

Stone loach in Stockholm, Sweden, and royal fish-ponds in the seventeenth and eighteenth centuries

S. LUNDBERG^A and I. SVANBERG^B

^A Swedish Museum of Natural History, P.O. Box 50007, SE-104 05 Stockholm, Sweden.

^B Uppsala Centre for Russian Studies, Uppsala University, PO Box 514, SE-751 20 Uppsala, Sweden.

ABSTRACT: The stone loach (*Barbatula barbatula*) occurs in three main areas in Sweden. In the north, it is found in Lapland in the River Torneälven. In the south, it is found in Skåne. There are also two populations near the cities of Stockholm and Nyköping. New data suggest that these two populations originate from fish that were kept in ponds. In the 1740s King Frederick I is said to have released stone loaches from German sources in Lake Mälaren, but this cannot explain its occurrence in Igelbäcken near Stockholm. There is also reason to believe that it was kept in ponds at the royal castle Ulriksdal in the mid-eighteenth century. The fish was possibly imported from the king's native Germany, to be eaten as a delicacy. However, historical records tell of pond-keeping of stone loach by the Royal court in the Stockholm area during the 1680s.

KEY WORDS: *Barbatula barbatula* – introduced species – food.

INTRODUCTION

In a recently published study of the genetic structure of the stone loach, *Barbatula barbatula* (Linnaeus, 1758), in southern Germany, it is argued that the fish had not been introduced there (Barluenga and Meyer 2005). Without questioning the results of that study, which focused on mitochondrial DNA (mtDNA), that statement is probably based on an erroneous presumption. The stone loach has a wide natural distribution in Eurasia, from the Pyrenees in the west to the Ural and Emba basins in the east, but it does not occur on the Italian and Iberian peninsulas (Ladiges and Vogt 1965; Mikelsaar 1984; Lelek 1987; Saat 2003). Closely related taxa exist in eastern Asia (see Nichols 1925; Tokranov 2006). However, the stone loach was once successfully introduced in Ireland, probably from England in the seventeenth century to stock fish ponds (Wheeler 1977; Elvira 2001). Today, the species is common in many parts of Ireland and has probably also been introduced locally in many other streams and small lakes in Europe, although the documentation is scarce.

In Sweden, the stone loach is believed to be native to the provinces of Skåne and Halland (Ohm 1919; Edman 1978). The northernmost population, in the lower parts of River Torneälven in Lapland close to the Swedish border with Finland, probably results from recent migration to the west by the Finnish populations (Lundberg 1998). There are also isolated populations near the cities of Stockholm and Nyköping (Figure 1). One of these is in Igelbäcken, a small brook in the vicinity of Stockholm (Lundberg and Andersson 2000; Lundberg 2006). The population may be connected with King Frederick I (1676–1751), who is said to have kept stone loaches in ponds during the 1740s (Linnaeus 1746; Bernström 1948). Historical records also indicate that the stone loach was kept in ponds during the seventeenth century in the Stockholm region.

In this article we present these sources together with a discussion about pond-keeping of fishes in general in Sweden, and about the distribution of the stone loach. We also discuss

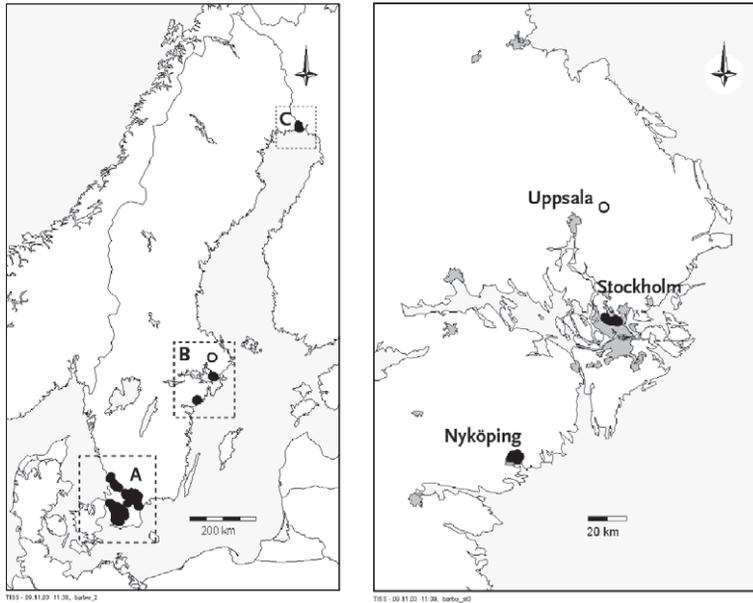


Figure 1. Left: the distribution of stone loach (*Barbatula barbatula*) in Sweden: A: the provinces of Skåne and Halland. B: the lower parts of River Torneälven in Lapland. C: the provinces of Södermanland and Uppland. Both current (filled dots) and historical records (open dot) are included. Right: the localities near Stockholm that are mentioned in the text. (Reproduced by permission of the Swedish node of Global Biodiversity Information Facility).

the possibility that the contemporary population of stone loach in the vicinity of Stockholm originated from intentionally released fish that were once kept in ponds.

KEEPING OF FISH IN PONDS

Although keeping fish in ponds for economic and religious reasons has a long tradition both in Asia and in Europe, we have only a few records from medieval sources for Sweden (Nordqvist 1922; Van Damme *et al.* 2007). There is no reason to doubt that the peasantry has long practised the translocation of fish species. There is also an old custom of keeping pike (*Esox lucius*) and eels (*Anguilla anguilla*) in wells, in order to keep the wells free from frogs and other unwanted animals (Svanberg 2000). Also, other species are known to have been kept in wells. Linnaeus (1751) mentioned, for instance, a peasant boy in Skåne, the southernmost province of Sweden, who released a crucian carp (*Carassius carassius*) in a well, and the fish survived there for many decades. This “young man” was 80 years old at the time of Linnaeus’s visit in 1749, and the fish were still alive in the well.

Keeping fish in ponds for food production in north-western Europe was mainly connected with the religious foundations. Fish ponds were important to ensure a food supply during periods of religious abstinence when “meat” could not be eaten (Rasmussen 1959; Andreška 1984; Bond 1988; Balon 1995). A pond for crucian carp is mentioned at Vadstena Abbey in 1470. Petrus Magni (1465–1534), the last Catholic bishop in the city of Västerås before the Reformation in the mid-sixteenth century, described pond-breeding of tench (*Tinca tinca*) and crucian carp in his book *Bondakonst*, written around 1510 (Månsson 1983).

We have evidence for the production of crucian carp in ponds from the fifteenth century (Bernström 1969), while pond-breeding of common carp (*Cyprinus carpio*) seems to be a practice that was imported from Germany in the early sixteenth century (Bernström 1963; see Hoffmann 1995). Also, tench were pond-bred in Sweden in early modern times (Bernström 1972).

Pond-breeding of fish continued after the Reformation in Sweden, and spread to castles and larger estates. During the seventeenth and early eighteenth century, fish ponds occurred at many vicarages in the southern and central parts of Sweden. The fish ponds were of great importance because of the strict rules of fasting that were applied during the seventeenth-century Lutheran orthodoxy (Bælter 1783). These ponds were important in spreading some fish species outside their natural area of occurrence in Swedish waters (Svanberg 2006; see Wheeler 2000). Crucian carp, tench and, in the southernmost part of Sweden, also common carp were the species commonly kept in ponds for food. In *Skånska resa*, Linnaeus (1751) described the estate of Marsvinsholm in Skåne where there were 99 ponds, including one on a roof, containing common carp and crucian carp.

STONE LOACH AS HUMAN FOOD

The stone loach occurs in both lotic and lentic freshwater. Although it prefers well-oxygenated rivers and streams, it can also be found in lakes and smaller ponds (Kotegov 2005). Usually it hides under stones during the day and is only active at night. It can grow to about 15 centimetres in length and attain a weight of around 200 grams, but its relatively small size militates against stone loach as a popular food fish. In Britain and Ireland it had no direct economic importance (Wheeler 1969).

While it is true that nowadays the stone loach is not economically important in Europe, the situation was different more than a century ago. In the eighteenth century in many parts of central Europe, the stone loach was common in streams and brooks, and it was easily caught with nets (Bloch 1783). Records from Hesse, Germany, where stone loaches were sold in markets according to weight (Landau 1865), show the fish's importance as early as the fifteenth century.

Conrad Gessner (1516–1565), the Swiss naturalist, praised its meat, which he regarded as good to eat and healthful since it was digestible. It was therefore useful for sick people. The flesh is best between Christmas and Easter, although it can be used throughout the year (Gessner 1598). In Britain during the seventeenth century the stone loach seems to have been appreciated as food, at least according to Isaac Walton (1653). Walton, who probably used Gessner as his source, also recommended it for persons who were ill as being tasty and nutritious. In a manuscript dated 1666 (see Baldner 1974), the fisherman Leonhardt Baldner, from Strasbourg, mentioned the stone loach as an expensive but healthy food. Many old handbooks give a positive opinion of its meat without being specific, and we must bear in mind that many authors simply repeated information given in earlier sources.

The German ichthyologist Marcus Elieser Bloch (1723–1799) gave detailed information about how it should be cooked in order to taste good and described several ways to prepare it. It could be boiled in salt water with vinegar, served in a butter sauce, or put in a marinade (Bloch 1783).

Although never in such great detail as Bloch, several nineteenth-century authors acclaimed its meat. For example, according to Siebold (1863) the flesh of the stone loach

was appreciated everywhere and was therefore common in markets. This is confirmed by a German encyclopaedia that claimed the meat was delicious if the fish was cooked immediately it was killed (Anonymous 1888). According to Benecke (1881) stone loach was tasty, but it was not eaten at all in Prussia. In a Swedish commercial dictionary, translated from a German original (Åstrand 1855), it was reported that canned stone loach was sold by “delikatesshandel”, stores selling the more exclusive imported groceries such as cheeses and tinned fruits. If this “appetizing” (Åstrand 1855) delicacy ever reached Sweden its origin was most certainly German. The reputation of stone loach as a healthy food certainly influenced demand in the seventeenth and eighteenth centuries.

Nowadays the stone loach is rarely caught for human consumption. The British horticulturist Stefan Buczacki (2005) wrote that while the stone loach is said to be good to eat, he was not impressed after trying it. The only economic use mentioned in contemporary handbooks is its role as prey for larger fishes like trout (Ladiges and Vogt 1965). It is also regarded as excellent bait (Muus 1998).

STONE LOACH IN STOCKHOLM

The stone loach populations in Skåne and southern Halland were first discovered in 1864 (Smitt 1895). However, according to Linnaeus (1763), this fish had been introduced by King Frederick I (ruler from 1720 to 1751) to Lake Mälaren, although no specimen has ever been caught there.

In the collections of the Swedish Museum of Natural History there is a single specimen of the stone loach from Lejstaån, a small brook, at Älvgärde, to the east of Uppsala in the province of Uppland.¹ Lejstaån is connected to Lake Mälaren. According to the label, this specimen was obtained there in the 1930s by a member of the Kolthoff family, who were Swedish naturalists. The reason for its presence in Lejstaån is still obscure because the stone loach has not been found there since that time, nor in any other streams or lakes around Uppsala.

The stone loach was first recorded closer to Stockholm in Igelbäcken in 1896 (Rendahl 1952), and it is still common in this small stream (Figure 2). A monitoring programme using test fishing has been performed yearly since 1999. Due to habitat loss caused by urban sprawl, the abundance and distribution of stone loach in Igelbäcken declined in the 1990s but recent restoration work, combined with measures to increase the water flow during dry periods, have led to colonization of upstream habitats, which had earlier been destroyed (Lundberg 2006).

POND-KEEPING OF STONE LOACH IN EUROPE

Although the stone loach prefers mainly the clear water of small streams, this fish will breed in ponds. Records of pond-bred stone loach exist from various areas of central Europe from the seventeenth to the nineteenth centuries. However, details are few. According to Benecke (1881) it was bred in ponds with rapid flow, or in ditches.

The late eighteenth-century author and ichthyologist Marcus Elieser Bloch (1783) gave detailed information about how it was kept in ponds:

For making the stone loach pond, one chooses either such places in a brook that have stones at the bottom, or such places that receive their water from a fresh source. These ponds must be half a man deep, six to eight feet



Figure 2. Igelbäcken in the urbanized cultural landscape of the Swedish capital Stockholm (photograph by Stefan Lundberg).

long and half as wide. They are lined with a wooden framework which has either holes or spaces, or with a basket, anyhow so that between this framework and the walls a space of half a foot is left, which is filled with sheep manure and trodden hard. The water is then led into the pond and the opening is lined with a tin sheet with holes, so that not only the entrance of foreign elements is hindered, but also freshwater fish-lice are kept away. Underneath at the same height an exit for superfluous water is created, which opening is lined with the same tin. The bottom must be filled with gravel to a depth of three to four inches high, and a big stone so that the fish has an opportunity to spawn. The introduced stone loaches which suck at the sheep manure, receive in this way, through feeding on the worms therein, a rich nutrition: however, they can also be fed with flax cakes and poppy seeds. Because the fish multiply quickly, and the numerous broods consume so much, there will not be enough food in the pond and the young will be hindered in their development and growth. Thus, it is better, as with carp, to keep several ponds running at the same time, one for spawning, one for the broods, and the third for those fish that are intended for the kitchen.

There are also records from Denmark of stone loach as pond-fish. In accounts for the Skanderborg district around 1649–1650, stone-loach ponds were mentioned at the royal castle at Hillerrød. A new royal fish-master was employed in Sønderjylland in 1655, and among other responsibilities took care of hundreds of stone loaches in ponds on the royal estate (Hofmeister 2004).

EVIDENCE OF POND-KEPT STONE LOACH IN STOCKHOLM

Although the wild populations of stone loach in Sweden were not discovered until the 1860s, it was already, thanks to German sources, a well-known species by the early seventeenth century. Its old Swedish name “smerling”, used in the historical sources, shows its German background. In German-speaking areas the fish is known as “Schmerle”, a word that is probably of Slavic origin (Blažek *et al.* 2004; Petz-Glechner 2006). For instance, Olaus Magnus Asteropherus (1579–1647), vicar in Västerfärnebo parish, wrote in a play in 1609 about “Carpar, lax, ål och smirlingh”, that is, carps, salmon, eel and stone loach

(Asteropherus 1909). The context indicates that the stone loach was regarded as fine food. Professor Sigfrid Aron Forsius (1550–1624), who wrote the first natural history in Swedish around 1611, mentioned “smerling” among edible fishes (Forsius 1952). It was also praised among good fish species by the Baroque author and bishop Haquin Spegel (1645–1714) in the influential book *Guds Werk och Hwila* (Spegel 1685).

The first record of pond-breeding is in a Swedish medical handbook published in 1642, Andreas Palmchron (1609–1658) wrote that the smärplingh “is not commonly found, but are kept by a few in ponds as a rarity” (Palmchron 1642). Palmchron was a royal physician to Queen Christine, who got his medical education in Uppsala and Leiden. After Queen Christine’s abdication in 1652 he continued as a physician to King Charles X. There is no proof that Palmchron ever saw or heard about stone-loach ponds in Sweden. The information was most probably taken from a foreign source.

The first reliable report for stone-loach ponds in Sweden is found some four decades later.² An important source for our knowledge about specific details in the cultural history of seventeenth-century Stockholm is the lists of food and drink at the royal court. These lists give detailed information about every item purchased or administered by the royal household. Fodder for animals and birds kept at the court was also listed in these minutes. For instance, Charles XI kept a sable (*Martes zibellina*), which was fed with birds, especially Bohemian waxwings (*Bombycilla borealis*) bought from dealers at the market in Stockholm (Berg 1937). The buyers also had to find “turnips and cabbage” for guinea pigs (*Cavia porcellus*) kept by the young Prince Charles in 1666 (Svanberg 2007). The lists of food and drink from the royal court are therefore often used in ethnobiological and historical research.

Among the animals mentioned in these records from the seventeenth century is the smerling. The first notes dates from 1681, when there is an annotation that the court had bought thread to make “Smärpling noten”, gill nets specially for catching stone loach.² The gill net was mentioned again the next year, where someone wrote that the net that was made the previous year was not long enough.³ Therefore Rendahl’s (1952) information that stone loach in Sweden was first mentioned by Linnaeus is not correct, provided that “smärpling” in these minutes really refers to *Barbatula barbatula* (see Linnaeus 1764; Lannér 1784).

The records from the early 1680s thus give us evidence for pond-keeping of stone loaches at Kungliga Djurgården, the royal game park, in Stockholm.⁴ They were first kept in a separate pond but later removed to another pond with carp. This is confirmed by an annotation from 1683, which indicates that three men were paid for two days work capturing stone loaches in their pond and carrying them to the carp pond.⁵ In the records from 1684 there is an annotation saying “when the ice was broken up, all the . . . carps had risen to the surface, while the stone loaches . . . to a large extent were unharmed.”⁶ The author of the notes also mentioned that all the dead carp had to be removed in order not to poison the water. The stone loaches and carp were obviously kept in the same pond.

Kungliga Djurgården is a large area in the vicinity of Stockholm, which has been under royal control since the fifteenth century. It was not fully integrated into Stockholm until 1868. We do not know where the ponds mentioned in the sources of 1682–1684 were located but on a map of Djurgården from 1696 at least three ponds from the period, probably for stocking of fish, can be identified (Figure 3).

Some authors connect the presence of stone loach in Igelbäcken with King Frederick I’s interest in introducing new fish species. It is well known that the king had an interest in breeding fish in ponds. King Frederick came to Sweden from Hesse in Germany and he kept



Figure 3. Map (left) (original scale 1 : 8000) dated 1696 showing Kungliga Djurgården of Stockholm. There were at least three established ponds for stocking of fish at this period. Extract from the main map (right) shows one square pond ("Dam"). Reproduced by permission from the Swedish royal court.

his ties with his native province during his lifetime. For instance, he became Landgrave of Hesse in 1730, ten years after becoming King of Sweden. Most probably he was familiar with the pond-keeping of stone loach and other fishes. According to Linnaeus (1754, 1763), Frederick kept weather loach (*Misgurnus fossilis*) in ponds at Ulriksdal castle (Fernholm and Wheeler 1983). Linnaeus also mentioned that the king tried to introduce the stone loach into Lake Mälaren (Linnaeus 1754, 1763; Bloch 1783). He released sturgeons (*Acipenser ruthenus*) at Hammarbysjön and Edsviken on the Baltic coast in the 1730s in order to establish the species there (Linnaeus 1746; Lönnberg 1913; Bernström 1947). A specimen of the weather loach is in the collection of Adolf Fredric at the Swedish Museum of Natural History, Stockholm. Also three specimens of the stone loach have been preserved, although no provenances are available (Figure 4) (Fernholm and Wheeler 1983; Åhlander *et al.* 1997).⁷

The other recently discovered eastern locality for the stone loach is in the lower reaches of the River Svärtaån and its brooks Tunsätterbäcken and Kattgaljebäcken, which are close to the manor estate Sjösa gård in Svärta parish at Nyköping in the province of Södermanland. The estate originated in the fourteenth century. The stone loach was first recorded from the two brooks in 1943 (Rendahl 1952) but the species was found during 2006 in both the main river and a third inflowing brook further upstream.

CONCLUSION

Widening the distribution of the stone loach through introduction is known from several regions, a good example being to Ireland during the seventeenth century. This fish can also survive in small ponds formed along water courses (Kotegov 2005). The scattered distribution of the stone loach in Sweden today, especially in the vicinity of Stockholm, is difficult to explain without taking into account the possibility of intentional release, or of



Figure 4. The three stone loaches (*Barbatula barbatula*) from King Adolf Fredrik's collection at Ulriksdal, now in the Swedish Museum of Natural History. The oldest label was written by J. W. Dalman between 1818 and 1828 (photograph by Staffan Waerndt). Scale divisions represent 10 mm.

escape from ponds. Historical records indicate that stone loach were kept in ponds in the Stockholm area during the 1680s, and suggestions that the fish was also kept at the royal castle of Ulriksdal in the mid-eighteenth century may explain the isolated occurrence of stone loach in this part of Sweden. Maps of the gardens of the royal castle Ulriksdal during the mid-eighteenth century show at least one pond connected to the Igelbäcken stream; this maintained a current of water running through the pond according to Statens Fastighetsverk (1994). Not far from another stone loach population in the province of Södermanland is Nyköping Castle. King Charles IX (1550–1611), who as “Duke of Södermanland” used this castle, also kept fish in at least three ponds that were probably established by Franciscan monks (Norén 2004). The fish ponds were even maintained during the rebuilding of the castle in the Renaissance fashion of the times. There is a probable connection between the castle of Nyköping, the estate Sjösa gård and recently reported occurrences of stone loach in the lower reaches of the River Svärtaån and its tributaries.

The impact of human activities on the occurrence of the stone loach in Skåne needs further investigation. It may be connected with, for example, the castle of Trolleholm, close to the River Saxån in which the stone loach is abundant and has been known since the late nineteenth century.

Historical analysis of Kungliga Djurgården points to conjunction of humans and landscape resulting in the high level of biological diversity found in the park today (see Kinzelbach 1999), and the stone loach has become a symbol for a specific area of the city of Stockholm as well as for nature and green urban parks. In the suburb of Kista, a coffee shop and a day-care centre are named after the fish. The increased public awareness of the stone loach has also stimulated the formation of several nature reserves in the suburb (Lundberg 2006).

ACKNOWLEDGEMENTS

Thanks to Marianne Svensson, member of the Scholarly council at the Dictionary of the Swedish Academy in Lund, who provided us with excerpts of the lists from the royal court. We are also grateful to Anders Bignert (Swedish Museum of Natural History) for the distribution-map of the stone loach in Sweden; to Henrik Niklasson

(Administration of Kunliga Djurgården (KDF)) for information about seventeenth-century maps; to Mikael Svensson (Swedish Species Information Centre, Uppsala), for information on the keeping of stone loach in ponds in Denmark; to Staffan Waerndt (Swedish Museum of Natural History) for photographs; and to Jonathan Ready and Anders Silfvergrip (Swedish Museum of Natural History) for assistance with the text. We also wish to thank the associate editors, Dr Christopher Lavers and Dr Juliet Clutton-Brock, and an anonymous referee for their constructive criticism.

NOTES

¹ Natural History Museum, Stockholm, catalogue number: NRM 14353 (collected by Kjell Kolthoff, 4 July 1934). The stone loach was found in a collection donated by the Zoological Institution (Stockholm) in 1987. Lot including one *Barbatula barbatula*, and three *Cobitis taenia* (one with head missing), in comparable state of preservation; labelled “Cobitis”. It is, of course, possible that the stone loach came from elsewhere.

² Royal Court Archive (Slottsarkivet, RCA), Stockholm: accounts from the Royal kitchen. Hovförtärboken för år 1681 A, p. 1388.

³ RCA: Hovförtärboken för år 1682, p. 1884.

⁴ RCA: Hovförtärboken för år 1683, p. 189.

⁵ RCA: Hovförtärboken för år 1683, p. 1326.

⁶ RCA: Hovförtärboken för år 1684, p. 1536.

⁷ The weather loach has catalogue number NRM 69. It comes from King Adolf Fredrik’s collection at Ulriksdal with printed label from 1765 or before. Written in ink on Ulriksdal label “1351 Svec. sata ad Ulricsdal [Sweden, introduced at Ulricsdall]”. The three stone loaches have catalogue number NRM 68 with the oldest label written by J. W. Dalman during the period 1818–1828.

REFERENCES

- ÅHLANDER, E., KULLANDER, S. O. and FERNHOLM, B., 1997 Ichthyological collection building at the Swedish Museum of Natural History, Stockholm, pp 13–25 in PIETSCH, T. W. and ANDERSON, W. D. Jr (editors), *Collection building in ichthyology and herpetology*. American Society of Ichthyologists and Herpetologists, special publication number 3.
- ANDREŠKA, J., 1984 Development of fish-pond culture in Bohemia, pp 77–90 in GUNDA, B. (editor), *The fishing culture of the world*. Volume 1. Budapest.
- ANONYMOUS, 1888 Schmerle. *Meyers Konversationslexikon* 14: 533. Leipzig & Vienna.
- ASTEROPHERUS, M. O., 1909 *En lustig comedia vid namn Tisbe*. Stockholm.
- ÅSTRAND, J. J., 1855 *Universal-lexikon för köpmän, fabrikanter, konsulter och alla, som stå i närmare beröring med handeln, omfattande handelsgeografi och statistik*. Stockholm.
- BALDNER, I., 1974 *Vogel-, Fisch- und Thierbuch: Handschrift Ms. 2^o phys. et hist. nat. 3 der Murhardschen Bibliothek der Stadt Kassel und Landesbibliothek*. Volume 2. Das Fischbuch. Stuttgart.
- BALON, E. K., 1995 Origin and domestication of the wild carp, *Cyprinus carpio*: from Roman gourmets to the swimming flowers. *Aquaculture* 129: 3–48.
- BARLUENGA, M. and MEYER, A., 2005 Old fish in a young lake. Stone loach (Pisces: *Barbatula barbatula*) populations in Lake Constance are genetically isolated by distance. *Molecular ecology* 14: 1229–1239.
- BÆLTER, S., 1783 *Historiska Anmärkningar om Kyrko-Ceremonierna*. Stockholm.
- BENECKE, B., 1881 *Fische, Fischerei und Fischzucht in Ost- und Westpreussen*. Königsberg.
- BERG, G., 1937 Lejon, kameler, apor och andra exotiska djur i det gamla Stockholm, pp 313–336 in *Svenska kulturbilder, Ny Följd*. Volume 5. Stockholm.
- BERNSTRÖM, J., 1947 Om försöken på 1730-talet att i Sverige inplantera sterlett, *Accipenser ruthenus* Linné. *Fauna och flora* 42: 147–148.
- BERNSTRÖM, J., 1948 Bidrag till kännedomen om några svenska fiskar i äldre tid. *Fauna och flora* 43: 35–46.

- BERNSTRÖM, J., 1963. Karp, pp 307–308 in *Kulturhistoriskt lexikon för nordisk medeltid*. Volume 8. Malmö.
- BERNSTRÖM, J., 1969 Ruda, pp 440–442 in *Kulturhistoriskt lexikon för nordisk medeltid*. Volume 14. Malmö.
- BERNSTRÖM, J., 1972 Sutare, pp 444–445 in *Kulturhistoriskt lexikon för nordisk medeltid*. Volume 17. Malmö.
- BLAŽEK, V., ČELADÍN, J. and BĚTÁKOVÁ, M., 2004 Old Preussian fish-names. *Baltistica* 34: 107–125.
- BLOCH, M. E., 1783 *Oeconomische Naturgeschichte der Fische Deutschlands*. Volume 1. Berlin.
- BOND, C. J., 1988 Monastic fisheries, pp 69–112 in ASTON, M. (editor), *Medieval fish, fisheries and fishponds in England*. Volume 1. London.
- BUCZACKI, S., 2005 *Fauna britannica*. London.
- EDMAN, G., 1978 Ny halländsk fyndlokal för grönlång. *Fauna och flora* 73: 193–196.
- ELVIRA, B., 2001 *Identification of non-native freshwater fishes established in Europe and assessment of their potential threats to the biological diversity*. Strasburg.
- FERNHOLM, B. and WHEELER, A., 1983 Linnaean fish specimens in the Swedish Museum of Natural History, Stockholm. *Zoological journal of the Linnean Society* 78: 199–286.
- FORSIUS, S. A., 1952 *Physica (Cod. Holm D. 76)*. Uppsala.
- GESSNER, C., 1598 *Fischbuch. Das ist Außführliche beschreibung vnd lebendige Conterfactur aller vnnd jeden Fischen von dem kleinsten Fischlein an biß auff den grösten Wallfisch*. Frankfurt am Main.
- HOFFMANN, R. C., 1995 Environmental change and the culture of common carp in medieval Europe. *Guelph ichthyology review* 3: 57–85.
- HOFMEISTER, E., 2004 Fiskeproduktion ved de ferske vande – fra karper til regnbuger, pp 75–86 in HOFMEISTER, E. (editor), *De ferske vandes kulturhistorie i Danmark*. Silkeborg.
- KINZELBACH, R., 1999 Was ist Kulturzoologie? Paradigmen und Koevolution von Mensch und Tier. *Beiträge zur Archäozoologie und Prähistorischen Anthropologie* 2: 11–20.
- KOTEGOV, B. G., 2005 Fish communities of small ponds in the Udmurt Republic: structural features and trends in anthropogenic successions. *Russian journal of ecology* 36: 408–413.
- LADIGES, W. and VOGT, D., 1965 *Die Süßwasserfische Europas bis zum Ural und Kaspischen Meer*. Hamburg.
- LANDAU, G., 1865 *Die Geschichte der Fischerei in beiden Hessen*. Kassel.
- LANNÉR, I., 1784 *Handlingar för et utkast, til svenska fiskeriernes historia*. Stockholm.
- LELEK, A., 1987 *Threatened fishes of Europe. The freshwater fishes of Europe*. Kassel.
- LINNAEUS, C., 1746 *Fauna svecica*. Stockholm.
- LINNAEUS, C., 1751 *Skånska resa*. Stockholm.
- LINNAEUS, C., 1754 *Hans Maj:ts Adolf Frideriks vår allernådigste konungs naturalie samling innehållande sällsynte och främmande djur, som bevaras på kongl. lust-slottet Ulriksdahl beskrefne och afritade samt på nådig befallning utgifne af Carl Linnaeus*. Stockholm.
- LINNAEUS, C., 1763 *Fauna svecica*. Stockholm.
- LINNAEUS, C., 1764 *Museum S:ae R:ae M:tis Adolphi Friderici Regis Svecorum, Gothorum, Vandalorumque &c. &c. &c. in quo Animalia rariora imprimis & exotica: Aves, Amphibia, Piscis describuntur. Tomi secundi Prodrromus*. Stockholm.
- LÖNNBERG, E., 1913 *Linnés föreläsningar öfver djurriket*. Uppsala.
- LUNDBERG, S., 1988 Grönlingens livsmiljö. *Fauna och flora* 83: 260–263.
- LUNDBERG, S., 1998 Åtgärdsprogram för bevarande av grönlång (*Barbatula barbatula*). Göteborg.
- LUNDBERG, S., 2006 Skygg fisk med gamla anor. *Fauna och flora* 101: 16–27.
- LUNDBERG, S. and ANDERSSON, H. C., 2000 *Grönlingen i Igelbäcken: en fiskeribiologisk inventering*. Stockholm.
- MÅNSSON, P., 1983 *Bondakonst jämte parallelltexter*. Uppsala.
- MIKELSAAR, N., 1984 *Eesti NSV kalad: käsiraamat-määraja*. Tallinn.
- MUUS, B. J., 1998 *Ferskvandsfisk*. Copenhagen.
- NICHOLS, J. T., 1925 *Nemacheilus and related loaches in China*. *American Museum novitates* 171: 1–7.

- NORDQVIST, H., 1922 Karp- och sutarodlingar i dammar, pp 587–659 in *Sörvattensfiske och fiskodling*. Stockholm.
- NORÉN, H., 2004 *Nyköpings historia*. Volume 1. *Mer än bara gästabud*. Strängnäs.
- OHM, O., 1919 Grönlingen, *Cobitis (Nemachilus) barbatula* Lin. *Fauna och flora* 14: 22–30.
- PALMCHRON, A. N., 1642 *Sundhetzens speghel*. Stockholm.
- PETZ-GLECHNER, R., 2006 Die Namen unserer Fische: eine etymologische Spurensuche 16. Schmerle. *Österreichs Fischerei* 59: 100–101.
- RASMUSSEN, H., 1959 Fiskedamme o. fiskeopræt, pp 307–309 in *Kulturhistoriskt lexikon för nordisk medeltid*. Volume 4. Malmö.
- RENDAHL, H., 1952 Studien über die Nominatform des *Nemacheilus barbatula* (Lin.). *Arkiv för zoologi* 2: 527–573.
- SAAT, T., 2003 Stone loach, *Barbatula barbatula* (L.), pp 247–251 in OJAVEER, E., PIHU, E. and SAAT, T. (editors.), *Fishes of Estonia*. Tallinn.
- SIEBOLD, C. T. E. von, 1863 *Die Süßwasserfische von Mitteleuropa*. Leipzig.
- SMITT, F. A., 1895 *Skandinaviens fiskar*. Volume 2. Stockholm.
- SPEGEL, H., 1685 *Guds Werck och Hwila*. Stockholm.
- STATENS FASTIGHETSVERK, 1994 *Trädgårdarna på Ulriksdal under 350 år – Historisk sammanställning*. Stockholm.
- SVANBERG, I., 2000 *Havsråttor, kuttluckor och rabboxar: folklig kunskap om fiskar i Norden*. Stockholm.
- SVANBERG, I., 2006 Odlarmöda och trädgårdsnöje, pp 285–318 in CHRISTENSSON, J. (editor), *Signum svenska kulturhistoria: frihetstiden*. Lund.
- SVANBERG, I., 2007 Efterskrift, pp 20–22 in LINNAEUS, C., *Om marsvin (De mure indico) 1754* (Translated from Latin by J. Strand). Uppsala.
- TOKRANOV, A. M., 2006 Distribution and some features of the biology of the bearded stone loach *Barbatula toni* (Balitoridae) in the Kamchatka River basin. *Journal of ichthyology* 46: 722–727.
- VAN DAMME, D., BOGUTSKAYA, N., HOFFMANN, R. C. and SMITH, C., 2007 The introduction of the European bitterling (*Rhodeus amarus*) to west and central Europe. *Fish and fisheries* 8: 79–106.
- WALTON, I., 1653 *The compleat angler, or the contemplative man's recreation*. London.
- WHEELER, A., 1969 *The fishes of the British Isles and north west Europe*. London.
- WHEELER, A., 1977 The origin and distribution of the freshwater fishes of the British Isles. *Journal of biogeography* 4: 1–24.
- WHEELER, A., 2000 Status of the crucian carp, *Carassius carassius* (L.), in the UK. *Fisheries management and ecology* 7: 315–322.

Received 21 January 2009. Accepted 15 August 2009.