauly (2010):

"Eurasia."

Status in the United States
This species has not been documented in the United States.

Means of Introductions in the United States
This species has not been introduced to the United States.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing
From ITIS (2011):

"Kingdom Animalia
Phylum Chordata
Subphylum Vertebrata
Superclass Osteichthyes

Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Cypriniformes
Superfamily Cyprinoidea
Family Cyprinidae
Genus Rutilus Rafinesque, 1820
Species *Rutilus rutilus* (Linnaeus, 1758) – roach"

Taxonomic status: "valid"

Size, Weight, Age

From Froese and Pauly (2010):

"Max length : 50.0 cm SL male/unsexed; (Kottelat and Freyhof 2007); common length: 25.0 cm TL male/unsexed; (Muus and Dahlström 1968); max. published weight: 1,840 g (International Game Fish Association 1991); max. reported age: 14 years (Wüstemann and Kammerad 1995)."

Environment

From Froese and Pauly (2010):

"Benthopelagic; potamodromous (Riede 2004); freshwater; brackish; [water hardness] range: 7.0 - 7.5; pH range: 10 - 15; depth range 15 - ? m."

Climate/Range

From Froese and Pauly (2010):

"Subtropical; 10°C - 20°C (Riehl and Baensch 1991); 71°N - 36°N, 10°W - 155°E." [Note: Climate range and latitudinal ranges are not concordant. Many data points document existence of *R. rutilus* in latitudes 68-71°N. Available information on temperature range is clearly incorrect. A lower (than 10°C) must more accurately characterize the minimum temperature of waters where the species can become established.]

Distribution Outside of the United States

From Froese and Pauly (2010):

"Europe: north to Pyrenees and Alps, eastward to Ural and Eya drainages (Caspian basin); Aegean basin in Pinios, Vardar, Vegoritis, Kastoria, Struma and Maritza drainages. Asia: Marmara basin and lower Sakarya in Anatolia, Aral basin, and Siberia from Ob eastward to Lena drainages. Naturally absent from Iberian Peninsula, Adriatic basin, Italy, Great Britain north of 56 N, Scandinavia north of 69° N. Locally introduced in Spain; introduced and invasive in northeastern Italy. At least one country reports adverse ecological impact after introduction."

Introduced to Spain, the Azores Islands, Portugal, United Kingdom (Lake districts), Australia, Ireland, Madagascar, Morocco, Kazakhstan, Cyprus, and Italy.

Means of Introductions Outside the United States

Intentionally introduced for sportfishing or accidentally as a baitfish. Some range expansion has also occurred (Froese and Pauly (2010).

Remarks

Established and expanding in almost all introduced locations except for Madagascar (Froese and Pauly (2010).

Short description

From Froese and Pauly (2010):

"Dorsal spines (total): 3; Dorsal soft rays (total): 9-12; Anal spines: 3; Anal soft rays: 9 - 13; Vertebrae: 39 - 41. The only species of the genus in Atlantic basin north of Pyrénées which can be distinguished from its congeners in Black and Caspian Sea basins and Apennine Peninsula by the combination of the following characters: 39-41 + 2-3 (41-44 total) scales along lateral line; dorsal and anal fins with 10½ branched rays; body laterally compressed, depth 25-35% SL; mouth terminal; snout pointed; iris from yellow in juveniles to deep red in adults; pectoral, pelvic and anal fins orange to red; and no midlateral stripe. Differs from its congeners in Balkan Peninsula by uniquely possessing 10½ branched anal rays (Kottelat and Freyhof 2007). Caudal fin with 18-19 rays (Spillman 1961)."

Biology

From Froese and Pauly (2010):

"Found in a wide variety of habitats, mainly in lowland areas. Most abundant in nutrient-rich lakes and large to medium sized rivers and backwaters. Also recorded from small lowland streams and from brackish coastal lagoons. In fast-flowing rivers, confined to stretches where backwaters or shelters allow for overwintering. Larvae and juveniles live in wide variety of littoral habitats. Preys predominantly on benthic invertebrates, zooplankton, plant material and detritus. May shift from littoral to pelagic habitats and between benthic food and zooplankton when abundance of a specific food item is high or for avoidance of predation and/or competition. Breeds among dense submerged vegetation in backwaters or lakes, flooded meadows or in shallow, fast-flowing river habitats on plant or gravel bottom. Undertakes short spawning migrations. Stays in backwaters or in deep parts of lakes to overwinter. Produces fertile hybrids with *Abramis brama* (Kottelat and Freyhof 2007). Pale yellow eggs are found attached to vegetation and tree roots (Pinder 2001)."

Human uses

From Froese and Pauly (2010):

"Fisheries: commercial; aquaculture: commercial; gamefish: yes. There is only little commercial fishing for this species, but valued for recreational fishing. Utilized fresh and dried or salted; can be pan-fried, broiled and baked (Frimodt 1995)."

Diseases

From Froese and Pauly (2010):

"Worm Cataract, Parasitic infestations (protozoa, worms, etc.)
Black Spot Disease, Parasitic infestations (protozoa, worms, etc.)"

Threat to humans

From Froese and Pauly (2010):

"Potential pest (Kottelat and Freyhof 2007)."

3 Impacts of Introductions

From Griffiths (1997):

"Other species, introduced from mainland Britain and spread mainly by anglers, have potentially larger impacts. For example, roach *(Rutilus rutilus* L.) is believed to have been introduced into the River Blackwater, Co. Cork, in 1889 by an angler using it as live bait. It has subsequently spread throughout Ireland, and has become common wherever it occurs. In the 1981 World Angling Competition, the winners caught 94 kg in the Upper Bann River and 117 kg in Lough [Lake] Erne in 5 h: these catches were almost exclusively roach (V. Refausse, personal communication). Roach comprised 70% of fish biomass in a 1991 survey of Lower Lough Erne (Rosell 1994). It was first reported in the Lough Neagh catchment in 1971 and is now probably the most common species within the Lough. There are insufficient data to say whether this increase has had a deleterious effect on the populations of most species in Lough Neagh, with the exception of rudd *(Scardinius eryrhrophthabnus* L.). This species was encountered until the late 1980s but not since and it is believed that hybridization with roach has been responsible for its disappearance, though both species coexist in a gravel pit pond a few metres from the lough. Ferguson (1986), in describing Lough Melvin's possibly unique postglacial salmonid community, notes with concern the appearance of rudd in the Lough, again presumably introduced by anglers."

From Ferguson (2008):

"Roach can have a significant impact on water quality through accentuating the effects of nutrient enrichment. The abundance of roach and its feeding habits mean that it competes both directly and indirectly with other freshwater fish for food and quickly becomes the dominant fish species. Roach has been shown to reduce Atlantic salmon and brown trout numbers. The introduction of roach has been linked to the extinction of the Arctic charr (*Salvelinus alpinus*) in Lough Corrib and to the severe decline in pollan [*Coregonus pollan*] numbers in Lower Lough Erne. It has led to reduction in numbers of rudd, an alien fish species introduced sometime prior to roach. In Lough Neagh competition for food with roach has been found to reduce the numbers of overwintering tufted duck (*Aythya fuligula*). However, the numbers of great crested grebes (*Podiceps cristatus*) increased, presumably as a result of the increased availability of small fish as food. Movement of roach could potentially result in the introduction of diseases and parasites."

From Winfield et al. (2007):

"The Arctic charr populations of Windermere face significant environmental pressures from eutrophication, climate change and potentially from competition with an increased roach population. Current Arctic charr abundance in the north basin, where eutrophication is limited and the local roach population has increased only recently, is comparable with that of the near pristine lake of the 1940s. In contrast, the situation is becoming critical in the south basin where eutrophication is much more developed, with associated deepwater hypoxia, and the local roach population increased earlier. Continued lake management in the form of nutrient control to address in particular the problem of deepwater hypoxia is essential to ensure survival of the local Arctic charr populations."

From Kottelat and Freyhof (2007):

"Introduced and invasive in northeastern Italy."

From Stokes et al. (2006):

"In Ireland, the introduction of the roach *Rutilus rutilus* has been implicated in the reduction of populations of several fish species through competitive superiority (Johannson and Persson 1986). Native Atlantic salmon and brown trout *Salmo trutta* may be affected (Kennedy and Strange 1978), rudd *Scardinius erythropthalmus* species have been displaced (Cragg- Hine 1973) and perch *Perca fluviatilis* populations are highly susceptible to roach introductions (Johannson and Persson 1986). The roach has, however, improved feeding for birds, to the extent that great crested grebe *Podiceps cristatus* and cormorant *Phalacrocorax carbo* populations have increased (Winfield et al. 1994). However, increased winter feeding for cormorants in Lough Neagh has been implicated in increasing predation pressures by these birds on young salmonids in the River Bush (Kennedy and Greer 1988), an example of hyperpredation."

"Finally, the indirect impacts of an invasive species upon habitat sustainability are unknown. Bottom feeding fish can result in increased nutrient loading in lake environments, resulting in damage to an ecosystem and reduction of its amenity value."

"Initially, roach were not thought likely to have any major impact on other native or previously introduced fish (Went 1950). This assessment proved, however, to be wrong. Following roach population explosion in Lower Lough Erne, rudd, a much earlier introduction to Ireland, disappeared (Cragg-Hine 1973), and this pattern has been repeated everywhere roach have been introduced to large lakes containing rudd. Rudd are now largely confined to small, isolated lakes without roach or to densely weeded sites where they are apparently more able to compete with Roach (Winfield 1986)."

"Roach can have severe ecological consequences, particularly when lakes become enriched from mesotrophic to eutrophic conditions. Their ability to reach a large biomass and heavily graze zooplankton can exacerbate the algal blooms associated with nutrient enrichment in lakes. They can apparently accelerate the switch from clear water mesotrophy to a turbid water eutrophic state, effectively altering their environment to their own requirements. Biomanipulation experiments in Finland have shown significant water quality benefits following large-scale roach removal (Horppila et al. 1994). It is probable that the high biomass reached by roach in Irish lakes has contributed to the effects of eutrophication. (Rosell and Gibson 2000)."

"The latest invasive introduction to Irish freshwater, the Zebra Mussel, may now act to control roach populations by removing some of its plankton food source. This may not, however come with any significant benefit to any of the native species affected by roach and/or eutrophication. In the long term, it is probable that the only viable roach (and Zebra mussel) control strategy likely to maintain elements of the affected native biodiversity is maintenance of low trophic status through effective control of nutrient loads to freshwater (Minchin et al. 2003)."

"There is also evidence that roach compete for the same benthic food as tufted duck, with reductions in the populations of duck being causally linked to roach population increases (Winfield et al. 1992; Winfield et al. 1994)."

4 Global Distribution

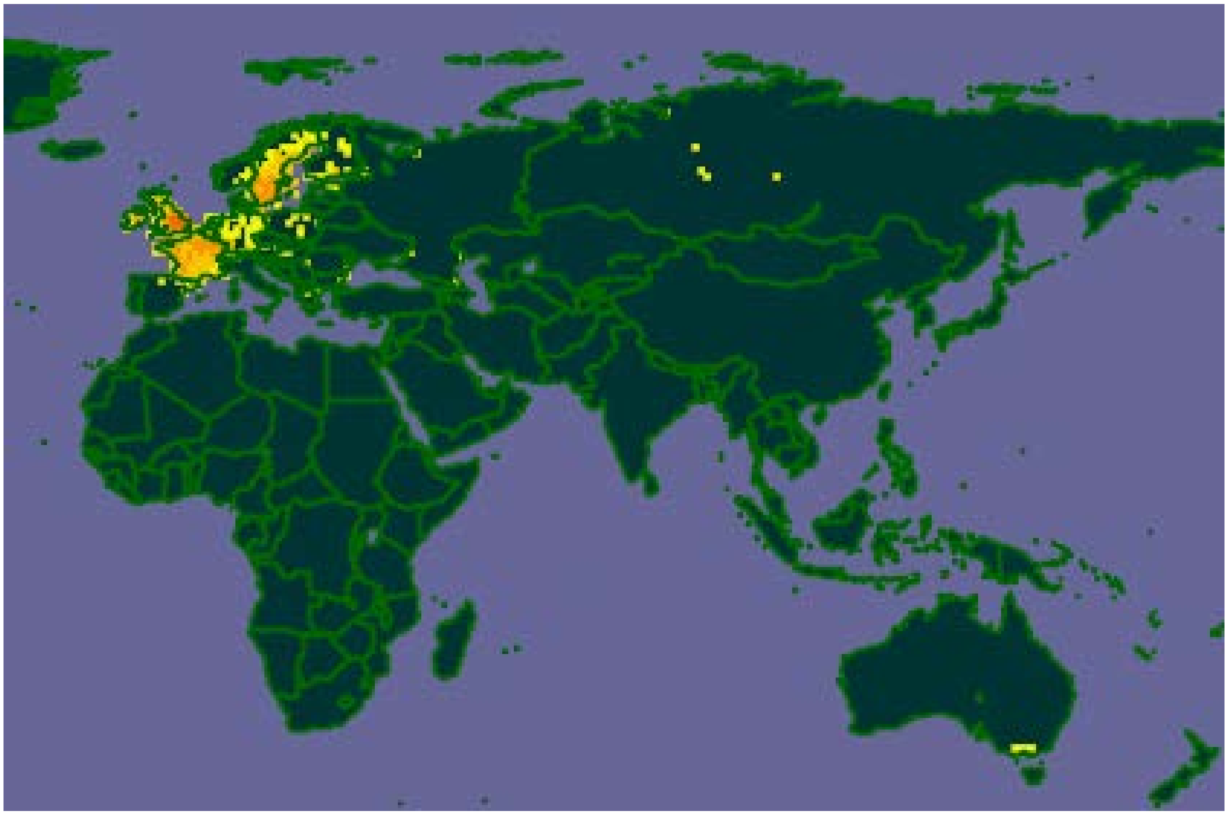

Figure 1 (above). Global distribution of *R. rutilus*. Map from GBIF (2010).

5 Distribution within the United States

This species has not been reported in the U.S.

6 CLIMATCH

Summary of Climate Matching Analysis

The climate match (Australian Bureau of Rural Sciences 2010; 16 climate variables; Euclidean Distance) was medium throughout most of the continental United States. Areas of medium-high to high matches occurred in the Midwest and Great Lakes regions. Climate 6 match indicated that the United States has a high climate match. The range for a high climate match is 0.103 and greater, climate match of *R. rutilus* is 0.411.

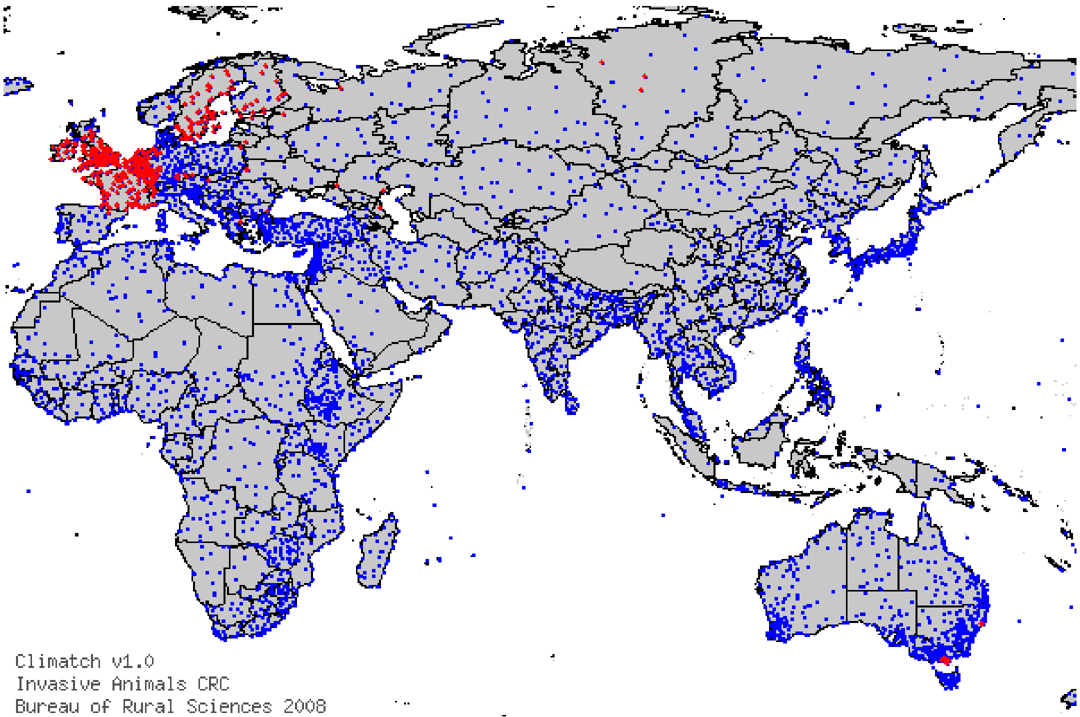

Figure 2 (above). CLIMATCH (Australian Bureau of Rural Sciences 2010) source map showing weather stations selected as source locations (red) and non-source locations (blue) for *R. rutilus* climate matching. Source locations from GBIF (2010).

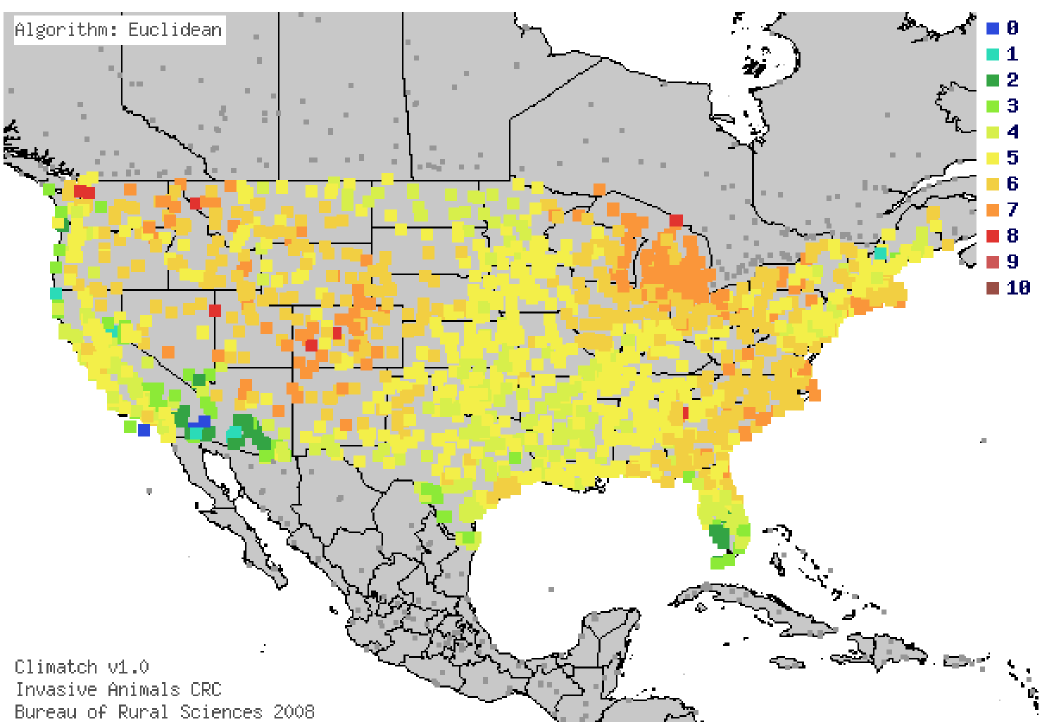

Figure 3 (above). Map of CLIMATCH (Australian Bureau of Rural Sciences 2010; 16 environmental variables; Euclidean distance) climate matches for *R. rutilus* in the continental United States based on source locations reported by GBIF (2010). 0= Lowest match, 10=Highest match.

Table 1 (below). CLIMATCH (Australian Bureau of Rural Sciences 2010) climate match scores

CLIMATCH Score	0	1	2	3	4	5	6	7	8	9	10
Count	4	12	38	68	306	737	596	207	11	0	0
Climate 6 Proportion =		0.411									

7 Certainty of Assessment

Information on the biology, invasion history, and impacts of this species is sufficient to give an accurate description of the risk posed by this species. Certainty of this assessment is high.

8 Risk Assessment

Summary of Risk to the Continental United States

Climate, of locations where *R. rutilus* is documented, is highly matched with that of the continental United States. Froese and Pauly (2010) list *R. rutilus* as a potential pest, based on information in Kottelat and Freyhof (2007). Impacts have been especially prevalent in Ireland, where *R. rutilus* has been implicated in: 1) the degradation of water quality in invaded waters, 2) competition with native fishes that led to extinction of Arctic charr, and to a "severe decline in the abundance of the coregonid pollan. The climate match, history of impacts, and projected impacts to wildlife resources of the United States and Great Lakes (Tables 1 and 2) are interpreted to mean that, if introduced into the wild, *R. rutilus* is a high risk to establish significant populations and impact natural resources of the United States.

Assessment Elements

- **History of Invasiveness (See Section 3):** High
- **Climate Match (See Section 6):** High
- **Certainty of Assessment (See Section 7):** High
- **Overall Risk Assessment Category: High**

Projections of impacts to the United States, and to the connected Great Lakes basin are summarized in Tables 1 and 2.

Table 1 (below). Generalized, projected impacts of *R. rutilus* on natural resources of the continental United States. Details of impacts are too numerous to list in this screening report. Specific details of impacts will depend on local ecological structure (i.e., fish species composition, population abundance, and community structure; food resource biomass and community structure; and habitat variables).

Threat	**Projected Level of Impact to Wildlife Resources of the U.S.**	**Description of Impact**	**Projections of Impacts to Wildlife Resources of the U.S.**
Habitat Degradation	Medium	Roach can significantly impact water quality as the result of accentuating the effects of nutrient enrichment (Ferguson 2008).	Habitat degradation, as the result of *R. rutilus*, will be greatest in lentic systems where the species becomes abundant, and nutrient enrichment is problematic.
Species Extirpation/Extinction	High	High density of *R. rutilus*, coupled with its feeding habits, resulted in competition with other freshwater fish for food. That competitive interaction resulted in *R. rutilus* quickly becoming the most abundant fish species in some lakes. *R. rutilus* has been shown to reduce Atlantic salmon and brown trout abundance. The introduction of *R. rutilus* has been linked to the extinction of the Arctic charr in Lough Corrib, and to the severe decline in pollan numbers in Lower Lough Erne (Ferguson 2008).	*R. rutilus* mainly inhabit lakes, ponds, and slow-moving rivers and their backwater areas. Species sharing these habitats are at the greatest risk for declines resulting from established populations of *R. rutilus*. Salmonids and coregonids are particularly at risk of extirpation/extinction.
Food Web Disruption	High	Roach composed 70% of fish biomass in a 1991 survey of Lower Lough Erne (Rosell 1994). It was first reported in the Lough Neagh catchment in 1971, and is now probably the most common species within the Lough (Griffiths 1997).	In Ireland lakes, *R. rutilus* has outcompeted other species for food, which has resulted in reduced abundance of species at higher levels in the food web (Atlantic salmon and brown trout) (Ferguson 2008). This has resulted in *R.*

			rutilus becoming the most abundant species in some lakes. Similar effects are projected, if populations become established in the U.S.
Degradation of Fish Stocks	High	*R. rutilus* has been shown to reduce Atlantic salmon, brown trout, pollan, and Arctic charr abundance (Ferguson 2008). Also, see information for Species Extirpation/Extinction.	Impacts to salmonid and coregonid stocks is projected.
Competition	High	High density of *R. rutilus* coupled with its feeding habits resulted in competition with other fishes for food. This competition has resulted in *R. rutilus* quickly becoming the most abundant fish species (Ferguson 2008). Also, see Degradation of Fish Stocks.	Significant competition for food with native fishes was described by Ferguson (2008) and Winfield (2007). Similar impacts are projected in U.S. waters. Salmonids and coregonids are particulary at risk.
Predation (with special emphasis on fishes)	Low	*R. rutilus* preys predominantly on benthic invertebrates and zooplankton. *R. rutilus* may shift from littoral to pelagic habitats, and between benthic food and zooplankton when abundance of a specific food item is high or for avoidance of predation and/or competition (Froese and Pauly 2010).	Significant predation on fishes is not projected. It is possible that the species will prey on fish eggs, and either benthic or pelagic larvae.
Reproductive Interference	High	*R. rutilus* has impacted [mostly as the result of competition for food] populations of Atlantic salmon, brown trout, pollan, and Arctic charr (Ferguson 2008).	Reductions in abundance of native fishes are projected. Those reduced populations will be too small to sustain recruitment at levels needed to sustain adult populations at historic levels. Species at risk, of

			reduced levels of recruitment, include native salmonids and coregonids.

Table 2. Generalized, projected impacts of *R. rutilus* on natural resources of the connected Great Lakes Basin (i.e., Great Lakes, connecting channels, and tributaries). The climate match is high between the native/established ranges of *R. rutilus* and that of the connected Great Lakes Basin. Therefore, details of impacts are too numerous to list in this screening report. Specific details of impacts will depend on local ecological structure (i.e., fish species composition, population abundance, and community structure; food resource biomass and community structure; and habitat variables).

Threat	**Projected Level of Impact to Natural Resources of the Connected Great Lakes Basin**	**Description of Impact**	**Projections of impacts to Natural Resources of the Connected Great Lakes Basin**
Habitat Degradation	Medium	Roach can have a significant impact on water quality through accentuating the effects of nutrient enrichment (Ferguson 2008).	Habitat degradation, as the result of *R. rutilus* establishment, is projected to be greatest in portions of the Great Lakes where nutrient enrichment is greatest. Those areas include Lake Erie, which is susceptible to nutrient enrichment and hypoxia, and to bays supplied with nutrient-rich waters from tributaries.
Species Extirpation/Extinction	High	High density of *R. rutilus*, coupled with its feeding habits, resulted in competition with other freshwater fish for food. That competitive interaction resulted in *R. rutilus* quickly becoming the most abundant fish species in	In the Great Lakes, *R. rutilus* impacts could include extinction of native salmonids and coregonids that are associated mostly with nearshore and tributary habitats.

		some lakes. *R. rutilus* has been shown to reduce Atlantic salmon and brown trout abundance. The introduction of *R. rutilus* has been linked to the extinction of the Arctic charr in Lough Corrib, and to the severe decline in pollan numbers in Lower Lough Erne (Ferguson 2008).	
Food Web Disruption	High	Roach comprised 70% of fish biomass in a 1991 survey of Lower Lough Erne (Rosell 1994). The species was first reported in the Lough Neagh catchment in 1971, and is now probably the most common species within the Lough (Griffiths 1997).	The invaded lakes in Ireland demonstrate how *R. rutilus*, given enough time, could completely alter the trophic assemblages in portions of the Great Lakes. Food webs in nearshore habitats and bays are projected to be most greatly impacted by *R. rutilus*.
Degradation of Fish Stocks	High	*R. rutilus* has been shown to reduce Atlantic salmon, brown trout, pollan, and Arctic charr abundance. (Ferguson 2008). Also, see information for Species Extirpation/Extinction.	In parts of the Great Lakes where competition for resources will occur between *R. rutilus* and native species, impacts on important fish stocks could be high. Impacts are projected to native salmonids and coregonids (nearshore and tributary stocks).
Competition	High	High density of *R. rutilus* coupled with its feeding habits resulted in competition with other fishes for food. This competition has resulted in *R. rutilus* quickly becoming the most abundant fish species (Ferguson 2008). Also, see Degradation of Fish Stocks.	Significant competition for food with native fishes was described by Ferguson (2008) and Winfield (2007). Similar impacts are projected in portions of the Great Lakes. Competition with coregonids and salmonids is projected

			in nearshore areas and tributaries of the Great Lakes.
Predation (with special emphasis on fishes)	Low	*R. rutilus* preys predominantly on benthic invertebrates and zooplankton. *R. rutilus* may shift from littoral to pelagic habitats, and between benthic food and zooplankton when abundance of a specific food item is high or for avoidance of predation and/or competition (Froese and Pauly 2010).	Significant predation on fishes is not projected in the Great Lakes. It is possible that the species will prey on fish eggs, and either benthic or pelagic larvae.
Reproductive Interference	High	Successful competition will reduce breeding populations of similar trophic species (Ferguson 2008).	Reductions in abundance of native fishes are projected in the Great Lakes. Those reduced populations will be too small to sustain recruitment at levels needed to sustain adult populations at historic levels. Species at risk, of reduced levels of recruitment, include native coregonids and salmonids. Nearshore stocks of those fishes are projected to be at greatest risk of unsustainable recruitment.

Sec. 9 – References

Note: References cited within quoted text but not accessed for this ERSS are included in Section 10 below.

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10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information

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