

# NOBANIS - Invasive Alien Species Fact Sheet

## *Sander lucioperca*

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**Bibliographical reference – how to cite this fact sheet:**

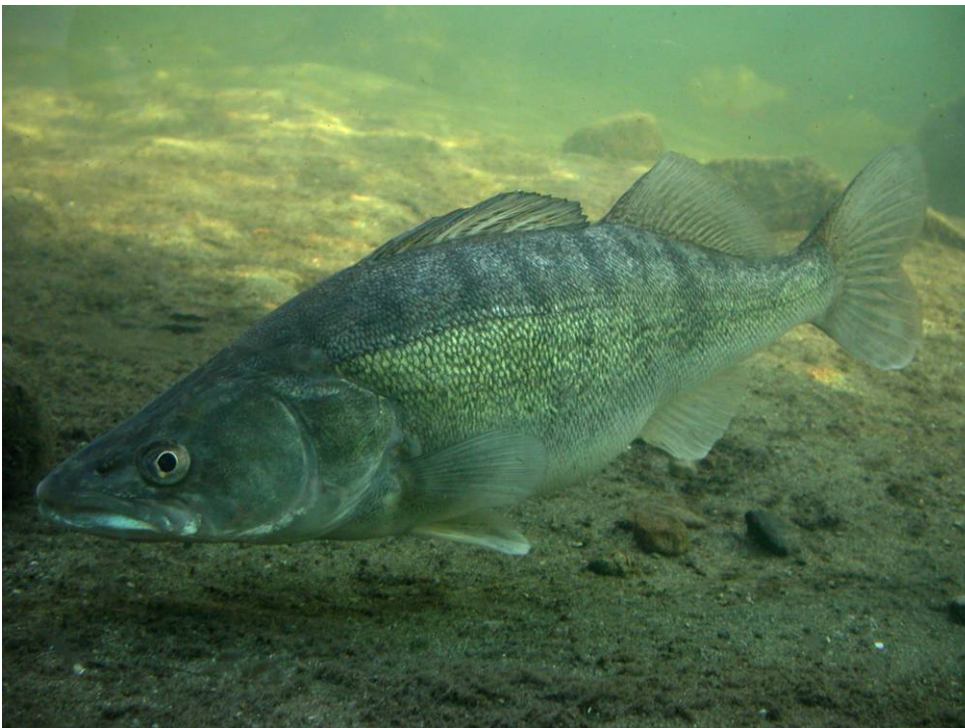
Larsen, L.K. and Berg, S. NOBANIS – Invasive Alien Species Fact Sheet – *Stizostedion lucioperca*. – From: Online Database of the North European and Baltic Network on Invasive Alien Species – NOBANIS [www.nobanis.org](http://www.nobanis.org), Date of access x/x/200x.

### Species description

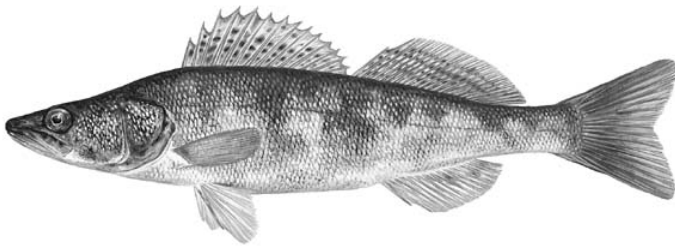
**Scientific name:** *Sander lucioperca* (L.), Percidae

**Synonyms:** *Stizostedion lucioperca* (L.)

**Common names:** Zander, Pikeperch (GB), Sandart (DK), koha (EE), Gjørs (NO), Gös (SE), Kuha (FI), Zander (DE), Starkis (LT), Zandarts (LV), Sudak obyknovennyi (RU), Sandacz (PL).



**Fig 1.** *Sander lucioperca*, photo by Henrik Baktoft.



**Fig 2.** *Sander lucioperca*, drawing from [Facts on Fish](#) (Nordic Council of Ministers).

### **Species identification**

*S. lucioperca* has a long slender body. There are no spines on the gill cover. The mouth has many small teeth and fewer large teeth for catching the prey. The species has two dorsal fins – one with 13 to 20 spines and one with 1-2 spines and 18 to 24 soft rays. The caudal fin has 17 soft rays and the anal fin has 2-3 spines and 10-14 soft rays (see Fig. 2).

*S. lucioperca* obtains a maximum length of 100-130 cm which corresponds to a weight of about 15-20 kg. Maximum age is inversely correlated to growth rate. Slow-growing *S. lucioperca* in the northern part of the distribution area reach 20-24 years of age, while faster-growing *S. lucioperca* in the southern part only reach about 8-9 years (Sonesten 1991).

### **Native range**

*S. lucioperca* occurs naturally in lakes and rivers of Middle and Eastern Europe from Elbe, Vistula, north from Danube up to the Aral Sea and the northernmost observations of native populations were recorded in Finland up to 64° N. *S. lucioperca* naturally inhabits Onega and Ladoga lakes, brackish bays and lagoons of the Baltic sea. The southern populations are known from regions near the Caucasus, inhabiting brackish and saline waters of Caspian, Azov and Black Seas (Bukelskis *et al.*, 1998).

### **Alien distribution**

#### **History of introduction and geographical spread**

*S. lucioperca* has been introduced into several European countries, among others the Netherlands and Turkey (Welcomme 1988), France (Daszkiewich 1999, Keith & Allardi 2001) Italy (Gandolfi *et al.* 1991) and Spain (Elvira 1995). It was first introduced into the UK in 1878 by the Ninth Duke of Bedford (Cacutt 1979). He stocked 23 *S. lucioperca* into two lakes at Bedfordshire from a lake in Schleswig-Holstein in Germany. In 1910 the first reproducing population was established.

The first introduction into Denmark was in 1879 where 20 *S. lucioperca* from Lake Brogdorf in south Schleswig, Germany, were stocked into the Odense River in Funen. The fish did not survive. In 1898, 200 *S. lucioperca* were successfully stocked into Søgård Lake in southern Jutland. Today more than 70 Danish lakes and rivers contain self-reproducing stocks of *S. lucioperca* (Otterstrøm 1912, Dahl 1982). In the other three Nordic countries, Sweden, Norway and Finland, *S. lucioperca* is, even though it is native to these countries, the most commonly introduced non-salmonid fish species in new lakes. This has increased the present range of the originally southernly distributed *S. lucioperca* northwards in these countries. Ca. 2500 lakes > 4 ha have an introduced population of *S. lucioperca* (Rask *et al.* 2000, Tammi *et al.* 2003). In Sweden alone more than 92 lakes and rivers contain *S. lucioperca* populations as a result of stocking (Filipsson 1994).

The only known natural distribution areas of the species in Lithuania is the Curonian Lagoon and the lower River Nemunas (Bukelskis *et al.*, 1998; Virbickas 2000). From there this species was introduced into Lake Dysnai before 1940. Numerous successful introductions into many water bodies followed. Currently large populations of pike-perch inhabit the Curonian Lagoon, Kauno, Antalieptes reservoirs, Sartai, Dysnai, Dviragis Lakes, the River Nemunas, etc. (Bukelskis *et al.*, 1998). In Latvia *S. lucioperca* occur naturally in coastal waters and inner waters connected to the sea, as well as in a few lakes and artificial reservoirs, where populations have established themselves after stocking. *S. lucioperca* has been stocked in at least 94 (12 %) lakes in Latvia, some artificial reservoirs on the Daugava, and the southern part of the Gulf of Riga from 1904 to 1996 (Nature of Latvia).

*S. lucioperca* occurs naturally in eastern Germany, especially in the German River Elbe and its tributaries. In 1881-1882, *S. lucioperca* was first stocked in western Germany, especially in Lake Constance and in the Rhine (Lehmann 1931). In later years *S. lucioperca* has also been introduced into other areas of Germany.

In Estonia *S. lucioperca* naturally populates the Gulf of Riga, the Väinameri and Narva Bay, occasionally it occurs in coastal waters of other regions. In freshwater it occurs in Lakes Võrtsjärv and Peipsi from where it occasionally migrates into the Emajõgi River, smaller lakes and the Narva Reservoir. Since the end of the 19<sup>th</sup> century *S. lucioperca* has been successfully introduced into more than 30 moraine lakes in south-eastern and southern Estonia (Ojaveer *et al.* 2003).

### Pathways of introduction

*S. lucioperca* has been introduced for both commercial and recreational fishing – the fish is very tasty and has high market and angling value. Furthermore, the species has been used for biomanipulation in order to reduce the number of unwanted fish, usually cyprinids (Lappalainen *et al.* 2003).

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Denmark				X			
Estonia				Native			
European part of Russia							X
Finland						Native	
Faroe Islands	X						
Germany				Native			
Greenland	X						
Iceland	X						
Latvia				Native			
Lithuania				Native			
Norway				Native			
Poland					Native		
Sweden				Native			

**Table 1.** The frequency and establishment of *Sander lucioperca*, please refer also to the information provided for this species at [www.nobanis.org/search.asp](http://www.nobanis.org/search.asp). Legend for this table: **Not found** –The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** – No information was available; **Native** – when a species is native in a country this is indicated in the table under the relevant frequency category.

### **Alien status in region**

As described above, *S. lucioperca* is found naturalised as an alien species in a large number of countries in Europe, including the UK, Denmark, Italy, Turkey, Spain, France and Holland. In addition it has been stocked into and established self-reproducing populations in other water bodies in countries, where it is native to one part or region of the country. This has happened in Estonia, Finland, Lithuania, Latvia, Germany, Norway and Sweden (see table 1).

## **Ecology**

### **Habitat description**

*S. lucioperca* is found in lakes, moderately running waters and brackish coastal waters with salinities up to ca. 12 ‰. It thrives in turbid, moderately eutrophic waters with high oxygen content. *S. lucioperca* is also found in clear waters if the depth is sufficient to enable it to seek refuge during daytime (Sonesten 1991).

### **Reproduction and life cycle**

Mature (maturation at age 2-5 years) *S. lucioperca* migrate to the spawning area shortly before spawning. The migrations are generally short 10-30 km, but can be rather long, up to 250 km (Sonesten 1991, Koed 2001, Lappalainen *et al.* 2003).

The spawning takes place in lakes and rivers on a substrate consisting of stone, gravel, sand or clay preferably with plant roots. *S. lucioperca* spawn in pairs in springtime (generally in May) when water temperature reaches about 10-14 °C. For optimal egg development water temperature must be between 12-20 °C, oxygen concentration above 4.5 mg O<sub>2</sub>/l, and salinity less than 3 ‰ (Muus & Dahlstrøm 1984, Sonesten 1991, Lappalainen *et al.* 2003). Populations of *S. lucioperca* living in coastal areas enter adjacent freshwaters for spawning. Sea spawning is, however, observed in the northern part of the Gulf of Riga (Nature of Latvia).

After hatching (about 110 degree-days) the larvae have a length of 4-5 mm. They feed on small zooplankton, but at a length of 10-25 mm the fry initiate piscivory. When *S. lucioperca* reaches 10 cm the diet almost solely comprises fish (Sonesten 1991).

### **Dispersal and spread**

Most *S. lucioperca* introductions have been done in lakes. From the lakes the fish have migrated into larger rivers (*e.g.* River Gudena in Denmark; Koed 2001), and in some cases have, through migration, established themselves in neighbouring lakes to the lakes, where they were first introduced. In Finland, the extinction of many northern native *S. lucioperca* populations in 1960's, has been followed by successful re-introductions in 1980's (Colby & Lehtonen 1994).

In Sweden *S. lucioperca* is still stocked to support fisheries, both within and outside the area of its natural range. 322 permits for stocking *S. lucioperca* were issued in Sweden in the period 1995-2001 (Laikre & Palmé 2005).

## **Impact**

### **Affected habitats and indigenous organisms**

*S. lucioperca* is piscivorous and normally feed on cyprinids, smelt (*Osmerus eperlanus*), ruffe/pope (*Acerina cernua*) etc. In the springtime *S. lucioperca* also predate on smolts of sea-trout (*Salmo*

*trutta*) and salmon (*Salmo salar*) when they migrate to the sea. Studies from River Gudena, Denmark has shown that predation on smolts in the lower part of the river has an adverse effect on the population of sea-trout (Jepsen *et al.* 2000, Koed 2001, Koed *et al.* 2002).

Other adverse effects on natural fish populations, as a result of introduction of *S. lucioperca*, have been described. Schulze *et al.* (2006) found that the perch (*Perca fluviatilis*) population in a shallow, mesotrophic lake with natural occurrence of perch and pike (*Esox lucius*) were negatively affected by *S. lucioperca* introduction. In an experiment they showed that perch was forced away from its preferred habitat, the pelagic zone, by *S. lucioperca*. As the littoral zone was already occupied by pike, the perch population was “sandwiched” between pike and the introduced *S. lucioperca*. As perch has been found to be the most important predator to control the density of zooplanktivorous 0+ cyprinids in Danish lakes, the introduction of *S. lucioperca* must be considered as negative and indeed has been observed to result in reduced environmental conditions compared to the expected in eutrophic Danish lakes (Jarl Jensen, pers. comm.).

Several authors have reported reduced population densities of cyprinids as a result of *S. lucioperca* introduction. Jeppesen *et al.* (2001) found evidence of this in a paleolimnologic study in the Danish Lake Skanderborg, where *S. lucioperca* was introduced in 1903-04. After this a permanent reduction in cyprinid densities was found. Based on theoretical modelling Nilsson (2001) also predicted reduced density of prey fish (roach (*Rutilus rutilus*) in the model) when *S. lucioperca* is introduced to lake ecosystems with pike already present. Cowx (1997) found that introducing *S. lucioperca* to English rivers created a crash in the cyprinid fish community. Brabrand and Faafeng (1993) showed how young roach shifted from pelagic to littoral habitats as a result of *S. lucioperca* introduction in a Norwegian lake. An indirect effect of the changed behaviour of roach was increased infection rate of roach with the ectoparasite *Ichthyophthirius multifiliis*, as roach was more often exposed to the free swimming state of *Ichthyophthirius multifiliis* when living in shallow water near the substrate compared to their previously more pelagic lifestyle (Brabrand *et al.* 1994).

In the Turkish Lake Egredir *S. lucioperca* was introduced in 1955 and from 1961 it became an important species in commercial fisheries in the lake. The introduction also had the result that 5 out of 9 indigenous fish species disappeared, among these three species of *Phoxinellus*, two of which were endemic to Lake Egredir (Crivelli 1995). Consequently these two species must now be considered extinct worldwide.

### **Genetic effects**

In Finland there is a growing concern about the potential loss of genetic diversity of the native *S. lucioperca* populations due to enhancement stocking with foreign *S. lucioperca*.

### **Human health effects**

High concentrations of toxic compounds from algae-preventing (anti-fouling) paints have been reported in some of the Finnish coastal *S. lucioperca* populations.

### **Economic and societal effects (positive/negative)**

*S. lucioperca* is a valuable fish – it has a high market value and is a target species in angling. After its introduction to Danish lakes, it soon became an economically very important species in commercial fisheries. At present the value of commercial inland fisheries in Denmark is very low while the value and social importance of recreational fisheries (both local angling and angling tourism) is increasing (Jacobsen *et al.* 2004). In the Turkish Lake Egredir, the value of commercial fisheries increased several fold after the introduction of *S. lucioperca*, both because all the

indigenous fish species had a very low commercial value compared to *S. lucioperca* and due to a drastic increase in the population of *Astacus leptodactylus*. In 1981 fisheries yield were 310 tonnes of *S. lucioperca* and 1573 tonnes of *A. leptodactylus* (Crivelli 1995). Before 1965 the commercial catch of *A. leptodactylus* was zero. In Latvia, where the species is native, a commercially important coastal fishery takes place. The annual catch is 30 - 80 tons, mostly in the southern part of the Gulf of Riga. The species is also a quite common catch for anglers in some freshwater bodies, mainly in the areas where it is regularly restocked (Nature in Latvia).

Even though studies in Denmark have shown that the predation from *S. lucioperca* can have an adverse effect on populations of anadromous salmonids and lake ecosystems, *S. lucioperca* is still protected by the Danish Fishery Act by both a closed season and minimum size limit, due to its importance to commercial and recreational fisheries.

## Management approaches

### Prevention methods

To prevent *S. lucioperca* from being introduced into lakes and rivers where it is not presently found, and where introduction is not desirable, stocking is not permitted in these waters in Denmark. In rivers and lakes where *S. lucioperca* is already present and has an adverse effect on populations of *e.g.* sea-trout, removing the protection of *S. lucioperca* could be considered, by eliminating the closed season, by removing the minimum size limit or by selective fishing.

In Finland many coastal and freshwater populations of *S. lucioperca* are over-exploited, and the main management concern has been the prevention of over-fishing by different technical measures, *e.g.* closed areas/seasons and gill-net mesh-size limitations (Lappalainen *et al.* 2005, Heikinheimo *et al.* 2006).

### Knowledge and research

*S. lucioperca* is an integrated part of research on the structure and function of lake ecosystems and the effects of anthropogenic induced eutrophication. The adverse effects of *S. lucioperca* on the natural predators of lowland lakes mentioned above is not yet fully understood. The behaviour of *S. lucioperca* and the adverse effects of *S. lucioperca* on anadromous salmonids is an important research area, which has been the subject of several studies.

### Recommendations or comments from experts and local communities

The general picture of the outcome of *S. lucioperca* introductions is two-sided. On the one hand, it is considered a success when evaluated from a commercial fisheries as well as in general from a recreational fisheries point of view (Crivelli 1995, Cowx 1997, Jacobsen *et al.* 2004). But on the other hand, the introduction of *S. lucioperca* has been found to have considerable, and often negative, effects on the fish community of the recipient environment (Brabrand & Faafeng 1993, Jepsen *et al.* 2000, Jeppesen *et al.* 2001, Koed *et al.* 2002 and others) and in some cases should be considered as an ecological disaster (Crivelli 1995, Cowx 1997).

Based on these findings, recommendations for future *S. lucioperca* introductions is this: If one wants to exploit the benefits of increased value of commercial fisheries and increased quality of recreational fisheries, one should be aware of and willing to accept the ecological consequences. These will occur and will most likely be substantial. Indigenous fish species will in most cases be affected negatively and might in some cases be extirpated. *S. lucioperca* populations stocked in rivers or in lakes connected to rivers with anadromous salmonids, can prey on descending smolts to a degree that can prevent the maintenance of self-sustaining populations. In shallow mesotrophic lakes with a native piscivorous species assembly consisting of perch and pike, perch being the

pelagic predator, the perch population can be negatively affected. In both lakes and rivers reduced populations of planktivorous species, especially cyprinids, will often be the result. The behaviour of planktivorous species can be changed. When introduced, *S. lucioperca* is in general able to establish self-reproducing populations. Thus, in most of these cases the process and the changes described above is irreversible.

## References and other resources

### Contact persons

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### Links

[Facts on Fish](#) (Nordic Council of Ministers)  
Fishbase – [Fact sheet](#) on *Sander lucioperca*  
[Danish Institute of Fisheries research](#) (in Danish)

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**Date of creation/modification of this species fact sheet: 21-11-2006**