ANNEXES REPORT

First Action Plan for the European Sturgeon (*Acipenser sturio*) for the Lower Rhine

Paving the way towards a reintroduction and restoration of the European Sturgeon

2020 - 2030

June 2020

Produced within the framework of the Rhine Sturgeon Project to implement the 'European Action Plan for the Conservation and Restoration of the European Sturgeon' adopted under the Bern Convention on 27 November 2007 (Rosenthal et al., 2009) and the 'Pan-European Action Plan for Sturgeons' adopted under the Bern Convention on November 30, 2018.

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Authors: Steven Visser (Water Resources Management expert), Wilco de Bruijne (consultant for aquatic ecology), Bram Houben (ARK Nature, The Netherlands), Bas Roels (WWF The Netherlands) and Niels Brevé (Dutch Angling Association, The Netherlands);

Geographical Scope: The Lower Rhine (the river branches of the River Rhine in The Netherlands and the River Rhine in North Rhine Westphalia in Germany) and the Dutch part of the North Sea.

Date of adoption: *June 2020*

Intended lifespan of plan: *2020 – 2030*

Table of Content

1. ANNEX A: Biological Assessment of the European/Common sturgeon (*Acipenser sturio*)

Pan-European Action Plan for Sturgeons[1]', prepared by the World Sturgeon Conservation Society and WWF, adopted on November 30, 2018 at the 38th Standing Committee Meeting of the Bern Convention.

European Atlantic sturgeon / Common sturgeon (*Acipenser sturio*, Linnaeus 1758)

Species description:

- Size: max. length: 6 m; max weight: 850 kg; average length: 1,5 – 3 m
- Age: max. >60 years; Maturation: ♀ 13 - 16 years, ♂ 10 - 12 years
- Range: White, North, Baltic, Black Seas, Atlantic Coast, Mediterranean Sea and its rivers
- Migration pattern: anadromous, hiemal and vernal forms

Past distribution in Europe:

- The North Sea with tributaries Eider, Elbe, Weser, Ems, Rhine, Maas, Scheldt, Thames, Trent, Severn, Seine; the Atlantic Coast with tributaries Loire, Gironde-Garonne-Dordogne, Adour, Douro, Guadiana, Guadalquivir; the Mediterranean Sea with its tributaries Ebro, Rhone, Saone, Tiber; the Adriatic Sea with tributaries Po, Adige, Isonzo, Nereteva, Drin, Buna, Pinios; the Aegan Sea with tributaries Struma, Meric, Ewros, Black Sea with tributaries Danube, Rioni, Ingouri, Kizilirmak, Sakarya.

Present Distribution & Status in Europe:

- The species is extirpated from all its range except the Gironde-Dordogne-Garonne Basin, with its marine distribution area extending from the Bay of Biscay to the North Sea. No detailed population estimates are available, but the stock is considered to consist of <800 wild mature individuals. No natural reproduction has been observed since 1994, when the last spawning took place in the Gironde watershed. Supportive stocking exists since 1995, the reintroduction efforts use fish from Gironde Basin in Elbe. A reintroduction program for the lower Rhine is under preparation.

- The last record from the Rioni River was in Georgia in 1991. Subsequent sampling campaigns in recent years have failed to prove its continuous existence.

[1] Download: https://rm.coe.int/pan-european-action-plan-for-sturgeons/16808e84f3. Editors / authors: Thomas Friedrich, University of Natural Resources and Life Sciences (WSCS); Jörn Gessner, Leibniz-Institute of Freshwater Ecology and Inland Fisheries (WSCS); Ralf Reinartz, Consultant for fisheries and aquatic ecology (WSCS); Beate Striebel-Greiter, WWF International, Danube-Carpathian Programme Office.

Figure 1 - Past and present distribution map of Acipenser sturio (Pan-European Action Plan for Sturgeons, 2018).

Management:

- A Management Plan is adopted under the Bern Convention and on a national scale in France. Coordinated restoration actions are in place only on a regional scale and medium term.

- Centralized *ex situ* stocks in France and Germany are available. A breeding plan is available, however, only partially useful due to the extremely low number of brood stock and infrequent maturation of breeders. Fishing is banned throughout its range. Bycatch in commercial fisheries (benthic trawling) hampers reintroduction efforts.

- There is an urgent need to secure long-term coordinated efforts and reduction of bycatch.

2. ANNEX B: Risk Assessment European Sturgeon for the Lower Rhine

In 2018, the European Sturgeon Platform conducted a risk assessment[2], based on all available data, feasibility studies, (inter)national literature and results of the two experimental releases. In the assessment the opportunities, potentials and obstacles were summarized, and preliminary actions and key actors were identified. For all anthropogenic factors the potential threats, adverse impacts and potential measures were discussed and further analysed by conducting a SWOT analysis with all relevant key stakeholders, multiple interviews, workshops and expert meetings. In this chapter, the outcome of the risk assessment is summarized. The results of the SWOT analysis are summarized in Annex C.

This chapter covers the following topics:

1. An introduction to the European sturgeon. It discusses the ecology, the decline of the species, ongoing recovery programs and the background and objective of the preliminary study for a Rhine action plan.
2. A description is given of the important factors that can influence the quality of the habitat and the chances of survival for the European sturgeon in the Rhine and the adjacent coastal areas.
3. An overview of current policies, laws, guidelines and conventions that deal with the protection of the species and its habitat.
4. An estimate is made of possible obstacles for the European sturgeon in the Rhine, after which an overview is given of the necessary actions, actors and stakeholders for the recovery of a Rhine population.

2.1 The European sturgeon

2.1.1 Profile of the European sturgeon

Sturgeons (Acipenseridae) are among one of the oldest fish families still living on Earth. Fossil finds date back to the early Triassic period, around 220 million years ago. The European sturgeon (Acipenser sturio) has an anadromous way of life, that its adult life is largely spent at sea and reproduction takes place in the fresh water of rivers. The young animals spend their first years of life in the river system and then mature further in the sea.
European sturgeons can grow very old and long; females can live up to 70 years and reach a length of more than 3 meters. The animals become sexually mature at a relatively late age, the males at the age of about 8 to 10 years and the females between 12 and 16 years. The males usually participate in reproduction once every 2 years, while the female only swims upstream once every 3 or 4 years to spawn. The females lay 500,000 to 2,500,000 eggs, depending on their length and weight.

Life cycle phases of European sturgeon based on literature (Kranenbarg J., *et al.* 2018, Gessner *et al.* 2010, Holčik *et al.* 1989) and field observations in the Gironde, France.

[2] Kranenbarg J., B. Houben & N. Brevé, 2018. Preliminary study of Rhine action plan for European sturgeon. Necessary actions and actors with regard to a reintroduction program in the Rhine. RAVON, Nijmegen. Report nr. 2017.105.

Figure 2 – Historic and potential life cycle of the European sturgeon in the Lower Rhine.

Figure 3 shows the distribution of the species. The European sturgeon can be found in the Northeast European Ocean (c & d), the North Sea (b), the Baltic Sea (a), the coastal seas of the Mediterranean areas (e), the Pontic region (i), Tyrrhenian Sea (f) , Adriatic Sea (g), Ionian Sea, the north Aegean Sea (h), Sea of Marmara and the Black Sea (i) (Holcyk et al. 1989). The reproduction sites were in all larger West European rivers.

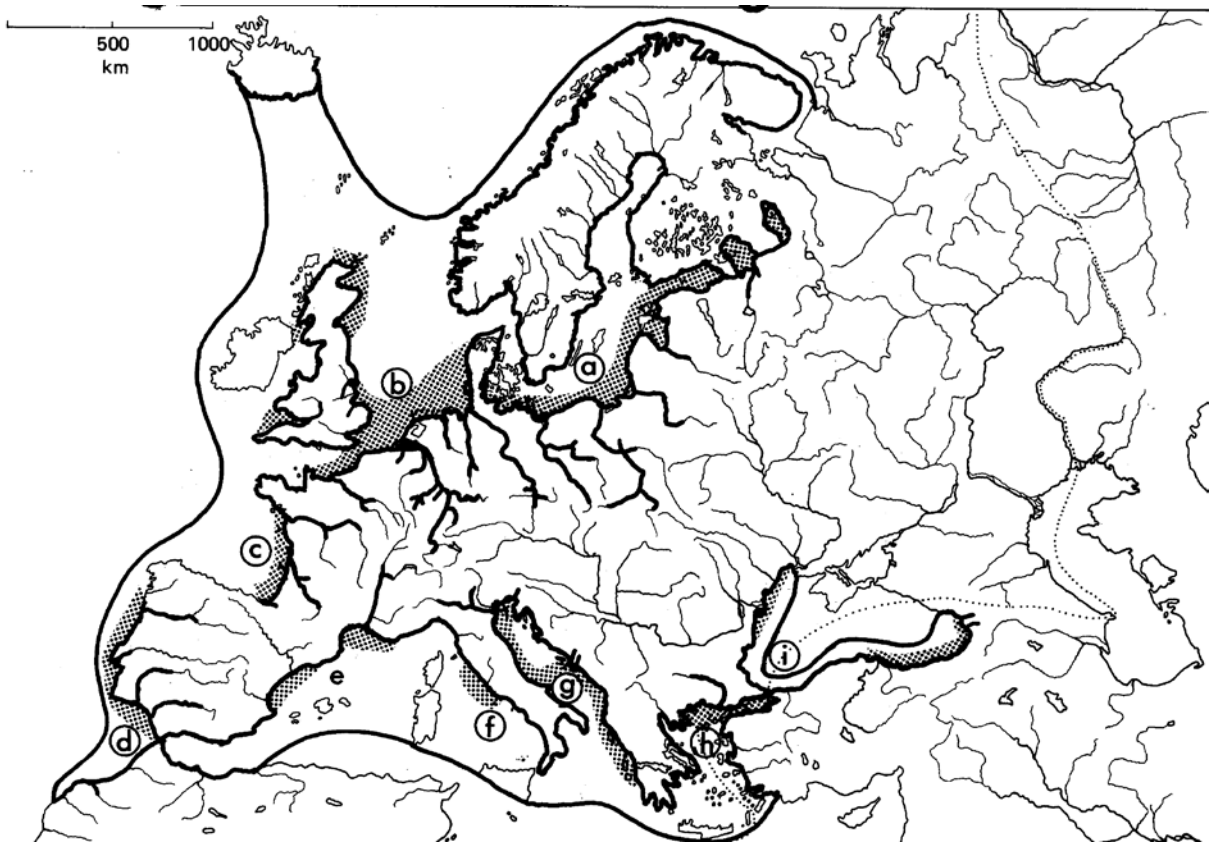


Figure 3 - Distribution map of sturgeon in Europe around 1900. The letters indicate the most important regions. The rivers where breeding took place are in bold. Source: Holcik et al. 1989.

The exact locations of the historic spawning sites in the Rhine are unknown. Kinzelbach (1987) describes, based on old catch data, where sturgeons ready for spawning were caught. In the Rhine this was up to the waterfall of Schaffhausen at about 860 km from the sea. In the tributary river Lippe (about 30 km above the Dutch border) sturgeons were caught in the first 100 km as far as Lünen. In addition, animals migrated from the Rhine up the Moselle to Toul in France.

2.1.2 Decline of the species

The European sturgeon was fished in all river systems where the species reproduced. The Rhine was one of the most important sturgeon rivers in Europe. One of the oldest sources (Houttuyn 1765) mentions Geertruidenberg – at that time an important fishing village in the Rhine-Meuse estuary, in the 17th century – where many sturgeons were supplied. Martens (1992) mentions an average supply of 470 specimens per year for Geertruidenberg in the period 1742-1775. Due to the use of steam engines in fishing boats, the fishing effort increased enormously from the second half of the 19th century. This allowed the rivers to be completely fenced off by means of large seines and fishing could be done faster and at greater depths off the coast with larger bottom-trawl nets. As a result, the catch efficiency increased considerably, and considerable by-catches of sturgeon were achieved (Quak 2016). In 1893, 832 sturgeons were landed in the Dutch rivers and in 1913 only 28 (Figure 4)

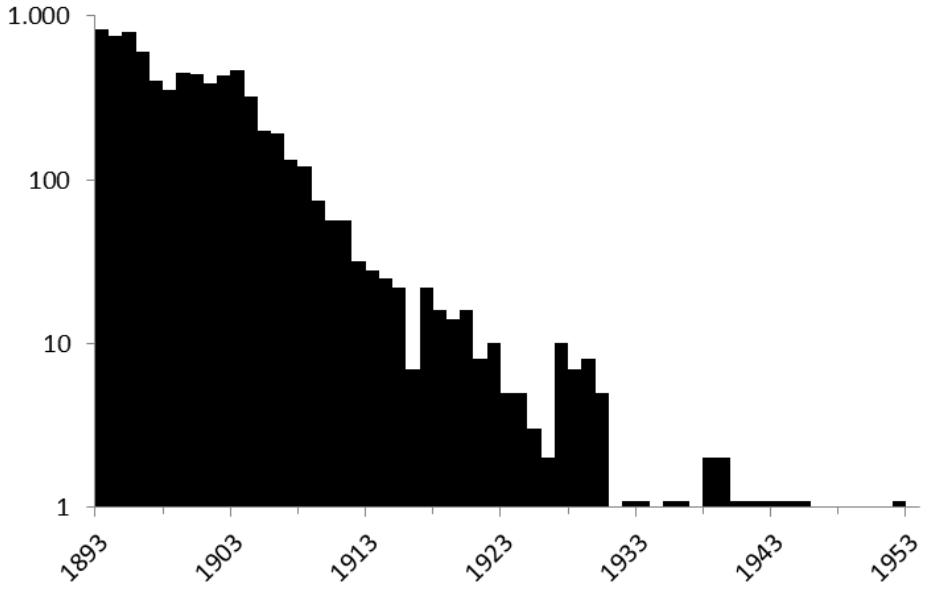


Figure 4 - Number of sturgeons caught per year in Dutch rivers 1893-1953 on a logarithmic scale (y-axis). Source: fishing statistics.

At the beginning of the 20th century, sturgeons were mainly caught off the Dutch coast. In the 1950s, one of the last adult sturgeons were caught in Dutch rivers (Figure 5), and in the 1960s, the last adult sturgeons were landed from the North and Wadden Sea. The last sturgeon was caught in 1942 in the German part of the Rhine (Kinzelbach 1987). A similar pattern occurred in all West European rivers. Holcik et al. (1989) summed up the landings for the beginning of the 20th century and this results in a total catch of between 14,000 and 16,000 European sturgeons per year. Fifty years later, the species has disappeared almost everywhere. Only in the French river Gironde did a population of several thousand animals remain after World War II, but in 1980 the population was also almost decimated here, after which fishing was prohibited.

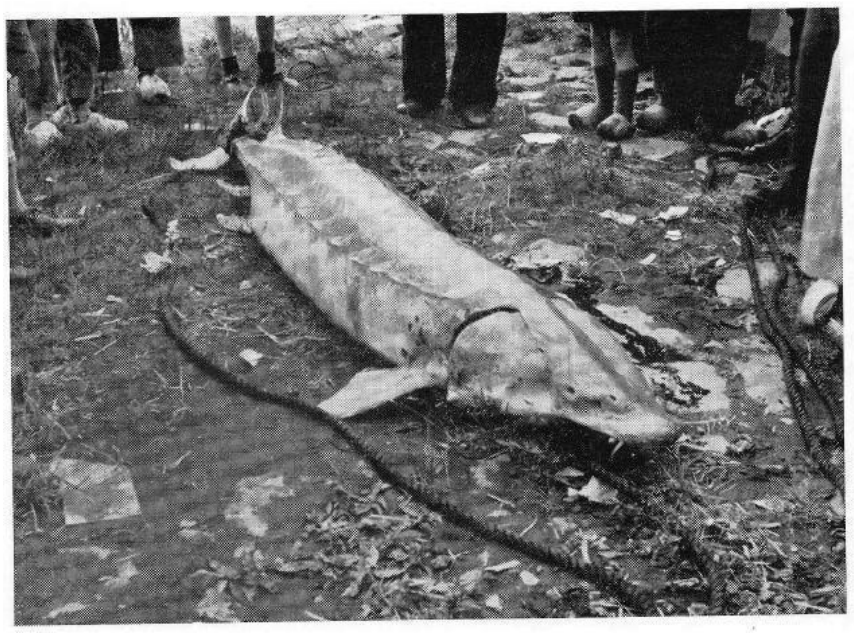


Figure 5 - One of the last adult European sturgeon caught in the Dutch rivers in 1952 on the Nieuwe Merwede with a length of 260 cm and a weight of more than 100 kg. Source: Verhey (1961).

The European sturgeon is, due to the late age at which the animals become sexually mature, very sensitive to overfishing. Another cause of the loss of populations is the industrial revolution, which has increased water pollution in all rivers. Dams were also built, and river sections normalized and dredged for shipping. This led to the disappearance or inaccessibility of many spawning and maturation areas, which reduced the reproduction success.

2.1.3 Causes of deterioration of sturgeon populations

The disappearance of the European sturgeon from the various river systems where the species still existed until the early 20th century is mainly due to:

- Mortality as a result of fishing in the rivers and coastal zones.
- The degradation of spawning areas and juvenile habitats in rivers through the construction of dams and the normalization of rivers for shipping and water safety.
- A deterioration in water quality.

In addition, there are more recent changes that could have a negative impact on the species, the most important being:

- Significant intensification of coastal fishing.
- The construction of dams on migration routes to spawning grounds (including coastal defense constructions such as the Afsluitdijk and the Deltawerken in the southwestern delta of The Netherlands).
- Climate changes that can change the discharge and temperature regime of rivers. In southern river systems, this can limit the propagation of the European sturgeon.
- The increase in river shipping with ships with an ever-increasing draught.
- The establishment of exotic fish species that can cause hybridization (exotic sturgeons) or ensure predation of eggs and/or competition with juvenile animals.
- The way in which the above factors can pose a threat to the European sturgeon in the current Rhine system and the adjacent Dutch coastal zone is described in the following sections.

2.1.4 Ongoing recovery programmes

Since the 1980s, work has been done to restore the last wild European sturgeon population in the Gironde-Dordogne-Garonne river system. For this purpose, a breeding centre was established in Bordeaux where initially sturgeons caught in the wild were kept for the breeding of young sturgeons. In 1995, they succeeded for the first time in raising offspring from this system with the sperm and eggs caught during the spawning season. Some of these young sturgeons have been released and the rest were kept behind for further breeding. Since 2006, there have been regular breeding successes in the French breeding centre, with the fish from the 1995 rearing. Thanks to this French breeding program and the commitment of the French partners, the European sturgeon still exists (Figure 5) and since 2007 more than 1.7 million juvenile sturgeons (and larvae) and more than three thousand sturgeons aged 1 year or older have been released.

To maintain the European sturgeon, there has been a joint venture between France and Germany since 1996. National action plans for both countries were published in 1997, 2011 (Dreal, A., 2011) and 2010 (Gessner *et al.* 2010), describing, among other things, actions to preserve the Gironde-Dordogne-Garonne population in France and the Elbe river population in Germany. In France, the follow up Sturgeon Action Plan 2020-2029 has recently been published for public consultation in January 2020[3].

[3] http://www.consultations-publiques.developpement-durable.gouv.fr/projet-de-plan-national-d-action-pour-l-esturgeon-a2115.html

Figure 6 - Evolution of the distribution of the European Sturgeon in Europe between 1850 and 2018 (French Action Plan: Plan national d'actions en faveur de l'esturgeon européen *Acipenser sturio* 2020-2029).

At the moment there are 80 adult European sturgeons and about 300 juvenile sturgeons (from 2007) in the breeding basins in Bordeaux (from MIGADO). The breeding is done under the supervision of the French research institute IRSTEA. It is expected that a large proportion of juvenile sturgeons will become sexually mature within a few years, so that a large number of young sturgeons can be raised in the coming decades.

As part of the French-German cooperation, a sturgeon breeding centre was established in Berlin in 1998. Complemented by a reintroduction program for the Elbe River. This program used larvae born in the French breeding centre to establish an autonomous ex situ stock and to experimentally release some 20,000 juveniles in the Elbe river to set the foundations for a local population. Due to a shortage of reproductions from the French brood stock after 2014 the releases in France and Germany have been interrupted since 2015.

Strategically located between the Gironde-Dordogne-Garonne and the Elbe, the Rhine is identified as a third potential river to start with experimental releases of the European sturgeon and gradually work on a sustainable reintroduction of this magnificent and ancient fish.

2.2 Suitability and accessibility of habitats in the (lower)Rhine

In the historic habitat of the European sturgeon, morphological changes have mainly occurred in the rivers and estuaries. These are important for the upstream migration of the spawning animals from the sea to the spawning areas in the rivers, and back again for the spawned sturgeons and the juvenile offspring (see section 1.1). The following river habitats are important and must be accessible:

- Spawning grounds with suitable conditions for the development of eggs and larvae.
- Maturation areas downstream from the spawning grounds for juvenile habitat during the first to second year of life.
- Deeper places for the adult sturgeons to hide, especially in the vicinity of the breeding sites.
- A gradual fresh-salt gradient for migration between the sea and the river system.
- Food-rich estuarine and coastal habitats for the further growth of juvenile sturgeons from the first or second year of life.

In the Rhine, in particular from the second half of the 19th century onwards, many modifications were carried out by man, including the securing of the banks (using rock and crib sections), the removal of bends, the deepening of the river (dredging) and the construction of weirs. This has made the morphology of the riverbed more uniform.
In addition to the degradation of river habitats described above, many shellfish banks have disappeared along the coastal zone due to diseases and overfishing.

Below it is described to what extent the current Rhine system is suitable as a habitat for the European sturgeon.

2.2.1 Migration possibilities

Fresh-salt transitions

In the course of the 20th century, almost all estuaries in the Netherlands were dammed, with the exception of the Nieuwe Waterweg which was dug. Especially for young sturgeons it is important that there is a gradual transition from fresh to salt water so that they can adjust their osmosis to the salt water. This is also apparent from the experiment in which the downstream migration of young sturgeons in the Dutch part of the Rhine was investigated (Brevé et al., 2014, Brevé et al., 2018 in prep). This research showed that a large proportion of the released animals found their way to the sea relatively quickly. Mainly the Nieuwe Waterweg was used for this, which was reached after an average of 13 days. The animals stayed in the Nieuwe Waterweg for some time (around 2 weeks), probably to adapt to the increasing salt content. Only a few animals migrated to the sea via the Haringvliet dam. It was found that one of these animals was repeatedly observed on the sweet side of the locks without passing through them, possibly this animal could not find the exit because the locks had only limited opening. None of the animals used the route via the Pannerdens Canal – IJssel-IJsselmeer-Wadden Sea. This indicates that the main discharge of the Rhine is followed during downstream migration, which for about 2/3 takes place via the Nieuwe Waterweg. The Haringvliet locks are currently still a migration barrier for sturgeons that want to migrate from the sea to the spawning grounds and for young sturgeons swimming downstream to the juvenile habitats in estuaries and coastal areas. With the introduction of Kierbeheer from 2018, this situation will improve considerably. The brackish zone that is created upstream of the locks creates suitable conditions for downstream (young) sturgeons to adapt their osmoregulation to the salty conditions of the sea. A brackish zone may also be important for juvenile sturgeons from around 4-7 years old. Based on telemetry research in the Gironde, regular migration was observed for this age group between the sea and the downstream part of the estuary (Acolas et al. 2011). The animals moved to the sea in the autumn in particular and to the estuary again in the spring.

Also, at the Afsluitdijk, a fresh-salt transition zone will be created by the construction of the fish migration river in 2018 that migrating sturgeons can use. A point of attention is that there are plans to install large two-megawatt tidal turbines here in the sluice gates. It is important to test to what extent these turbines can damage larger fish species such as sturgeons.

The Rhine

Most spawning areas and juvenile habitats of the European sturgeon, within the Rhine catchment area, were probably in the main stream of the Rhine. In comparison with many other large rivers, the lower reaches of the Rhine have been constructed with few dams. Upstream from the Netherlands, the Rhine can be freely migrated for approximately 660 km to the Iffezheim weir. From here there is upstream a large number of weirs in the Rhine.

Within the Netherlands, three weirs were built in the Lower Rhine in the 20th century, which have since been fitted with a fish trap. These fish traps are probably difficult for adult sturgeons to pass through (Winter et al., 2015). At one of the dams in the Lower Rhine, there is currently a hydroelectric power station that can potentially kill young sturgeons migrating downstream. It should be noted that probably few sturgeons will choose the route via the Lower Rhine because the share of discharge via this Rhine branch is relatively small (Brevé et al., In prep).

Tributaries

Most of the spawning grounds were probably largely in the main stream of the Rhine itself, and to a lesser extent in some of the larger tributaries such as the Neckar and Moselle. The fact that many tributaries of the Rhine cannot be raised for the European sturgeon (Figure

2.1) does not seem to be a problem for the recovery of the species because there are sufficient potential spawning grounds in the Rhine itself (see section 2.2.2).

Fish migration possibilities from 2018

Figure 7 provides an overview of the migration possibilities for sturgeon from 2018. This shows that if the measures for the Haringvlietdam (Kierbeheer from 2018) and the Afsluitdijk (fish migration river from 2018) are implemented, the possibilities for the sturgeon and other migratory fish species to migrate between the sea and the Rhine system improve significantly. This means that a large part of the area where the species reproduced until the beginning of the 20th century can be reached.

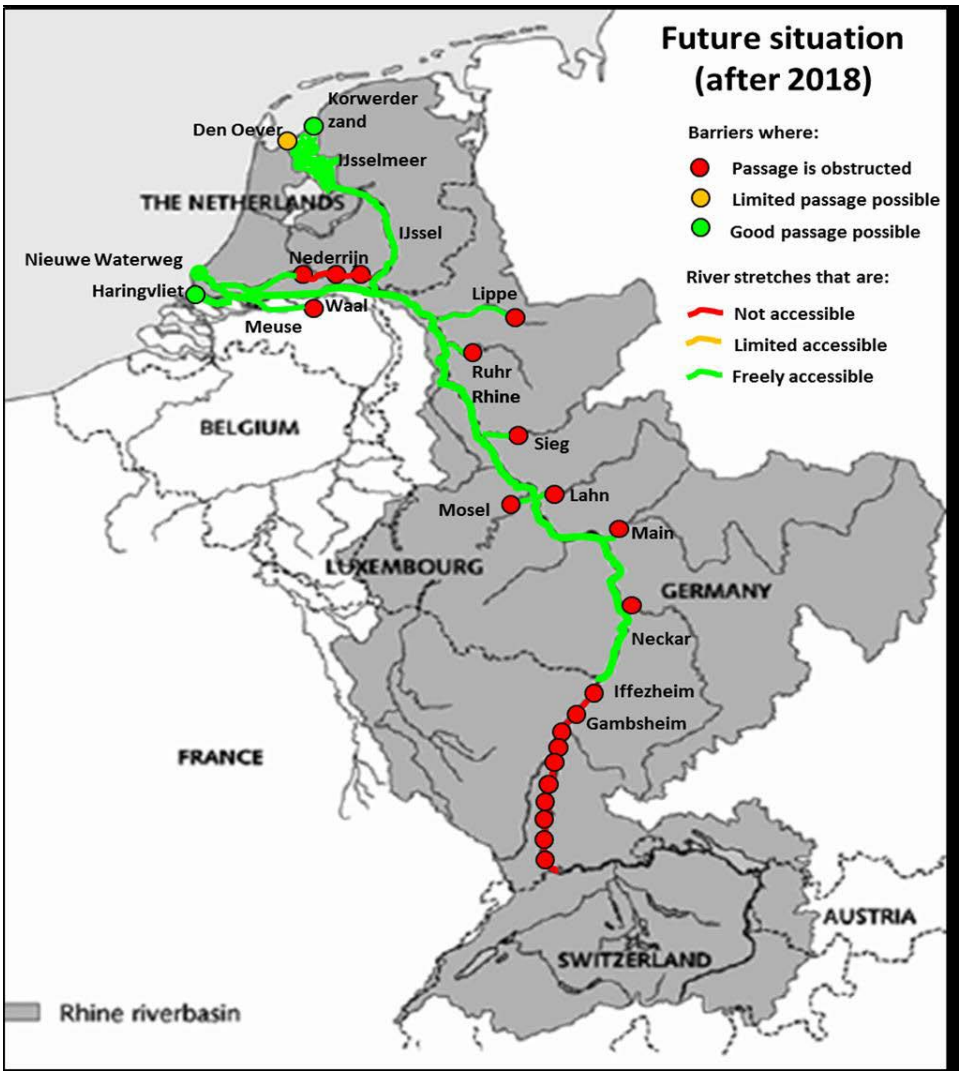


Figure 7 - Migration possibilities for sturgeon in the Rhine from 2018. Source: Winter et al. (2015).

2.2.2 Breeding areas

Based on literature information from different river systems, the spawning habitat of the European sturgeon can be described as deep (> 2m_ relatively fast-flowing (0.5-1.om/s) river sections with a bottom substrate of large pebbles and stones (average diameter > 25 mm) (Figure 8). Staas (2017) performed a GIS analysis based on detailed depth, flow and substrate data from the approximately 220-km-long river stretch of the German Lower Rhine in the state of North Rhine-Westphalia, directly upstream of the Netherlands.

Figure 8 - Bottom photo of the Rhine. This and other information were used by Staas (2017) to show the suitability of the soil substrate.

The study by Staas (2017) shows that 21.84 km² (33%) of the main stream of the Lower Rhine is potentially suitable. There are six areas that are promising (Figure 2.3). These areas are located around 50, 60, 110, 130, 180 and 190 km upstream of the Dutch border, respectively. A point of attention is that a large part lies within the busy shipping route, which may have negative consequences for reproduction success (see section 2.4). Staas (2017) also indicates that upstream of the area studied suitable spawning habitat is probably also present, and that the shipping is less intense there (see also section 2.5).

Although considerable action has been taken in the course of the Rhine in the last century, it seems that there are still suitable circumstances for the sturgeon to spawn. This can be explained by the fact that, unlike many other rivers, no dams have been built in a large part of the Rhine. As a result, the maximum flow velocities have been little affected and there is still sufficient coarse substrate on the river bottom. There may also be suitable spawning grounds in the Lippe, in the Rhine upstream of North Rhine-Westphalia, or more downstream around the Gelderse Poort. Furthermore, Staas (2017) indicates that deeper side canals laid out for nature development may offer suitable spawning habitats.

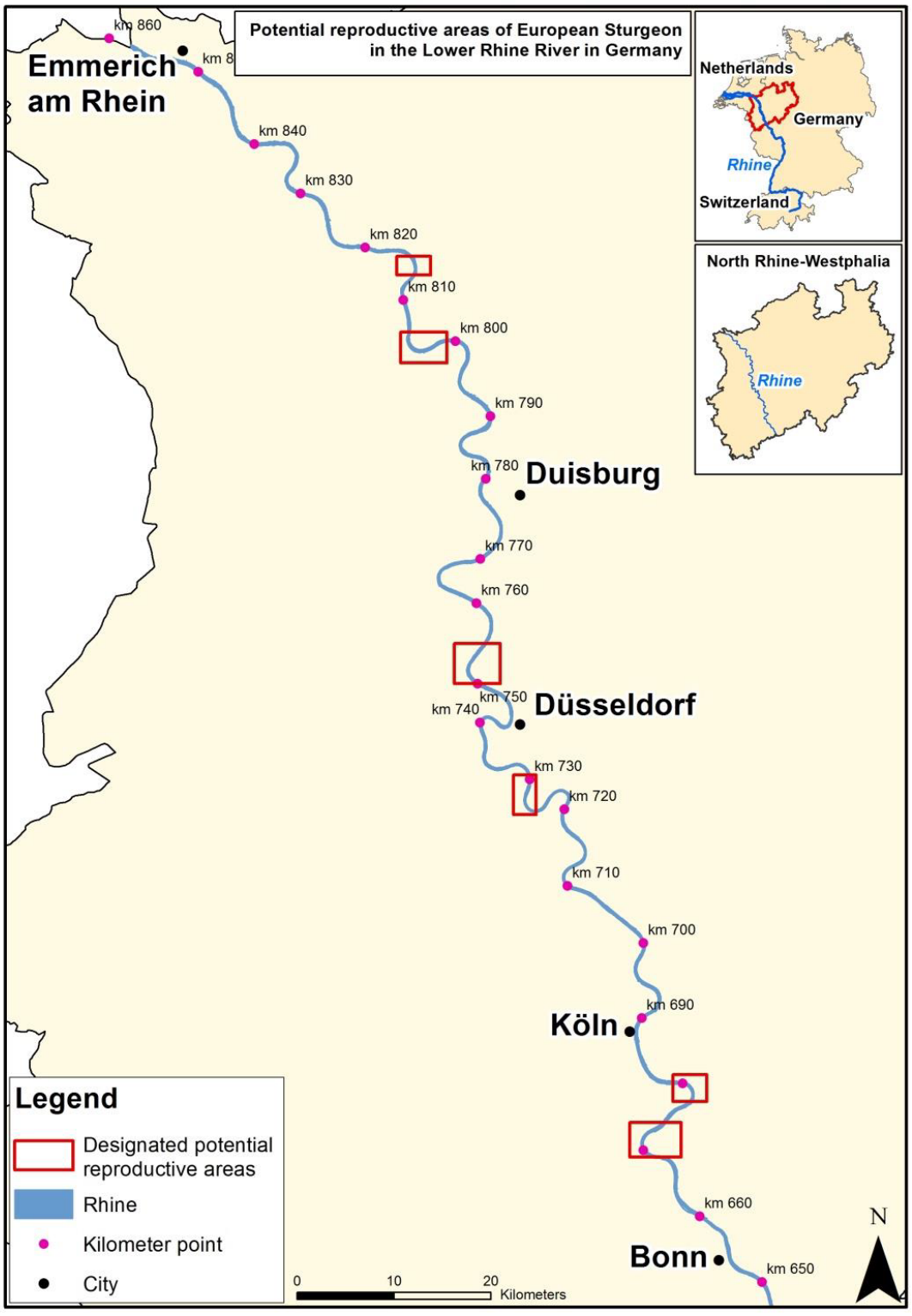
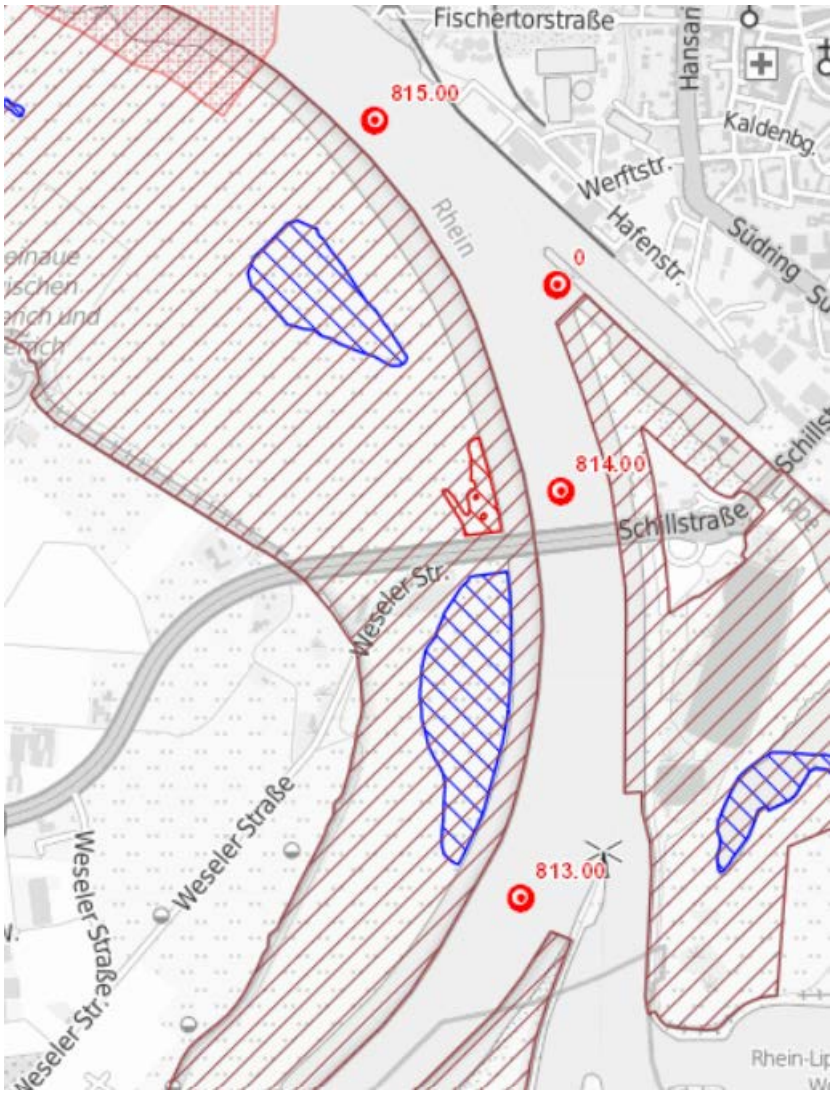


Figure 9 - Areas designated by Staas (2017) that are potentially suitable as spawning grounds for the European sturgeon in the German Lower Rhine.

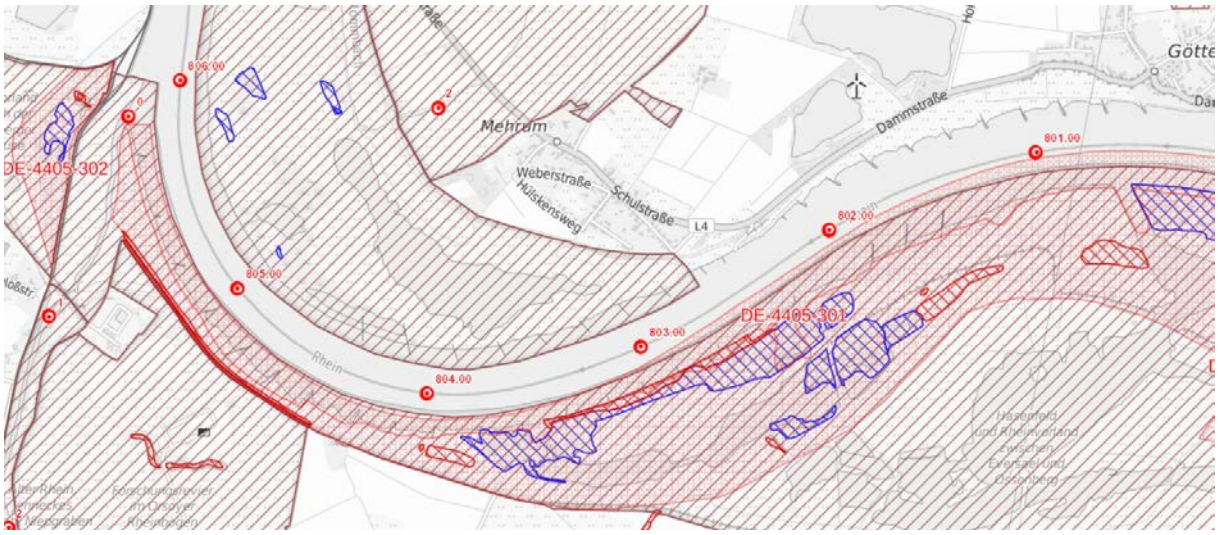
Legend to figures:

- Light red dots: FFH area
- Purple stripes: nature reserve
- Blue stripes: particularly protected biotops

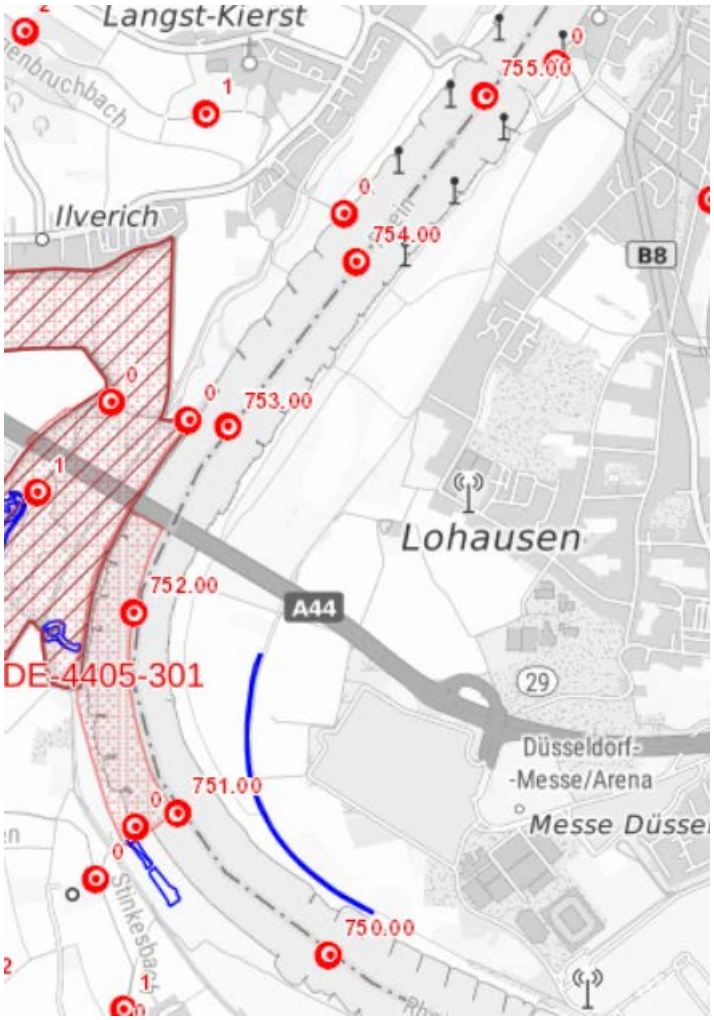
Potential spawning area No.1 (“Wesel”) – Rhine-km 813.0 – 8150.0 (length 2 km)



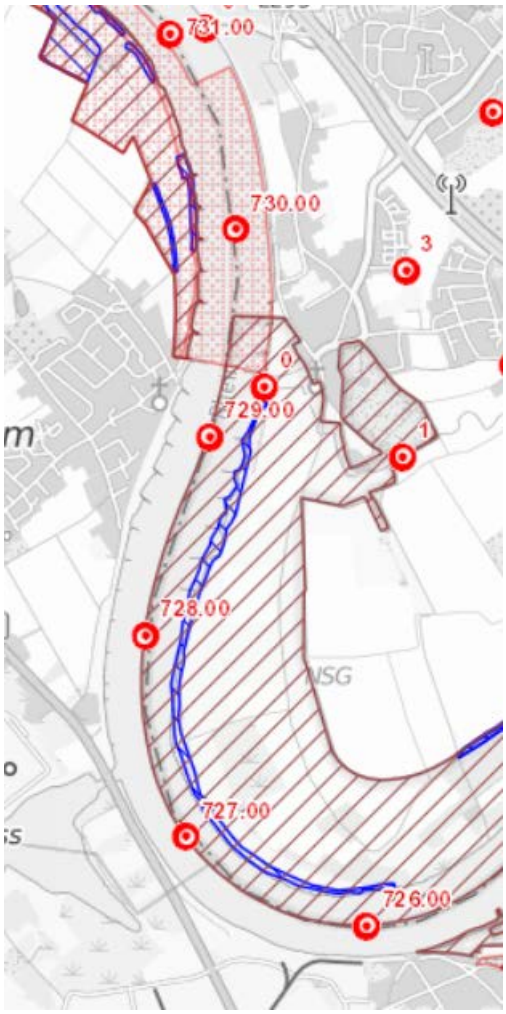
Potential spawning area No.2 ("Rheinberg") – Rhine-km 801.5 – 806.5 (length 5 km)



Potential spawning area No.3 ("Meerbusch") – Rhine-km 750.0 – 755.0 (length 5 km)

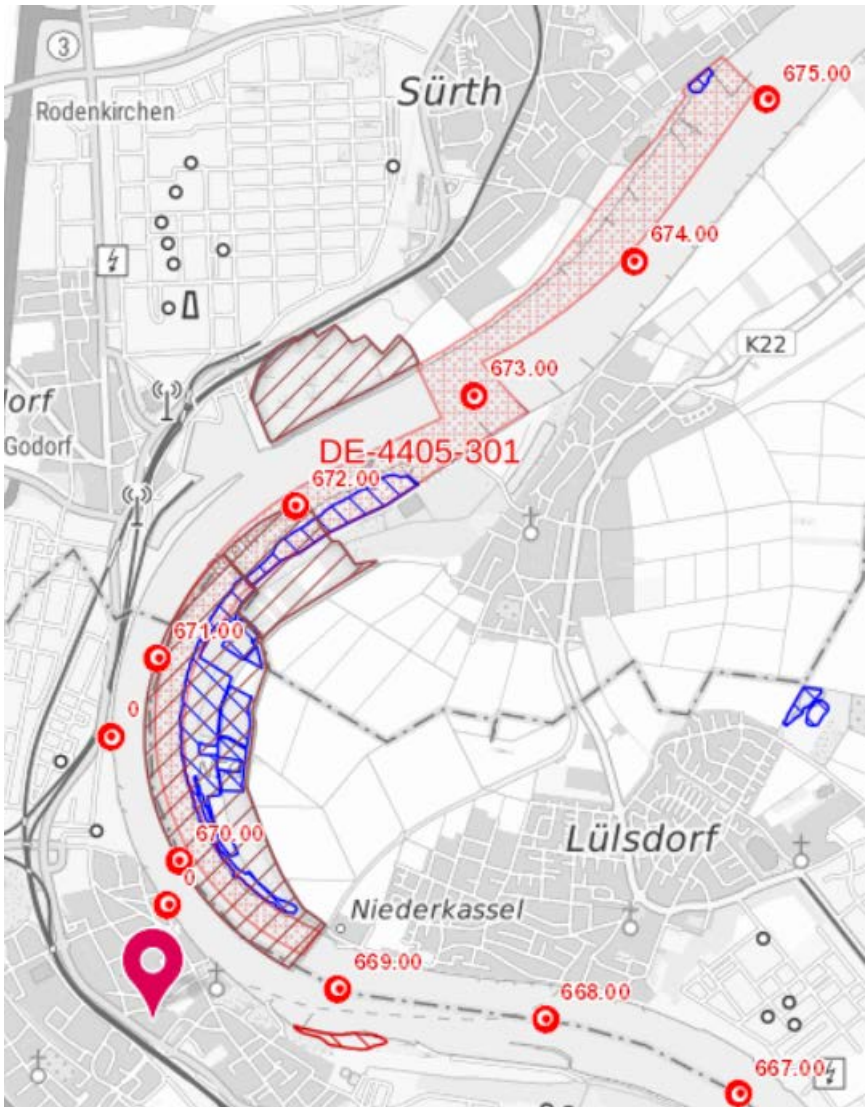


Potential spawning area No.4 ("Neuss") – Rhine-km 726.0 – 730.5 (length 4.5 km)



Potential spawning area No.5 ("Köln-Porz") – Rhine-km 677.5 – 681.0 (length 3.5 km)

Potential spawning area No.6 ("Wesseling") – Rhine-km 668.5 – 674.0 (length 5.5 km)



2.2.3 Maturation areas

River & estuary

The location of the juvenile habitats of the European sturgeon in the Rhine system, when the species still existed here, is unknown. The knowledge about the characteristics of these areas comes mainly from research conducting over the past decades in the Gironde estuary. Little is known about the habitat preference of larvae and juvenile sturgeons during the first months of their life in the river. This is probably the deeper parts with lower flow rates (0.1-0.6 m/s) and sufficient food (Staas 2017).

In the Dordogne river, approximately 5-month-old sturgeons were observed during fish sampling near the bank in places with little current and fine sediment. The preference for fine substrate (sand of 0.8–1.4 mm) is also apparent from laboratory experiments with the Atlantic sturgeon, which is closely related to the European sturgeon (Acipenser oxyrinchus) (Gessner et al. 2011). Young Atlantic sturgeons released in the Oder system looked for structurally rich habitats such as sunken trees and deep holes (Gessner et al. 2011). Such habitats are potentially present in the Biesbosch. Measures in the context of space for river projects and

the construction of longitudinal dams also ensure that habitat variation increases and may provide habitat for young sturgeons.

A relatively large amount of research has been conducted on the habitat use of young sturgeons from 9 months of age. In the Gironde system, cultivated sturgeons between the ages of 9 and 12 months were released into the freshwater tidal section, and followed by telemetry (Acolas et al. 2012). All animals migrated downstream. Different patterns were distinguished: animals that remained in the freshwater part, animals that migrated fairly quickly to the estuary and animals that migrated between the different parts of the estuary. In the end, most animals settled in a more or less permanent place, probably the presence of sufficient food was an important factor in this (Acolas et al. 2012). Other research in Gironde also indicates that the presence of food (such as brush worms) is an important factor in the choice of habitat of young sturgeons (Brosse et al. 2011). Based on trawl catches, it appeared that the youngest animals (from 25 cm) were found in the upstream part of the estuary, and the older animals (from 45 cm) in the downstream part. The habitat preference with respect to flow rate and substrate was similar. All the preferred areas contain a lot of suitable food. Older juvenile sturgeons, up to the age of about 7 years, continue to use the estuary depending on the season (see also section 2.1.2).

With regard to the historical occurrence of young sturgeons in the Dutch estuaries, Kok (1936) mentions the privilege of Kamper and Vollenhover fishermen to be allowed to fish exclusively for sturgeon on the IJssel and the mouth in the Zuiderzee. In the mid-16th century, they found that the nets of the Dutch fishermen in the Zuiderzee had such small meshes that they caught the young sturgeons. This indicates that the Zuiderzee and adjacent Wadden Sea used to have a growth function for the European sturgeon. Kinzelbach (1987) describes that in the 16th century young sturgeons were caught in the mouths of the Rhine, Meuse and Scheldt as a special treat during the second half of the summer. However, it is not stated how large these sturgeons were. During an intensive investigation (Hoek & Bottemanne 1888, Hoek 1897) in which the anchor-net catches of the Haringvliet were noted, no young sturgeon was found. This could be because the young sturgeons were well able to dodge the anchor-nets or were in deeper places but given the great catch effort it is remarkable that no young sturgeon was caught. It is possible that the reproductive success of the sturgeon in the Rhine at the time of the investigation (end of the 19th century) had already declined so significantly that the densities and therefore the chance of capture were very low. Another explanation could be that young downstream migrating sturgeons mainly grew up in the Voordelta and adjacent coastal areas. In this case they would have passed the Haringvliet estuary fairly quickly.

Hoek & Bottemanne (1888) do mention that it is very incidental that small sturgeons of about 20 kg are caught with the anchor-net in June; these are perhaps animals that entered the estuary from the sea for foraging.

Both the situation in the Zuiderzee and in the Haringvliet have changed considerably compared to the situation when the European sturgeon was still present there. Both estuaries currently have the character of a freshwater lake; the estuarine dynamics and the associated food web have disappeared. In the Haringvliet, the estuarine characteristics will partially return beginning in 2018 as a result of the Kierbeheer. With regard to the possible reintroduction of the European sturgeon, it is important to determine to what extent a large-scale estuarine zone is necessary for the maturation of young animals. Both the Kierbeheer of the Haringvliet and the fish migration river in the Afsluitdijk restore the fresh-salt transition, but its size is limited in relation to the historical situation.

Coastal areas

The nutrient-rich coastal areas are of great importance for the further growth of young sturgeons and probably also as a foraging area for adult sturgeons. There is little data on the historical occurrence of young sturgeons off the Dutch coast; the reason for this is probably that the catch of small sturgeon was not recorded in the past. The landings of 276 sturgeons

are reported for the Wadden Sea from 1858-1866, of which 100 were in 1858 (*Verslag den staat der Nederlandsche Zeevisscherijen*). In addition to catching a number of adult sturgeons, Joosten (1964) also mentions the catch of eight younger animals with a length of 0.8-1.5 meters from the Wadden Sea and the North Sea in the period 1936-1956. In the period from 1968 to 1969, there were three reports from the North Sea of animals of 1, 1.4 and 1.45 m respectively (De Groot 1992, Timmermans & Melchers 1994). In the period 1992-1993, five sturgeons of 0.7-1.35m were caught, one on the Wadden Sea and four on the North Sea (Timmermans & Melchers 1994). Three of these animals had a CEMAGREF mark, which indicates that they were marked in the Gironde. The other sturgeons probably also came from the Gironde because around that time there was no longer any reproductive population of the sturgeon in the Rhine or other nearby rivers. The capture of these sturgeons indicates that there are still suitable growing and foraging areas for the European sturgeon along the Dutch coast. This is confirmed by a model calculation by Winter et al (2015) where the habitat suitability for young European sturgeon is determined on the basis of temperature and benthic productivity (see Figure 10). This is also supported by recent telemetric research with sturgeons grown in France for 3-5 years, which were released in the Dutch part of the Rhine. Relatively many of these animals were caught by beam trawlers (see also section 2.3), which indicates that the young sturgeons settled on food grounds near the coast (Brevé et al. 2013, Brevé et al., 2018 in prep).

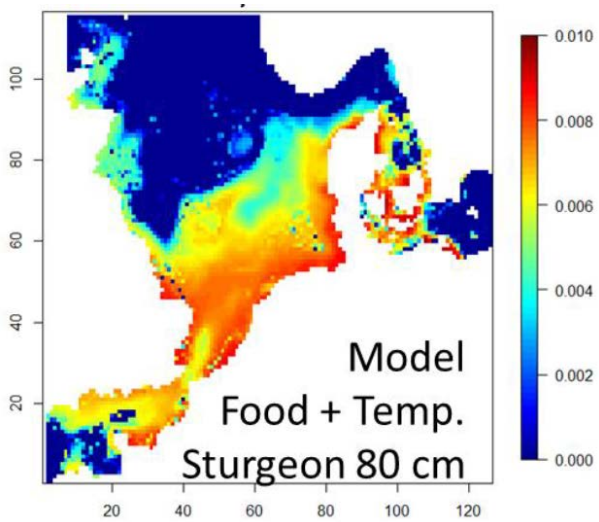


Figure 10 - Maximum potential growth of young sturgeon (80 cm) based on temperature and benthic production for the year 2002. Source: Winter et al. (2015).

2.3 Water quality

From the first half of the 20th century, the Rhine became increasingly polluted by the direct discharge of waste water. This caused a lot of fish mortality and many species disappeared. The fire at the Swiss chemical company Sandoz in 1986, in which heavily contaminated fire extinguishing water led to enormous fish mortality, made the Rhine states aware that the degradation of the Rhine had to be halted immediately. The Rhine Action Plan set the objective of ecological restoration of the Rhine whereby the quality of the water needed to be improved in such a way that higher animal species could populate the river again. The Atlantic salmon (Salmo salar) was chosen as the symbol for improving the environment in the Rhine.

The water quality of the Rhine has been greatly improved compared to the period before 1980 due to the construction of sewage treatment plants, strict supervision of factory discharges and the banning of phosphates in many products. As a result, the oxygen content has increased to around 10 mg/l, which benefits the diversity of underwater life (see Figure 11). The Rhine is now one of the cleanest major rivers in Europe and organisms that serve as

food for fish have largely returned. Thanks in part to the improvement of water quality, salmon were caught again in the Rhine from the 1990s, and this species is now reproducing in a number of German tributaries. Most other migratory fish species (sea trout, sea lamprey, river lamprey, houting, twaite shad and allis shad) are also found in the Rhine.

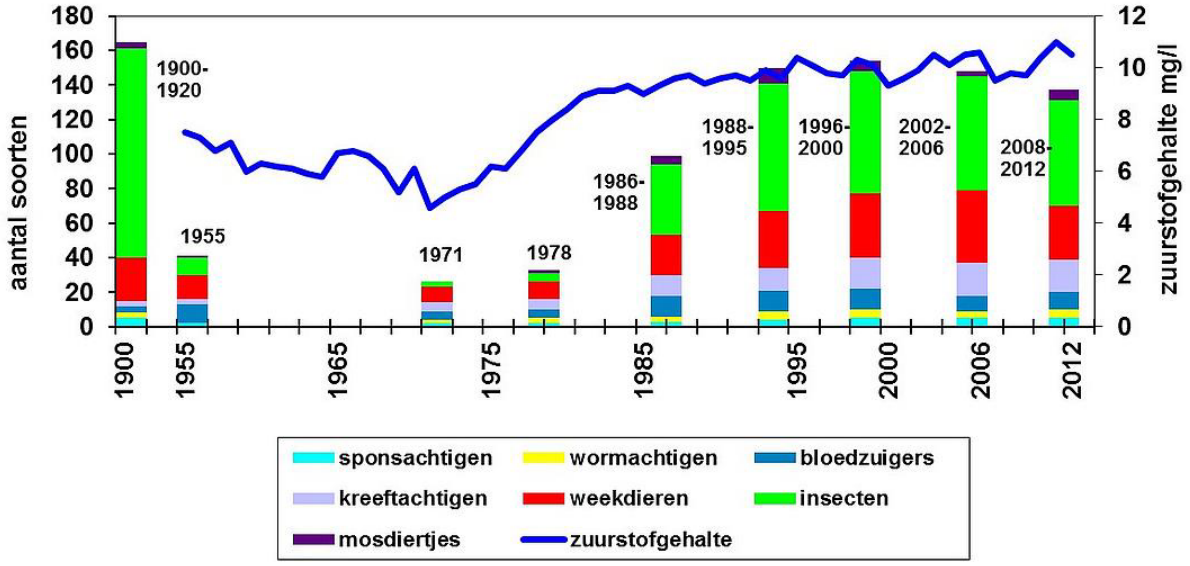


Figure 11 - Development of the average oxygen content and the number of species in the Rhine near Emmerich between 1900 and 2012. Source: iksr.org.

Despite the improved water quality, there is still contamination. For example, the concentration of PCB/dioxin in eel in the lower river area is still far above the norm (Kotterman et al., 2011). In theory, due to old age and bottom-feeding, sturgeon can accumulate high levels of toxic substances such as insecticides, heavy metals and PCBs and this can have negative consequences for reproduction. However, since the release of sturgeons to river water is relatively short during their lifetime, the chance of this appears small (Maury-Brachet et al. 2008).

2.4 Fisheries

Because the sturgeon becomes sexually mature at a late age (females only from 12 years of age), the species is very sensitive to mortality due to fishing. A distinction can be made here between fishing in the rivers where the species breeds and fishing in the estuaries and coastal zones where the sturgeons continue to grow up and look for food.

2.4.1 Fresh water

Until the beginning of the 20th century, the mature European sturgeons that swam up the rivers to spawn were caught in many places in the Netherlands as a by-catch when fishing for migratory species such as salmon and shad. The female animals in particular were sought after because of the precious caviar they contained. Fishing for migratory fish in the Dutch rivers has had a major impact on the spawning stock of the sturgeon in the past (see section 1.2). However, Dutch river fishing virtually disappeared in the second half of the 20th century as a result of the degradation of river systems, so that commercially interesting migratory species such as salmon and shad disappeared. Since then, fishing is mainly for eel using fish traps. This fishery was banned in almost the entire river area in 2010 due to the high levels of dioxin in this species, which makes consumption a health risk. Given the limited number of professional fishermen still active on the major rivers, it is estimated that current river fishing does not pose a threat to the sturgeon's return. However, the standing-rigging fisheries in deep sand-ponds and with big seines in the lower rivers deserve attention.

In comparison with fishing on the large rivers, fishing pressure on the IJsselmeer and Ketelmeer is much higher. There is no year-round ban on fishing with traps because the dioxin levels in the IJsselmeer are below the norm. Fishing in the IJsselmeer area includes shooting traps, standing rigging, hook nets and seines. These are for the most part traps in which sturgeons can get stuck. Although the main migration route of the European sturgeon runs via Nieuwe Waterweg and the Haringvliet, the high fishing pressure in the IJsselmeer and Ketelmeer deserves attention. This is to ensure that sturgeons that choose the IJssel-IJsselmeer-Wadden Sea route and vice versa are sufficiently protected.

2.4.2 Coast and sea

Fishing in the coastal zone and estuaries is mentioned as a major threat in almost all areas where sturgeon species are still present or where reintroduction projects are ongoing. This is especially because the places where this fishery focuses are also among the important potential food areas for the sturgeon (see also section 2.1.3). Fishing along the Dutch coast with bottom-trawling nets (see Figure 14) has intensified further since the disappearance of the sturgeon, partly thanks to the development of boats with stronger engines. Because the sturgeon is a bottom-bound fish, the chance of catching them with bottom capturing devices is relatively high. This is also apparent from the experiments in which approximately 4-year-old European sturgeons from the French breeding program have been released in the Dutch part of the Rhine (Brevé et al. 2013, Brevé et al., 2018 in prep). A significant proportion of these animals were fished within a few months of reaching the North Sea (Figure 12 & 13).

In 2012 this concerned 27% of the animals that were known to reach the North Sea (Brevé et al. 2013). In addition to the catch in bottom-trawling nets, sturgeons are also caught during fishing with gill nets and entangling nets and sometimes also with fishing poles. In 2015, two of the European sturgeons released in the Rhine were caught with gillnets off the North Sea coast, and then released alive (Brevé et al. in prep). Also this year one of the released sturgeons was caught back in the Oosterschelde by a fisherman and released alive (Brevé et al. 2018 in prep).

Figure 12 - Young sturgeon recovered by shrimp fisherman in the North Sea had been released in the Dutch part of the Rhine.

For the recovery of the European sturgeon both in France (Elie 1997) as well as in Germany (Gessner et al. 2010), it is indicated that coastal fishing with bottom trawling nets, gill nets and entangling nets is a major bottleneck for the recovery of the species. In the bottom fishing for shrimp, use can be made of a so-called sieve net. There is no upper side of the net, which allows fish to escape. Since its application by Dutch shrimp fishermen in September 2012, only one sturgeon by-catch from shrimp fishing has been reported (Brevé et al. 2018 in prep). Sturgeons that are caught by fishermen and die as a result cannot grow into adult animals. However, if treated correctly, the chance of survival of sturgeons caught in bottom trawling nets is relatively high (Lepage & Rochard 2011, Beardsall et al. 2013). The release of sturgeons by professional fishermen is therefore essential for the return of a natural reproductive population of the species. It is important for fishermen to register the catches of sturgeons (preferably on an individual level by marking animals). This data provides insight into the development of the sturgeon stock, migrations and habitat use of the species.

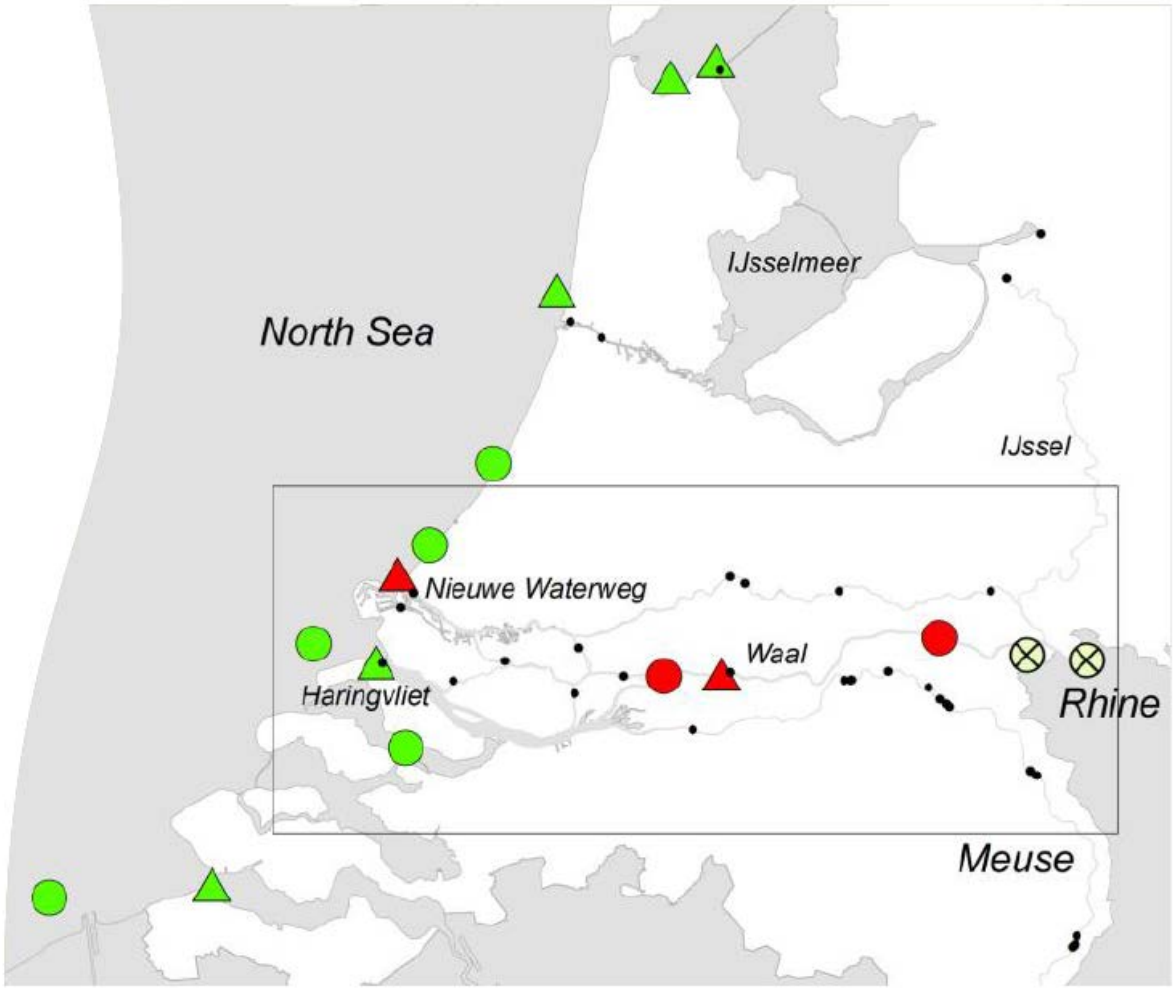


Figure 13 - Feedbacks from European sturgeons experimentally released in 2012 and 2015 in the Dutch rivers and along the Dutch coast. Triangles: released in 2015. Circles: released in 2012. Red: found dead. Green: found alive and restored. X: stake out locations.

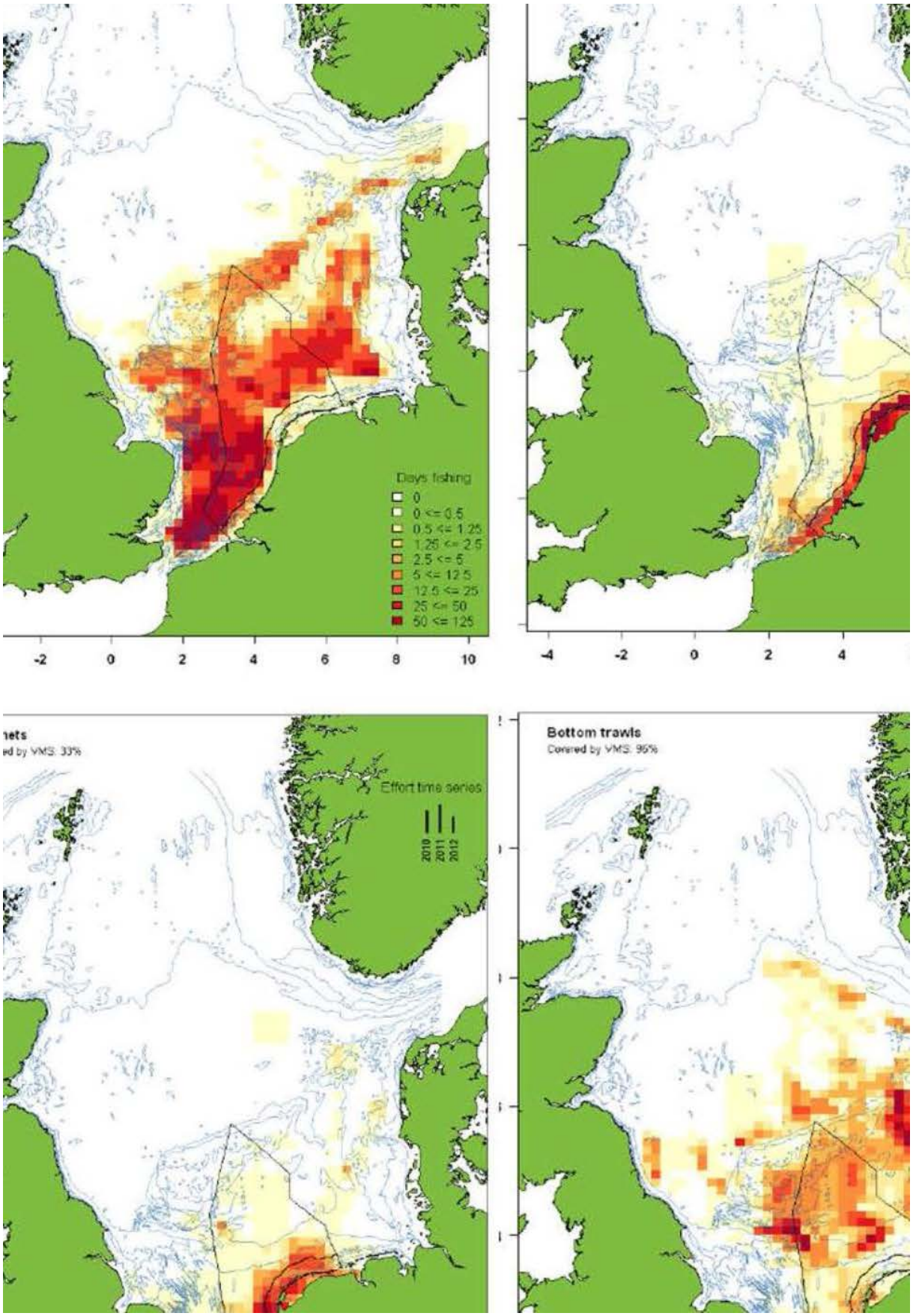


Figure 14 - Fishing intensity Dutch fishermen with respectively large beam trawl (top left), small beam trawl (top right), Gillnet (bottom left) and bottom trawl (bottom right). Source: Winter et al., (2015).

Because European sturgeons can migrate over large distances along the coastal areas, international education and cooperation of professional fishermen is essential for the conservation of the species. The habitat of sub-adult and adult sturgeons is very extensive and catching and not releasing (Figure 15) is very harmful to the species. Several recent catches also occurred on the Dutch coast. Timmermans & Melchers (1994) describe the catch of sturgeons in the Netherlands for 1992 and 1993. Three of the animals caught along the Dutch coast had a CEMAGREF mark in the dorsal fin. It is also known that the sturgeons reintroduced in the Elbe were caught back in Danish coastal waters and ended up here on the fish market (oral communication J. Gessner). Also in 2007, a sturgeon with a CEMAGREF marking was caught off the Dutch coast (Houben et al. 2012). A sturgeon from the Elbe was also caught back in the Westerschelde in 2012 (Brevé et al. 2014).

Figure 15 - Adult sturgeon caught and landed by Spanish fishermen in 2010.

2.5 Shipping

Since the extinction of the European sturgeon, shipping intensity has increased sharply, as well as the draught and capacity of the ships. The Rhine is one of the busiest rivers in the world, with 160,000 cargo ships crossing the border between the Netherlands and Germany each year (Nienhuis et al. 2002). About 25 ships per hour pass on the border of the Netherlands and Germany. Upstream from the German Lower Rhine, the number of shipping movements has decreased significantly to around 4 an hour at Iffezheim (Figure 16).

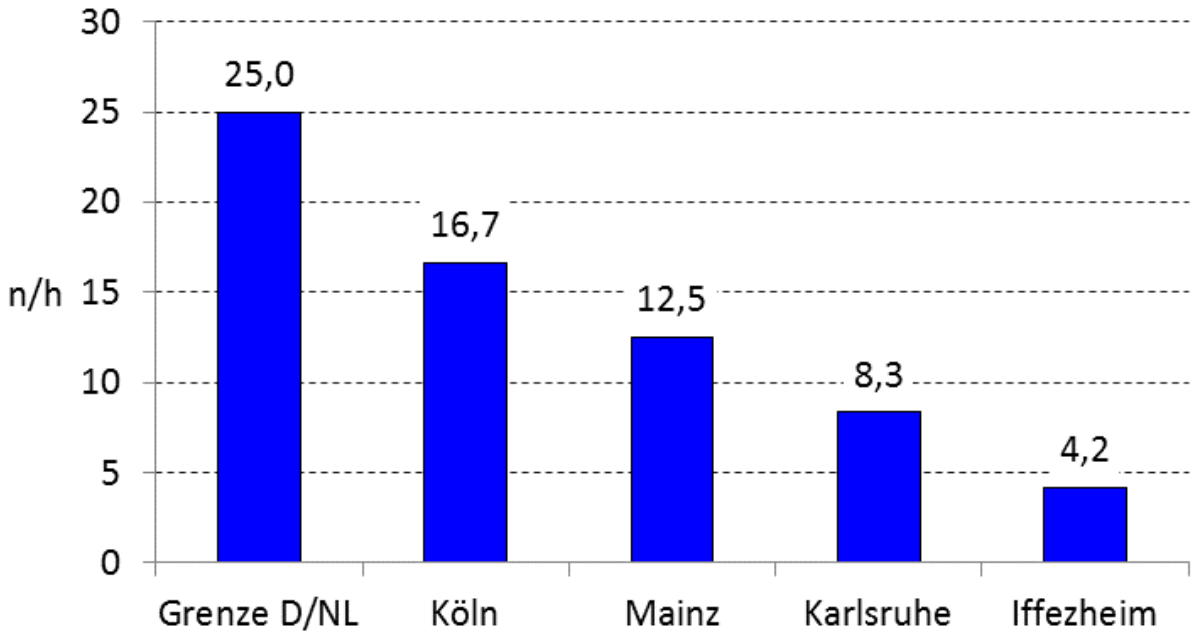


Figure 16 - Number of passing ships per hour in the Rhine from the Dutch border to Iffezheim. Source: Staas (2017).

2.5.1 Mortality from ships' propellers

In busy rivers such as the Rhine, it is possible that large fish such as sturgeons come into contact with the propellers of ships. This is because animals that swim on the bottom are hit by a propeller or when they swim to the surface to swallow air for their swim bladder. The desk study by Spierts (2016) shows that from several rivers dead sturgeons with damage have been reported that may or almost certainly point to ship propellers. These include the Yangtze River, Volga River (including in shipping locks), Hudson River (presumably due to fast boats in shallow water), Delaware River and James River.

The dangers of mortality caused by shipping propellers are probably greatest at low water levels, when the propellers of the largest ships are relatively close to the bottom. Fish that are in the main stream can theoretically be sucked in by the displacement of the ship's propellers and end up in the propeller or they can get hit by the propeller if they are too close to the boats. In the Netherlands, there were relatively many dead fish in the past at low tides on the beaches along the large rivers, many of which were broken or cut in half (Spierts 2016, Kranenbarg 2011). This mainly concerns longer fish species such as eel and sea lamprey. Incidentally, it has not been investigated to what extent these animals died as a result of shipping propellers.

Of the young sturgeons released on the German border in 2012 and 2015 (43 and 44 respectively), three were found dead on the riverbank. Two of these animals were recovered shortly after being released and had injuries possibly caused by a ship's propeller. This concerned young sturgeons of around 4 years of age. The downstream migration rates of

these animals indicated that they were allowed to pass (passively) with the flow (Brevé et al. 2018 in prep). Such behaviour probably increases the chance of contact with a ship's propeller.

It is difficult to determine how great the risk is of migrating sturgeons in the Rhine coming into contact with a ship's propeller. An important aspect here is to what extent the animals choose to migrate (also) at lower river discharges and/or to stay at shallower places to forage or spawn. The chance that they will be hit by a ship's propeller will then be much greater. In addition, the behaviour of the fish, to avoid the current and noise caused by the ships, will also play a role. For example, telemetric research studies have found that catfish avoid arriving ships (Todd et al., 1989).

2.5.2 Turbulence and sound

In theory, it is also possible that the larvae or young juveniles of the sturgeon will be disturbed or damaged as a result of the turbulence or the pressure differences caused by the water movements of shipping propellers. From this point of view, heavy shipping traffic above the spawning grounds of the species can be disadvantageous.
Telemetric research on Atlantic sturgeons in relation to shipping was conducted in the Delaware River. The study showed that the sturgeons were mainly at the bottom and that there was no disturbance from the noise of the passing ships (Balazik et al. 2012).

2.5.3 Dredging

To keep the Rhine at a sufficient depth for shipping, dredging can be done at shallow places. Nowadays, the dredged sediment is often moved to deeper places (De Kok & Meijer 2012). This changes the natural heterogeneity of the soil and this can be disadvantageous for the presence of deeper places near the breeding sites or foraging areas for young sturgeons.

2.6 Alien species

2.6.1 Exotic sturgeon species

Exotic sturgeon species can have a negative impact on European sturgeon through competition for food or habitat, through the spread of diseases and parasites and possibly through hybridization. The following exotic sturgeon species have been found in the Netherlands: the Russian sturgeon (Acipenser gueldenstaedtii), the Siberian sturgeon (Acipenser baerii baerii), and the sterlet (Acipenser Ruthenus). These are probably garden pond and aquarium specimens released in the wild. Often people are not aware of the risk of releasing exotic animal species. Based on the data from the RAVON and Sportvisserij Nederland databases, it appears that the numbers are fortunately very small. As far as is known, the exotic sturgeon species do not reproduce in the Rhine. In addition, the different sturgeon species each have their own ecology with regard to their spawning area and the period in which they spawn, so hybridization does not occur quickly. For example, in various river systems, including the Danube, several sturgeon species live side by side.

2.6.2 Other exotic species

Since the extinction of the European sturgeon, relatively many exotic species have settled in the Rhine. The most common of these are walleye (Sander lucioperca), asp (Aspius aspius) and the Ponto Caspian goby species marble goby (Proterorhinus semilunaris), Kessler's goby (Ponticola kessleri), round goby (Neogobius melanostomus) and Pontic goby (Neogobius fluvilis). All these species eat other fish. The exotic bottom-bound goby species, which nowadays are very abundant in the Rhine, are expected to be able to eat the eggs and larvae of the European sturgeon. Pike perch, which is also very common in the Rhine, is expected to also eat smaller juvenile sturgeons.

2.7 Climate change

The impact of climate changes on the Rhine basis will result in an overall increase in temperature, with summers on average warmer and drier and winters warmer and wetter. The Rhine discharge regime will shift to an increase in winter discharge and a sharp decrease in summer discharge (De Wit *et al.* 2008). Both temperature and discharge regime have an impact on the European sturgeon's breeding success. A model was used to compute the impact of climate changes on the suitability of European river systems for sturgeon. The Rhine comes out as a potentially suitable river system for spawning and growing up of sturgeons.

Future sturgeon habitat suitability in the face of climate change is assessed in several studies (Lasalle, *et al.* 2009, 2010 and 2011). A predictive distribution model was established, and projections were performed at two time-steps, 2050 and 2100[4]. The model incorporated average annual winter and summer precipitation and air temperature for most of the former European sturgeon habitats in Europe, Turkey, Caucasus and North-Africa.

Species presence in a system was categorized into three functional groups: spawning basins, where the species reproduced; transitory basins, where the species occurred infrequently and in very low numbers; unexplored basins, where the species was never recorded. The European sturgeon was reported to be present in 68 out of the 196 basins investigated. It historically reproduced in 24 large basins, located exclusively in Europe, the eastern most basins were the Rioni and the Inguri rivers flowing through Georgia into the Black Sea.

Most of the former sturgeon distribution range was assessed as being strongly affected by climate change, especially basins along the southern limit of its range.

In the '2050' simulation, only some 55% of historical spawning basins are predicted to be particularly suitable to the species. Historical spawning basins which become unsuitable will be most exclusively in the southern parts of Europe; especially the Ebro and the Tiber basins. For the '2100' simulation, 18 out of the 24 historical spawning basins are projected to experience a drastic decrease in suitability. However, five northern basins seem to be potentially suitable for spawning: the Rhine, the Oder, the Vistula, the Neman and the Neva rivers (Lasalle, 2010 and 2011).

[4] For this study, the HadCM3 Global Climate Model (GCM) and the A2 and A1FI emissions scenarios were used.

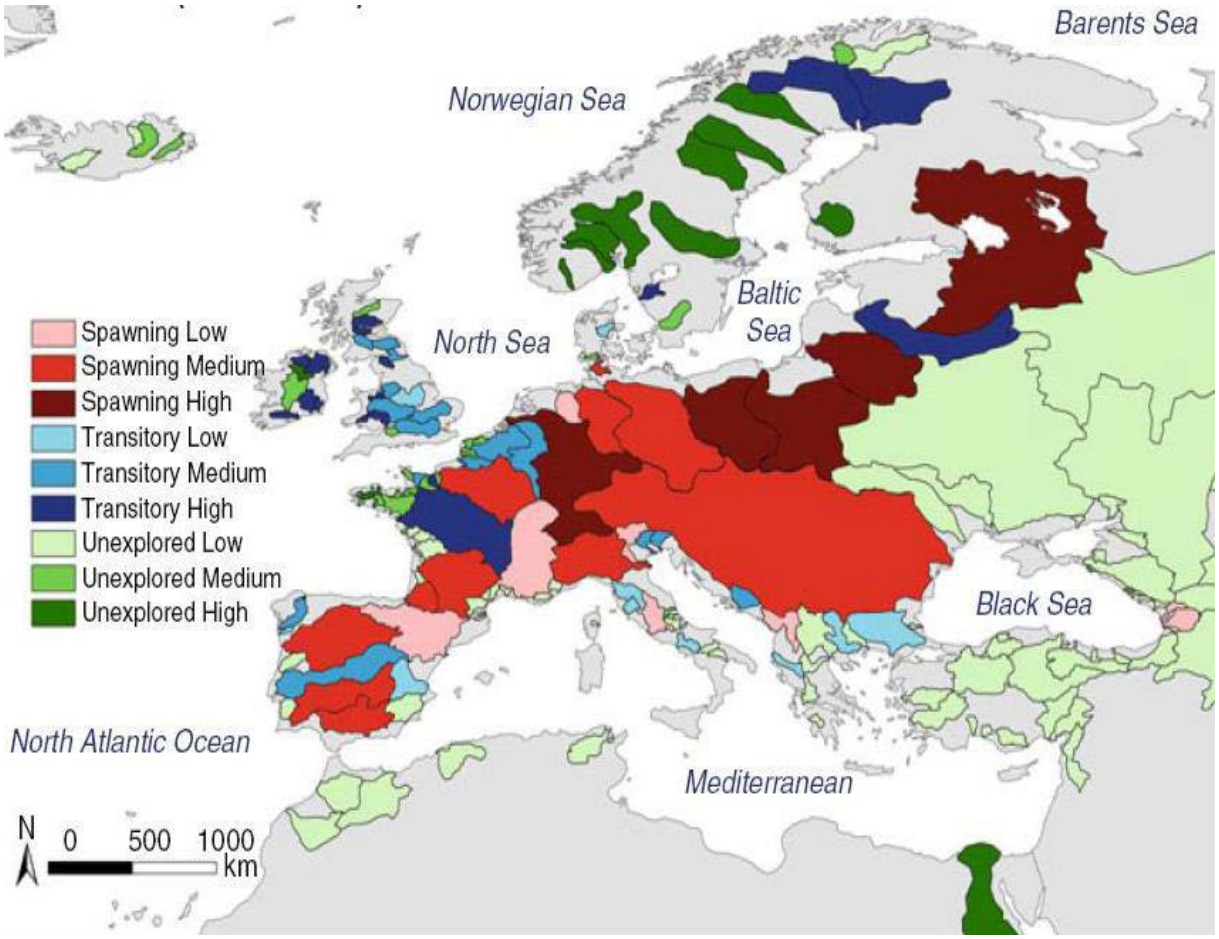


Figure 17 - Mean probabilities of occurrence providing potential future basin suitability for the European sturgeon displayed according to the functional group of basins and calculated using the final BRT model and A2 and A1FI climate change scenarios for the middle and end of the 21st century scenario's (Lassalle *et al* 2010 and 2011).

2.8 Cooling water withdrawals and hydropower

Cooling water withdrawal

In the Netherlands, an 'Ecological Assessment Method for Cooling Water Withdrawals' has been developed to assess the impact on fish population as part of the Cooling Water Regulation, applicable to intakes of power stations and other industries. The impact of fish ingress foremost applies to small length classes (eggs, larvae, 0 + fish, < 15 cm), due to their passive presence in water flow, limited orientation (especially during dark periods) and low swimming capacity. Juveniles >15 cm and adults get impinged to a much lesser extent because of their increased swimming capacity, rheotaxis (orientation to flow) and behavior (hesitation to pass through trash racks). For larvae ad early juveniles, water abstraction can be detrimental when located adjacent to the main migration corridors. The regulated approach velocity in front of trash racks is low (< 0.3 m/s). Survival of impinged fish is related to the presence and efficiency of a Fish Recovery and Return system.

There are several large-scale cooling water withdrawals along the (lower)Rhine, the largest belonging to power stations. In the Netherlands, in the port of Rotterdam, these are mainly situated in port areas adjacent to the main river, such as the Beerkanaal. It is expected that any impact of (cooling) water withdrawal of sturgeon will be low as they are not likely to encounter the direct vicinity of such intakes. In addition, as sturgeons are good swimmers and are of relatively large sizing, they can easily escape the hydraulic area of concern in front of intakes.

Hydropower

In the Netherlands, there are three low-head hydropower plants (HP's) located along the Meuse (2: Linne, Lith) and Nederrijn (1: Maurik). For hydropower plants, the hydraulic conditions are clearly different from cooling water intakes. In principle, HP's (typically with adjacent regulation weir and a fish pass) are designed and positioned such that main flow of the river/canal passes through the turbines to produce energy. Often the approach velocity towards the intake gradually increases and easily reaches >1m/s in front of the trash racks. As (migratory) fish follow the main flow of the river during downstream migration, these have 3 optional routes: the weir, the turbine or the fish pass/bypass. Survival of turbine passage at low-head HP's is strongly related to the chance the fish will be struck by guide vanes and runner blades of the turbines, which is related to the length of the fish.

As migrating sturgeon (upstream and downstream) will mainly use the mainstream of the Rhine and the Waal, passage of the 3 hydropower plants along the Meuse and Nederrijn is not likely and the potential impact shall be small. For sturgeons passing one of the hydropower plants, there will be no/little impact if the sturgeon goes efficiently over the weir and/or can find the fish bypass.

Regarding the development of regulations for sturgeon in relation to cooling water withdrawals and hydropower, this amounts to the addition of 'the sturgeon' as a species in existing regulation and policies in The Netherlands (WFD, Natura 2000, policies on cooling water withdrawal and hydropower).

3. ANNEX C: Reintroduction of the European sturgeon in the Lower Rhine – *strengths, weaknesses, opportunities and threats*

3.1 Introduction

As part of our assignment to present a Sturgeon Action Plan for the (lower)Rhine at the end of 2019, we conducted over 20 discussions with directly involved partners and stakeholders in the period October 2018 – January 2019. Together with the Sturgeon Taskforce we have selected the key partners and stakeholders from a detailed and extensive network overview. We have strived to make at least 2 interviews with partners and stakeholders where we might face a potential bottleneck in a possible reintroduction of the sturgeon.

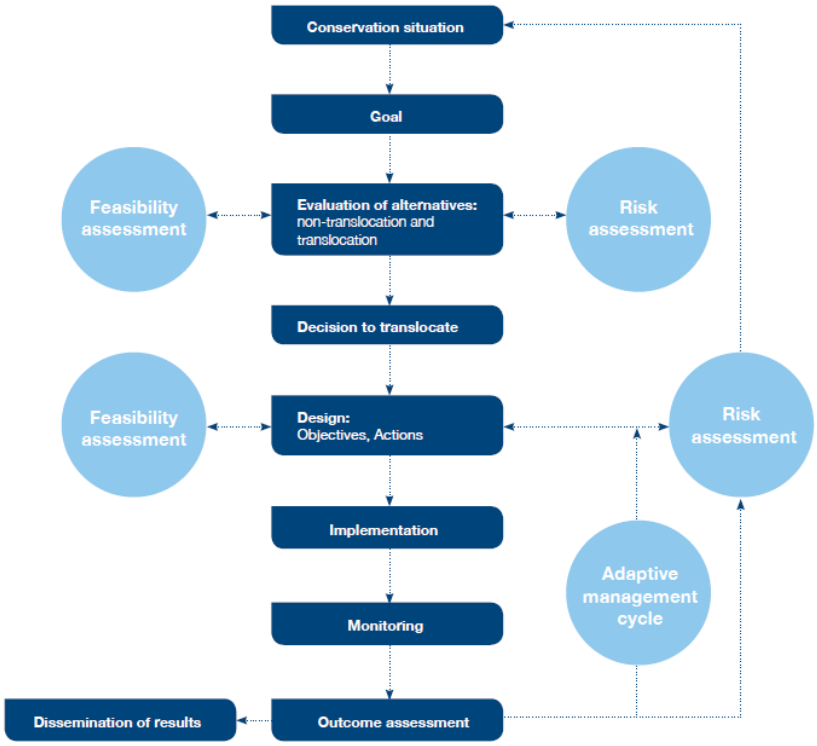
The aim of this round of interviews was twofold: (1) To create awareness, involvement and support of the stakeholders and (2) to portray opportunities and bottlenecks.

The Sturgeon Action Plan for the (lower) Rhine will provide a clear overview of the strengths, opportunities and threats in the eventual reintroduction of the European sturgeon. Both the opportunities and the threats are substantiated based on scientific analysis (literature), knowledge and experience from other river basins and *Joint Fact finding* with all relevant partners involved.

The interviews were conducted on the basis of a selection of questions based on a SWOT analysis. The results of the SWOT analysis are incorporate in the Sturgeon Action Plan and are summarized in this annex.

In the ' IUCN guidelines for reintroductions and Other conservation translocations ' A clear figure has been included which clearly reflects what information we collected with the SWOT analysis. The left part of the figure is about *Feasibility Assessment* (suitability of the current Rhine for the sturgeon). The right part deals with information about *risk assessment* (what are the current, surviving threats that still need to be addressed in order to give the Sturgeon a real chance in reintroduction). With the SWOT analysis, we focused on the risk's assessment

part: enumerating where the most important remaining threats are and finding solutions with the help of the responsible stakeholders.



3.2 Overview of the interviews

Organisatie	Naam
IGB	Jorn Gessner (telefonisch overleg in april 2019)
NRW	Peter Beeck
Ministerie van Infrastructuur en Waterstaat	Marc de Rooij
Ministerie van LNV	Wilmer Remmelts
Ministerie van LNV	Anne-Marie Svoboda
Provincie Gelderland	Lucas van Eijsden
Provincie Zuid-Holland	Jan Willem Rijke
Provincie Noord-Holland	Ad Stavenuiter
Provincie Utrecht	Jose Huismann
Rijkswaterstaat Oost Nederland	Luc Jans
Rijkswaterstaat Oost Nederland	Margriet Schoor
Rijkswaterstaat West NL Zuid	Nick Schoone
Netviswerk Beroepsvissers	Arjan Heinen
NL Vissersbond	Johan K. Nooitgedagt
VisNed	Wouter van Broekhoven
Cascade (zand & grindwinning)	Leonie van der Voort
EWA, Nederlandse Vereniging voor Energie uit Water	Piet Ackermans
Havenbedrijf Rotterdam	Robbert Wolf
Koninklijke BLN-Schuttevear	Marleen Buitendijk

VEMW	Roy Tummers
Waterrecreatie Nederland	Marleen Maarleveld
Watersportverbond	Ronald Geertzen

3.3 SWOT analysis

	Helps to achieve the goal	Hinders reaching the target
Internally **(within your own organization)**	• Are you known/unfamiliar with the current (international) policy around Sturgeon and other protected migratory fish? • Is there a valid policy I.R.T. (expand) Trek fishing? If so, what does this policy look like? • Is there specific policy aimed at the Sturgeon? • What is the ambition to reintroduce Sturgeon in the NETHERLANDS? • Does the sturgeon introduction help your organization achieve certain goals/ambitions?	• What internal threats do you see in a possible re-introduction of Sturgeon in NL? • Where do the core tasks of your organization collide with the occurrence of reintroduced sturgeon? • If there is no policy the IRT expand Trek fish, why not? • If there is no ambition attn reintroduction sturgeon in NL, why not?
External **(Outside your own organization)**	• Are you known/unfamiliar with the current (international) policy around Sturgeon and other protected migratory fish? • What opportunities do you see in a possible re-introduction of Sturgeon in NL? • What (external) targets will be achieved with a possible re-introduction of Sturgeon? • What goals/measures/projects can the Sturgeon as an icon kind help as a catalyst?	• What external threats do you see in a possible re-introduction of Sturgeon in NL? • Which external parties will see a possible re-introduction of Sturgeon in NL as a threat? • …

3.4 Summary of conclusions of the SWOT analysis

The discussions were conducted on the basis of a selection of questions based on a SWOT analysis of "opportunities and bottlenecks". The results of the discussions are summarised in an anonymous manner in this summary.

3.4.1 Opportunities (internal, within your own organisations)

Positive attitude

Enthusiasm and positivity characterise most reactions to a possible future reintroduction of the sturgeon. It is even seen as "icing on the cake" when it comes to fish migration policy goals. Others support the idea of reintroducing the European sturgeon, but it is not actively promoted. Finally, a number of parties support a possible reintroduction, but then integrally in combination with other river functions, such as energy extraction.

Releases

There is still a willingness and support for future experimental releases. An exemption was granted in 2012 and 2015, and the latter is still valid. In one province, the sturgeon is an iconic species. If there is a plan to be reintroduced, this is also supported, and thus the species is on the icon list.

Policy

The Pan-European action plan adopted by the Berne Convention is being more widely shared to start an internal discussion about this. There is also the intention to identify and approve the initiative of the Dutch reintroduction plans in the long term in their own plans, but they have not yet made this their own objective. The WFD policy of two parties is aimed at offering as much passage as possible to migratory fish (in particular Salmonides) in the national waters, inter alia through fish passages and fish-friendly lock management such as the Kier. In addition, they focus on habitat improvement that also benefits migratory fish. The construction of fishing-free zones, 250 m where no fishing is allowed in the vicinity of dams, bridges, etc., is currently a proposal that is coming up. The future *Programma Integraal Rivier Management* is also seen as the successor to *Ruimte voor de Rivier*. According to the government, the program should be set in 2020. The Minister wants to set up and implement the program together with inland shipping, sand and gravel extraction and nature organisations. Provinces collaborate intensively on fish migration trajectory within the RBO Rhine-West partnership (route map fish migration Rhine-West, connection main water system with regional water system). There is no objection from shipping if the sturgeon would return. Relationship with provincial policy: spatial planning, tourism, recreation and nature development, also in the area of the main water system. In the context of the *Wet Natuurbescherming*, the province designates that part of the *Natuur Netwerk Nederland* (NNN) must be protected and connected.

Ecology

Harmful anti-fouling paints have been banned for many years. A study states: sufficient spawning habitat is present in NRW, but there is almost no spawning habitat in the Netherlands. The Netherlands is important as the main fish migration stream (raising and moving sturgeons to spawning grounds) and maturation areas (groynes, secondary channels, perpendicular groynes). Recovery brackish zone is important for acclimatisation migratory fish.

Sand and gravel extraction projects create water. They convert land (often agricultural land) into swamp/wetland areas. As soon as there are opportunities (PR, corporate social responsibility) to link the reintroduction of the sturgeon to their projects, there is certainly a willingness to work together more. This sector is open to assist in the construction of design criteria that are specifically relevant to sturgeon. Wherever possible, donations are made with developments that promote nature and habitat in the lower river area.

Extraction of cooling water along the large rivers: flow velocity at inlets is low (max. 0.3 m/s, mandatory) and sturgeons, including young sturgeons, can swim away from it. Gratings that prevent suction are also mandatory. Perhaps there are good connection possibilities with the ongoing development of tidal nature in the port area: in particular the Groenepoort-noord project (near Maassluis) and Groenepoort-zuid project (Rozenburg) lend themselves to this because it lies in the brackish tidal zone. There are more tidal nature parks under development (including Eiland Brienenoord). They can act as stepping stones, perhaps also for the migrant sturgeon. Work is also being done on a plan for redesigning hard quays and banks. The best measures for this are now being sought.

Fish passages & Lock management

The adaptation of fish passages, a potential bottleneck that has arisen earlier, is not recognised because sturgeons are expected to migrate only via the main stream of the Rhine. Both migratory fish and recreational boating must be able to pass water constructions such as locks and dams; this is a common interest.

Sustainability

Rotterdam no longer has the largest port in the world (currently no. 10), but it does want to become the "best port" in the world. Best in terms of sustainability (energy transition, nature development, living environment). Dutch fisheries are known for their certification and sustainability. Almost all fishermen from the Netherlands are certified sustainable and would like to stay that way.

Fishing

Certification means that there are strict rules with regard to protected fish and their by-catch, such as porpoises, seals, sharks and rays. The policy and the rules for catching a sturgeon are known. Catch at sea is reported, but not when fish are caught on inland waterways. Reports are passed on in a digital registration system from LNV (*Visserij Registratie en Informatie Systeem*, VIRIS). Modern alternatives to beam-trawl fishing include the pulse trawl that scares the flatfish through electrical pulses. Advantages: less fuel consumption, no seabed turning, less by-catch. It is very unfortunate that European decision-making has (temporarily) put an end to this. Fishing does not seem to be a major bottleneck for sturgeon, according to the sector organisations. It is a strong fish that can survive catch and release.

3.4.2 External opportunities (outside your own organisations)

Policy

Pan-European action plan was approved by the Standing Committee of the Bern Convention on 30 November 2018. Agreements for further roll-out have been made. The EC (DG ENV) wants to make some adjustments to include the Pan-European sturgeon action plan as Species Action Plan under the Habitats Directive (1st half of 2019). The sturgeon is already included in Appendix 4 of the N2000 and is therefore already a target species for the N2000 along the Rhine, along with salmon, sea trout and shad. Some people in The Netherlands are afraid of what we are losing (identity, individuality), and uses these sentiments to discuss the sturgeon, for example. Everything that has to do with nature is politically sensitive. A smart strategy is needed here. The sturgeon may possibly benefit from the WFD measures currently being implemented and still being planned in the main water system. The province is the competent authority for approving N2000 management plans for the part of the area that is not owned by the government. The Delta waters are State property, so there is no role for the province. Possibly there is a role for the province in terms of permit issuer for excavations along the major rivers.

Response of the Minister of LNV to parliamentary questions about fishing around the Haringvliet dam: (1) No intensification of fishing took place on the sea side of the Haringvliet locks. On the contrary, a substantial reduction in fishing has taken place since 2011; (2) The data currently available do not indicate that there is a large-scale problem at the HV that requires additional fishing restrictions in addition to the cross-compliance rules that are already in force.

The fishing sector is and remains well informed of the applicable rules. The degree of acceptance of these rules can also be considered average to good and there is strict supervision of compliance through good cooperation between the MIK (*Maritiem Informatie Knooppunt*, formerly the enforcement desk) of the *Kustwachtcentrum* (KWC) in Den Helder and the NVWA.

A manual has been drawn up for an assessment method for cooling water extraction with regard to the impact on fish and the EQR scores from the WFD.

Salmon and Sturgeon

The sturgeon has a life cycle similar to that of the salmon, so the sturgeon may benefit from measures taken by RWS for salmon, among other things. Re-introduction of the sturgeon fits in with the ambition to achieve a sustainable healthy water environment. Possibly there will be the same positive effect as the salmon as an iconic species.

Threats

Fish mortality due to ship propellers is a well-known phenomenon, but there are good developments, including Fishflow innovations. Development of fish (sturgeon)-friendly hydropower.

Development of a new generation of weirs in which all functions are performed proportionally: water management, shipping, fish migration and energy extraction.

3.4.3 Internal threats (within your own organisations)

Policy

Ministries do not have a supplementary policy when it comes to re-introduction of sturgeon and there is also no intention to actively release. With the main water manager there are in principle no ambitions with regard to the sturgeon; if the sturgeon is present, then it falls under the WFD policy.

Active attitude

Provinces do not see a direct active, initiating role when it comes to the reintroduction of new species. Actively releasing sturgeon is not always possible for others.

Financing

Financial support will be a challenge because it will require long-term investments.

Ecology

The dredging policy is aimed at dredging just as much as dumping into deeper places. Dredging will not be removed from the river system. There are therefore fewer deep pits due to the flattening. The deep wells in the main stream of the river are important for the sturgeon as a resting place during spawning, but certainly also for other fish species. A Dutch spawn habitat study is currently being conducted by Ravon, including mapping the deep wells. Possibly the most important ones deserve better protection/attention. RWS observes that more and more catfish are swimming around in the river area; the sturgeon might also experience competition. The catfish has an effect on all species.

Nuisance from noise due to the busy Rotterdam-Germany shipping route (on some routes on the Waal there are more than 110,000 passages per year, which corresponds to on average a ship passing every 5 minutes 24/7). The extent to which sturgeons are sensitive to noise must become clearer.

Will the sturgeon soon be leading to additional quality requirements for surface water and therefore even more demanding permits? This is a concern for industrial water users, partly as a result of the discussion about pyrazole and GenX.

Animals sucked up during sand and gravel extraction: this is rare, this has not been measured nor are there any known incidents. The sand and gravel extraction sector will not be happy to cooperate if the implementation of the business is endangered.

Risk of collision damage and propeller damage to the fish. There is possible damage due to ships' propellers in recreational boating, but that will be disproportionate to commercial shipping. We have to learn more about this; what is the impact and how quickly can innovations solve this?

Fishing

Sturgeons caught as by-catch do not always survive, despite the fact that it is a strong fish. The Dutch fishing sector faces a large number of challenges. There are serious concerns about its future. Possible reintroduction of the sturgeon is not the main focus. If the sturgeon necessitates extra measures and investments, this will create resistance from coastal fishing.

Ports

Reintroduction of the sturgeon must not lead to extra (expensive) measures in the port area or hinder the operational management of the port. Port basins themselves will not be adapted quickly for nature or biodiversity. These remain busily navigated basins with hard

banks. Trust is needed that a reintroduction of a new species such as the sturgeon will not lead to major legal processes and that the risks can be handled.

Agreements on the gap decision with regard to the freshwater supply should not be extended if the sturgeon swims again in the lower river area. Include in AP as a precondition. There is an open attitude towards the permanent eastern supply, so that there is more fresh water for the lower edge and therefore more room to make gaps. If the re-introduction of the sturgeon fits in with the picture "best port", that is great in terms of communication.

Others

There is a negative image due to damage to fish caused by hydropower. Will adjustments to water constructions prevent recreational boating?

3.4.4 External threats (outside your own organisations)

Image of the sturgeon

Some parties are getting too far ahead of themselves. Don't present the sturgeon too much as an emotional icon. This causes irritation among fishermen, among others. A number of federal states in Germany in particular are concerned about the sturgeon's return (adapting fish ways, costing a lot of money), despite repeated communication that this care is not necessary, because the spawning grounds are located in undisrupted parts of the Rhine.

Shipping threats

Does the noise of ships create an obstacle? A strategy is being developed to promote cleaner and, in time, also quieter ships. An active policy on this is not yet being pursued.

Fishing threats

It has been found that the obligation to release salmon and sea trout, in particular among many sports fishermen, is unknown (70%, IMARES 2008). Fish mortality as a percentage is relatively high with recreational and sport fishing compared to fish mortality due to by-catch in professional fishing, IMARES, 2008.

Climate change threats

Climate development could lead to more frequent low water and higher temperatures. This seems to be more positive for the Rhine, according to (preliminary) studies. A new impulse for Integrated River Management (IRM) is gaining attention. According to those involved, there should be more focus on raising the dyke than on river widening and nature development. The nature organisations in the Netherlands are paying attention to this. Design requirements for fish are also being considered.

Rhine basin threats

Results of research into whether sturgeon can live in the Rhine basin
Are the spawning grounds easily accessible and suitable for maturation?
Seals eat the salmon, but do they also eat sturgeon? (no research has been done)
Contaminated water bottoms: more frequent low water due to low drainage.

Physical threats

Whereas in the east of the Netherlands hydropower in the rivers may be an issue, in South Holland it may be tidal turbines in the Brouwersdam, Haringvlietdam and Oosterscheldekering. These turbines may be fish-friendly, but does that also apply to a sturgeon that is several meters long? This only has a possible impact at the Haringvliet locks, as the other basins are not connected to the river.

Physical obstruction of sturgeon migration by hydropower: negative impact of a dam/weir on river dynamics and direct damage to fish by turbines.

4. ANNEX D: Legal Framework

4.1 Legal status of the European sturgeon under international nature conservation treaties and the EU Habitats Directive

The sturgeon has more or less the highest possible protected status imaginable for a wild animal species. This is not only because the species is protected under a large number of international conventions and the EU Habitats Directive, but also because the species has been given the most extensive protection within each of these systems. Under three of the four treaty systems examined, the sturgeon has also received substantial attention in 'soft-law' documents, such as recommendations or resolutions. Only the contracting parties to the Rhine Treaty have very little attention for the sturgeon.

The status of the sturgeon under the Berne Convention, the Bonn Convention, the OSPAR Convention, the Rhine Convention and the EU Habitats Directive and the main consequences of this status are discussed in Section 2 of the report and have been summarised in Table 1 below (columns 2 and 3). Attention is also paid to the relevant recommendations and resolutions (column 4) and to the question whether/where the relevant components have been incorporated into Dutch law.

Table 1 - Overview of the legal status of the sturgeon: relevant listing, applicable prohibitions and obligations, adopted recommendations, resolutions and guidance documents and transposition into Dutch law

Legal system	Status	Treaty articles and consequences	Recommendations, Resolutions, Action Plans, etc. ('soft-law' instruments)	Implementation of Dutch legislation
Berne Convention	**Annex II** with extra attention because the sturgeon is a migratory species (see e.g. Article 10).	**Area protection:** Duty to take appropriate and necessary legislative and administrative measures for the protection of areas (4(1) and 4(3)).	**Recommendation No. 41 (1993)** on the protection of freshwater fish' recommends parties to "consider the need to establish captive breeding and re-introduction programmes for endangered fish species, using established scientific guidelines."	**Area protection:** Via Natura 2000 and the implementation of this regime in the Nature Protection Act (Ch.2). However, the Action Plan in particular calls for a broader commitment, e.g. to restore potentially suitable habitats where species do not yet exist.
		Species protection: Obligation pursuant to Article 6 to take appropriate and necessary legal and administrative measures for the special protection of Appendix II species, including specific prohibitions similar to Article 12 of the Habitats Directive and relating to individual specimen of the species concerned. Exceptions are possible under Article 9, also for repopulation and re-introduction.	**Recommendation No. 127 (2007**) established the first 'Pan-European Action Plan for Sturgeons', which was replaced by the 'Pan-European Action Plan for Sturgeons' in 2018 with the adoption **Recommendation No. 199 (2018)**. Intended in Action Plan: to reduce catches and by-catches from the wild, to restore populations, to protect existing habitats and to restore potentially suitable habitats in key rivers, to remove obstacles to migration, to monitor,	**Species protection:** It is partly covered by the implementation of the Habitats Directive (species protection) in the Nature Protection Act (Ch.3) but proper implementation and effectiveness of the Action Plan requires a broad interpretation of prohibitions.
		International cooperation: Parties are required "to co-ordinate their efforts for the protection of the migratory species specified in Appendices II and III whose range extends into		**International cooperation:** it could be argued that this duty should be expressed more explicitly in the Nature

		their territories" (Art. 10(1)). Art. 11(1)(a) also contains a more general obligation to cooperate if this would enhance the effectiveness of the measures taken.	to combat illegal trade, to educate and to evaluate the implementation of the Action Plan.	Protection Act. Active efforts of the Dutch government are required.
		Research: Duty to encourage and coordinate research activities related to the objective of the Convention (Article 11(1)(b)).	**Reintroduction:** According to the Action Plan, population recovery requires, among other actions, that "reproduction and release programmes are in place and being implemented." Concerns, among other things, a continuous and science-based release programme with monitoring. Priority: 'High'. Primary responsible actors: "National ministries; Scientific institutions (technical and advisory support)."	**Research:** Monitoring provisions are relevant; active efforts of the Dutch government are required.
		Reintroduction: "Each Contracting Party undertakes: a) to encourage the reintroduction of native species of wild flora and fauna when this would contribute to the conservation of an endangered species, provided that a study is first made in the light of the experiences of other Contracting Parties to establish that such reintroduction would be effective and acceptable" (Article 11(2)(a)).		**Reintroduction:** The principle obligation to reintroduce (art. 11(2)) is (wrongly) not explicitly included in the Habitats Directive and the Nature Protection Act. The wording in the Hab. Dir. is weaker and Art. 3.34(5) of the Nature Protection Act only regulates the competence to issue an exemption from the prohibition to release animals in the wild. Active efforts of the Dutch government are required.
Bonn Agreement There is no special daughter agreement or MOU for the European sturgeon.	The European sturgeon has been listed on **Appendix II** (COP6 (1999)) and on **Appendix I** (COP8 (2005)) (double listing has been made possible in Art. IV (2) of the convention.	**Area protection:** Article III(4) states: "Parties that are Range States of a migratory species listed in Appendix I shall endeavour: a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction; b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and c) […]	**Resolution 7.7** (2002) "*Calls upon* CMS Party Range States of sturgeons listed in CMS Appendices to take the lead to develop an appropriate CMS instrument on sturgeons." In general terms, the importance of concluding these agreements has been reiterated several times, for instance in Resolution 12.8 (2017). **Collaboration:** **Resolution 7.7** (2002) also calls for cooperation, including with the CITES Convention system.	**Area protection:** No specific transposition. Partly covered by the implementation of the Habitats Directive (Natura 2000) in the Nature Protection Act. Art. III (§4), however, requires a broader commitment, e.g. through efforts to restore potentially suitable habitats where species are not yet present.
		Species protection: Art. III(4) states: "Parties that are Range States of a migratory species listed in Appendix I shall endeavour: a) […] b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; Art. III (5) states that Range States of an Appendix I species "shall prohibit the taking of animals belonging to such species." Exceptions may be made under		**Species protection:** Partly covered by implementation of the Habitats Directive (species protection) in the Nature Protection Act (art. 3.5). However, the obligation of Art. III (4) is broader than the sum of the specific prohibitions in Art. 3.5. Furthermore, Article 6(2) of the Habitats Directive only applies to N2000 sites. The implementation

		certain strict conditions.		therefore does not seem to be fully comprehensive.
		International cooperation: Art. IV (3) obliges Parties that are Range States of an Appendix II-species to "endeavour to conclude AGREEMENTS where these should benefit the species and should give priority to those species in an unfavourable conservation status." According to Art. IV (4), this obligation may also apply to cross-border sub-populations.		**International cooperation:** It could be argued that this obligation should be incorporated more explicitly in the Nature Protection Act. Active efforts of the Dutch government are required.
		Research: The conduct of research on migratory species is a general obligation under Art. II(3)(a). Various mandatory components of agreements (Art. V) also relate to research.		**Research:** Monitoring provisions are relevant. Active efforts of the Dutch government are required.
		Reintroduction: No explicit obligation, but Art. V(5)(g) states in respect of 'daughter agreements" under the Bonn Convention: "5. Where appropriate and feasible, each AGREEMENT should provide for but not be limited to: [...] g) where it appears desirable, the provision of new habitats favourable to the migratory species or reintroduction of the migratory species into favourable habitats." However, no such agreement has been concluded for the sturgeon.		**Reintroduction:** Depends on the content of daughter agreements but see above: this issue has received little attention in the Nature Protection Act.
OSPAR Convention	Since 2003, the European sturgeon has been on the **OSPAR List of Threatened and/or Declining Species and Habitats** (the OSPAR list; Agreement 2008-6). This is an instrument to support the implementation of **Annex V to the Convention.**	**Annex V, Art. 2(a)** requires the contracting parties to take the "necessary measures to protect and conserve the ecosystems and the biological diversity of the maritime area, and to restore, where practicable, marine areas which have been adversely affected." This obligation has been worked out in Recommendation 2014/1 (see column to the right).	Het **2009-background document** for the sturgeon states: "Depending on the availability of brood stock, Contracting Parties in whose territory *A. sturio* is considered native, should aim at establishing appropriate restocking programmes (as *e.g.* Germany is currently undertaking)." Marine Protected areas should also be designated. The OSPAR Commission adopted in 2014 the 'OSPAR **Recommendation 2014/1** on furthering the protection and conservation of the common or European sturgeon [...]', which was based on the 2009-background document for this species. MPA	No specific transposition. Partly covered by the implementation of the Habitats Directive (Natura 2000 and species protection) in the Nature Protection Act, but recommendations for the designation of MPAs go a little further than what the Nature Protection Act requires. Active efforts of the Dutch government are required.

			designation, monitoring and other measures are called for. **Reintroduction** is not mentioned in this Recommendation.	
Rhine Convention 1999	There is no system for granting special protection status to species under the Rhine Convention.	"The sustainable development of the Rhine ecosystem is one of the objectives. Explicitly includes 'protection of populations of organisms and species diversity, as well as reduction of pollution of organisms with harmful substances' (Article 3(1)(b)). To this end, the Contracting Parties shall be guided by principles listed in Art. 4, including the precautionary principle (Art. 4). To achieve the aims and in the light of the principles "the Contracting Parties undertake […] 5. to initiate the necessary actions in their territory to implement decisions taken by the Commission in accordance with Article 11 (Art. 5(5)).	One of the objectives of the 'Rhine 2020' action programme is to improve the Rhine ecosystem by restoring ecological continuity and protecting intact spawning grounds and habitats for juvenile fish as well as revitalising suitable habitats for fish in the tributaries covered by the programme on migratory fish. A master plan for migratory fish was adopted in 2009 and 2018 (update), but no ambitions for the European sturgeon were formulated. The focus is on removing migration barriers and on a few species (salmon, eel). No measures or decisions of the Commission for the Protection of the Rhine, on the protection of the sturgeon are known.	No specific transposition.
EU Habitat Directive	**Annex II:** species for which Natura 2000 must be selected and designated	**Area protection:** Member States must select and designate on the basis of Art. 4 and the criteria of Annex III to the Habitats Directive.	A non-binding **EU Species Action Plan** can be developed but this instrument has not been used for the European sturgeon.	Art. 2.1 Nature Protection Act. No areas have been designated by the Netherlands for the sturgeon because it is assumed that the sturgeon is not present in Dutch territory.
	Art. 6: the protection regime for Natura 2000 sites	Requirement to take conservation measures to achieve the conservation objectives (6(1)), the obligation to prevent deterioration of the site and significant disturbance (6(2)) and plans and projects may only be allowed if there is no reasonable scientific doubt that there will be no significant effects on the site (6(3)). Exception to 6(3) may be made in accordance with strict conditions of 6(4).	The Eur. Commission gives guidance on the interpretation of Art.6 in its guidance notice "Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC" (Nov. 2018).	Art. 2.2 - 2.10 Nature Protection Act.

	Sturgeon has been identified as a **priority species (*)**	**Extra strict regime for priority species:** For plans and projects, an extra strict regime applies for allowing exceptions to Art. 6(3): see article 6(4), last sentence.		Art. 2.8(5) Nature Protection Act.
	Annex IV: Species that are the subject of a strict protection system	**Species protection** Each specimen of a sturgeon enjoys protection from the prohibitions of Art. 12. Exceptions may only be allowed if the strict conditions of Art.16 are fulfilled.	The Eur. Commission gives guidance on the interpretation of Art.12 and 16 in its guidance notice "Guidance document on the strict protection of animal species of Community interest under the 'Habitats' Directive 92/43/EEC" (Feb. 2007)	Art. 3.5 Nature Protection Act.
		Reintroduction Art. 22(1) requires Member States to "(a) study the desirability of re-introducing species in Annex IV that are native to their territory where this might contribute to their conservation, provided that an investigation, also taking into account experience in other Member States or elsewhere, has established that such re-introduction contributes effectively to re-establishing these species at a favourable conservation status and that it takes place only after proper consultation of the public concerned." This obligation "to study" is a too weak implementation of Art.11(2)(a)) of the Berne Convention (see above).		**Reintroduction:** The principle obligation to reintroduce under Art.11(2)(a)) of the Berne Convention (see above) is (wrongly) not explicitly included in the Habitats Directive and the Nature Protection Act. The wording in the Hab. Dir. is weaker and Art. 3.34(5) of the Nature Protection Act only regulates the competence to issue an exemption from the prohibition to release animals in the wild.
		International cooperation: Preamble: "Whereas it is recognized that the adoption of measures intended to promote the conservation of priority natural habitats and priority species of Community interest is a common responsibility of all Member States."		**International cooperation:** No specific transposition. See also above.

4.2 Legal status of the Action Plan for Sturgeons, adopted under the Bern Convention

The Action Plan was adopted with a recommendation from the Standing Committee under the Berne Convention and is formally not legally binding, however, the Plan may be considered as an interpretation of the binding provisions of the Convention, as is indicated by the references to these provisions in the preamble of the Recommendation and in the Action Plan itself (reference is made in particular to Articles 1(2), 3 and 4(1)). This makes the Action Plan legally relevant and this relevance is further increased because the Action Plan also implements legal obligations of other legal systems that apply to the European sturgeon. For example, the preamble of OSPAR Recommendation 2014/1 on furthering the protection and conservation of the common or European sturgeon (*Acipenser sturio*) refers to the Action Plan and, according to section 3.1, OSPAR contracting parties must consider implementing this Action Plan. Consequently, although this recommendation itself is not legally binding, the recommendation and the Action Plan therefore also fulfil the obligations under the OSPAR Convention (in particular Annex V). A similar reasoning applies to the Bonn Convention. In fact, it seems that the Berne Action Plan have been a reason for contracting parties not to develop a separate agreement on the sturgeon under the Bonn Convention, while the sturgeon's situation should be considered as particularly appropriate for such a subsidiary agreement. This underlines the importance of proper implementation of the Action Plan as an

instrument to achieve the objectives and obligations of the Bonn Convention. As the EU is also a party to the Berne Convention and the Bonn Convention and the Habitats Directive is an important instrument for the implementation of these conventions, the implementation of the Action Plan is also an important tool to comply with the Habitats Directive's obligations with regard to the European sturgeon.

The measures described in the Action Plan can therefore be seen as an important indication of how a contracting party, such as the Netherlands, can fulfil the relevant obligations of the aforementioned treaties. The legal relevance of the Action Plan for a state is further enhanced if that state can play a central role in the recovery of a critically endangered species, e.g. because of the location of major threats, important ecological opportunities for recovery within its territory, etc. In such cases, it must be considered reasonable to 'reverse the burden of proof': if such a contracting party would not (or would not be willing to) implement the Action Plan or parts of it, it is up to that contracting party to explain and motivate how the obligations under the conventions and Habitats Directive are fulfilled.

4.3 Consequences of protected status before and after reintroduction

4.3.1 Species protection law

The species protection regimes as discussed in paragraph 2, including the strict prohibitions of the Habitats Directive and the Bern Convention, apply to every individual specimen of the European sturgeon within its natural range. According to the European Commission, the concept of natural range should be interpreted broadly: "When a species or habitat spreads on its own to a new area/territory or when a species has been re-introduced into its former natural range (in accordance with the rules in Article 22 of the Habitats Directive), this territory has to be considered part of the natural range" (Guidance document strict species protection, 2007, p. 11). This means that the species protection law applies both to, for example, a sturgeon from the French Gironde that visits areas under Dutch jurisdiction and to a sturgeon that has been reintroduced into the wild in the Netherlands (or elsewhere) for the purpose of restoring or building up a population. The applicability of the species protection law is therefore not substantially different before and after reintroduction, but whereas in the situation before reintroduction only a few specimens (e.g. from the Garonne) receive protection, after reintroduction there will be many more protected specimens.

As far as the specific species prohibitions and exceptions are concerned, the Dutch legislation is in line with the above since Article 3.5 of the Nature Protection Act applies to all species in Annex IV of the Habitats Directive, Annex II of the Berne Convention and Annex I of the Bonn Convention. The European sturgeon is included in all these annexes, which, for various reasons, gives it the protection afforded by Article 3(5).

In view of the heavily protected status and the assessment as 'critically endangered' on the IUCN European Red List, it is worth noting that the European sturgeon has not been placed by the Netherlands on the official Dutch Red List for fish. This is because the Dutch Red List system differs from the IUCN system in terms of the assessment criteria that are used. Unlike the IUCN system, the Dutch system requires a species to reproduce in the Netherlands or to have done so in the past. This criterion does not do justice to the intention of the Red List for migratory species that do not reproduce in the Netherlands but for which the Netherlands is of great importance during other stages of the life cycle. It is important to review this system, not only for the sturgeon but also for other fish species, such as eel, and other migratory species.

4.3.2 Area protection law (Natura 2000)

As far as area protection law is concerned, the Natura 2000 regime of the Birds and Habitats Directives is most relevant as most provisions on area protection of the international conventions are considered to be implemented in the EU through the Natura 2000 regime. The selection and designation of Natura 2000 sites under the Habitats Directive is based on

the requirements of Article 4 and criteria of Annex III to this directive. This system, as implemented by Member States, focuses strongly on existing ecological values: habitat types and species that are 'present' within the Member States. Consequently, in the Netherlands no areas have been designated for the European sturgeon (the situation before reintroduction). Examination of the designation history, management plans and the Alterra study for the purpose of updating Standard Data Forms (SDFs) for the existing Natura 2000 sites also shows that the sturgeon have not received explicit attention during the designation process, the elaboration of the management for the sites and the updating of SDFs.

This approach may be considered legally defensible due to the strong focus of the Natura 2000 designation system on habitat types and species that are actually present in a country; however, the approach may also be criticised in view of the strong emphasis of nature conservation conventions and the Habitats Directive on restoring habitat types and species in a favourable conservation status. This particularly applies to the European sturgeon in view of its highly protected status, the content of the Action Plan for sturgeons under the Berne Convention, and in particular the explicit attention given within the Convention's systems for the restoration of potential habitat. Such arguments strongly support the view that the Natura 2000 selection and designation process should also consider areas that may be essential for the return and recovery of the sturgeon.

One would expect that sturgeon habitats would qualify for protection under the Natura 2000 regime soon after reintroduction to support the success of the reintroduction program, however, for a reintroduced species, the Netherlands (and possibly also other Member States) raises the bar for applying area protection much higher. According to the Dutch government a 'new' or returning (previously extinct) species is only 'present' in the Netherlands after the species has established a self-sustaining population. For determining this, the Netherlands applies a ten-year criterion: a species is present again when the species has reproduced naturally for a time period of at least ten years. This requirement has ensured that for the otter - a species that got extinct in the Netherlands in 1988 and was reintroduced in the Wieden-Weerribben around 2004 and soon had a healthy population – still no Natura 2000 sites have yet been designated. The criterion does not arise from the Habitats Directive and could lead to two obstacles for applying the Natura 2000 regime in the benefit of recovery and protection of the European sturgeon:

- As indicated in this report, the reproduction process of the sturgeon takes a very long time. After reintroduction, the first natural reproduction may only take place after 15 years, and if a further 10 years-period has to be applied, no Natura 2000 network sites will be protected for the sturgeon for a period of 25 years or more.
- It is even likely that after reintroduction the sturgeon will not have spawning grounds in the Netherlands but more upstream, which may not allow for natural reproduction in the Netherlands. Application of the above criterion would result in a situation that the Netherlands will never select and designate Natura 2000-sites for the European sturgeon as the species is not considered 'present' in the Netherlands.

On the first issue, it should be noted that the long postponement of site protection described above is not consistent with the obligation to ensure that the sturgeon will recover and reach a favourable conservation status. Waiting for the species itself to prove that it can build up a healthy population must be judged contrary to the objectives of the conventions and the Habitat Directive and the relevant soft-law instruments discussed in the report. After all, these regimes assume that the protection and restoration of areas is essential in order to enable the species to build up a healthy population.

On the first point, it should be stressed that, in order to make an effective contribution to the restoration and protection of the sturgeon, area protection will have to follow the sturgeon's life pattern and cannot be limited to the spawning grounds.

Especially in view of the very poor condition of the European sturgeon, there is urgency, which is also reflected by the international treaty systems, in particular Article III (4) of the Bonn Convention and the Action Plan for sturgeons under the Bern Convention. For instance, the action to '[i]identify habitat restoration possibilities' is one of the actions to be implemented by States Parties in the short term and with high priority. In order to comply with all obligations, the Dutch government should therefore abandon the above discussed ten years criterion.

4.4 Legal status of European sturgeons in the North Sea

In the past, the North Sea was part of the habitat of the Rhine sturgeon sub-population. It is not clear how long sturgeons have used Rhine spawning grounds after 1900, but it is clear that at the beginning of the twentieth century several hundred sturgeons from the Rhine system were still being caught in the North Sea. However, even after the extinction of the Rhine sub-population, professional fishermen have regularly caught a European sturgeon in the Dutch part of the North Sea, also in recent decades. These are probably specimens from the sub-population of the French Gironde delta.

This continuing occurrence of the species in the Dutch North Sea could be an argument for the statement that the European sturgeon as a species has never really disappeared from the Netherlands and is still present in legal terms, although critically endangered. The specimens originate from another sub-population, but they belong to the same species *Acipenser sturio* and the Dutch North Sea is part of the natural range of this sub-population. This interpretation would have two main legal consequences:

I. Because the species continued to occur in the Netherlands - even if in very small numbers - the Natura 2000 site designation should not be postponed on the basis of the above discussed 10-year criterion;
II. The release of juvenile sturgeons in the Netherlands to improve the conservation status of the European sturgeon does not formally qualify as 'reintroduction' but should be considered 'regional reintroduction' or 'population restoration'. This would mean that it is not the Minister of Agriculture, Nature and Food Quality but the relevant provinces that would be the competent authorities to grant exemption from the prohibition of Article 3.34(1) of the Nature Conservation Act regarding the release of animals into the wild.

In view of these consequences, it seems important to get clarity on the question whether this interpretation is correct or not.

4.5 'Passive protection' of occurring sturgeon specimens or also 'active efforts' to restore European (sub)populations of this species?

In order to achieve the objectives of international treaties and the EU Birds and Habitats Directives, not only passive protection (prohibitions with exceptions) but also active recovery is required. The Netherlands is obliged to make an active contribution to restoration on the basis of the treaties discussed and the Habitats Directive. Within the Dutch legal system, this obligation is addressed to the provinces. For example, Article 1.12(1) of the Wnb states that the provinces must ensure that measures are taken to ensure that bird species, species listed in Annex IV of the Habitats Directive, Annex II of the Berne Convention and Annex I of the Bonn Convention, and Red List species are brought to and maintained at a favourable conservation status. The Province of South Holland has taken this obligation seriously and has placed the sturgeon on the provincial list of iconic species to ensure that the sturgeon receives special attention in the active species policy. However, at international and European level, the central government should be held accountable for the proper fulfilment of its treaty and EU obligations, including the result (restoration to a favourable conservation status) sought by Article 1.12(1).

4.6 Obligation to reintroduce the sturgeon?

On the basis of the legally binding and supporting documents examined, it is concluded that the Netherlands has an obligation to investigate the possibilities of reintroduction of species that have got extinct. It is also concluded that if this possibility exists because all preconditions are fulfilled, the government is obliged to initiate reintroduction. This follows in particular from Article 11(2)(a) of the Berne Convention, which has been implemented in the Habitats Directive in weaker wording and is missing in the Dutch Nature Conservation Act. The Berne Convention states: "Each Contracting Party undertakes: (a) “to encourage the reintroduction of native species of wild flora and fauna when this would contribute to the conservation of an endangered species, provided that a study is first made in the light of the experiences of other Contracting Parties to establish that such reintroduction would be effective and acceptable.”

This obligation to reintroduce also stems from the various soft-law documents on sturgeons under the different treaty systems. This concerns the more general statements on sturgeon population recovery but particularly also the more specific texts on sturgeon reintroduction in, for example, the 2009 background document for the European sturgeon under the OSPAR Convention: “Depending on the availability of brood stock, Contracting Parties in whose territory *A. sturio* is considered native, should aim at establishing appropriate restocking programmes (as *e.g.* Germany is currently undertaking)" (p.12). Under the Bern Convention, this duty is explicitly addressed in Recommendation No. 41 (1993) on the protection of freshwater fish (see §2) and, specifically for the sturgeon, the 2018 Action Plan for sturgeons states that "Science-based continuous release of offspring to recover historic population structure" must be given high priority by the responsible government.

In view of the above, it is striking that in the Netherlands initiatives to prepare for the reintroduction were not taken by the government, but mainly by civil society organisations. However, it is interesting to note that in 2015 the Dutch government has announced the reintroduction of the European sturgeon as a component of the implementation of the EU Marine Strategy Framework Directive (the Marine Strategy for the Dutch part of the North Sea 2012-2020 (2015), p. 16).

4.7 Conditions and authorisation requirements for re-introduction of the European sturgeon in the Netherlands

The re-introduction of the sturgeon in the Netherlands may involve several approval requirements and related conditions:

- For a reintroduction permit under Article 3.34 of the Nature Conservation Act, conditions must be met relating to the importance of the reintroduction for the recovery of the species and to the likelihood of the effectiveness of the reintroduction. In the case of reintroduction, the Minister of Agriculture, Nature and Food Quality is the competent authority and will probably apply the policy document 'Policy on reintroductions of animals' (2008) when assessing a permit application. If an application meets the criteria laid down therein, it will also be assessed in the light of the IUCN guidelines. From an international and European law perspective, it is clear, however, that the criteria set out in the 2008 policy document will not all have the same weight. In view of the treaty obligations discussed above, the need, urgency and chance of success of reintroduction in order to prevent full extinction in Europe must be decisive and not, for example, socio-economic interests;
- CITES implementing legislation (EU regulation) must be respected if the specimen to be reintroduced is imported from a foreign country;
- An assessment in accordance with Article 6(3) of the Habitats Directive must be conducted to determine whether the reintroduction of the sturgeon may have negative effects on existing Natura 2000 sites. According to case law of the EU Court of Justice, the concept of ‘project’ must be interpreted broadly, and the

reintroduction of a species is most likely covered by this concept. can also be covered by this concept. Whether the reintroduction of the sturgeon can jeopardise the achievement of the conservation objectives of existing Natura 2000 areas requires ecological expertise. The competent authority is the province in which the relevant Natura 2000 site is located.

In addition to nature protection law, the Dutch Animals Act is also relevant to ensure proper care for the health and welfare of the animals to be released during the various phases of the project. In principle, the provisions of the 1963 Fisheries Act do not apply to the European sturgeon, with the exception of Article 17 of the Fisheries Act. This provision states that the release of any species of fish into a water requires a written consent of the holder of the right to fish.

4.8 The European sturgeon as a test case for the effectiveness of nature conservation law and the position of the Netherlands

This research shows that the European sturgeon is the most endangered and most protected species in Western Europe, however, the discussions also make clear that the species does not yet really benefit from this protected status. In order to protect the European sturgeon from total extinction in the wild and to make it part of its original range, a great deal of action is needed. Much work has already been done to improve water quality and remove migration barriers, but because of the natural characteristics of the species (e.g., long life cycle) and the disappearance of almost all sub-populations, long-term deployment through reintroduction and population restoration is necessary. At the moment, the efforts of The Netherlands and many Contracting Parties to the conventions under discussion do not seem to be actively aimed at this.

Under the Bonn Agreement, for example, the relevant contracting parties did not respond to the call-in resolutions for a legally binding daughter agreement to be concluded for sturgeon species. It seems that contracting parties prefer to give substance to the protection of the European sturgeon under the Berne Convention, in particular through the implementation of the Action Plan for sturgeon, updated in 2018. OSPAR Recommendation 2014/1 also calls for the implementation of this Action Plan. If – given their scope and content - treaty obligations can be fulfilled by implementing an Action Plan adopted under another treaty, this is not in itself a problem, however, the question is whether the 2018 Action Plan will actually be implemented.

This implementation in good faith of the Action Plan is uncertain, for instance because of the lack of action in relation to the reintroduction of the sturgeon in the river Rhine, one of the most promising and important rivers for reintroduction. It is particularly striking that the sturgeon is hardly receiving any attention under the Rhine Convention. It is important to note that all contracting parties to the Rhine Convention are also contracting parties to the Berne Convention. Active involvement in the recovery of the European sturgeon under the Rhine Convention would therefore be a logical interpretation of the obligations of these states and the EU under the Bern Convention, as well as of the obligations of the other treaties (Bonn and OSPAR).

This brings us to the position of the Dutch government. This study makes clear that the internationally threatened and protected status of the sturgeon is clear, but that this is by no means the case under Dutch policy. The sturgeon is regarded as a species to which the prohibitions of Section 3.5 of the Nature Protection Act apply. The sturgeon is regarded as critically endangered on IUCN's Red List but is not on the Dutch Red List due to the application of the Dutch government's requirement that a species must reproduce in the Netherlands in order to qualify for a Red List status. The obligation for the provinces, laid down in Section 1.12(1) of the Nature Protection Act, to bring the species referred to in that paragraph into a favourable conservation status does apply to the European sturgeon because this species is listed on the relevant appendices to the Habitats Directive and the

Berne and Bonn Conventions. The Province of Zuid-Holland has therefore rightly placed the sturgeon on the list of iconic species. However, the sturgeon is not seen as a species for which Natura 2000 areas must be designated, not even in order to make areas suitable for the return and recovery of the European sturgeon. Even after a successful reintroduction, the sturgeon will not be protected under the Natura 2000 regime in the coming decades if the government were to apply similar criteria to those applied to otters. However, in terms of policy, the sturgeon is seen as a target species for certain Dutch natural habitat types. The European sturgeon is also mentioned in plans for the implementation of the EU Marine Strategy Framework Directive and in the progress report under the Biodiversity Convention (CBD) the sturgeon is mentioned as one of the species for which the Netherlands is committed to protection.

This forms a confusing picture that is at odds with the heavily protected status of the sturgeon and the related international and European obligations that the Netherlands has for this species. The sturgeon is too much the victim of policy criteria that are counterproductive from the point of view of the objectives and provisions of the conventions and the Habitats Directive. Possibly even more problematic is that the Dutch government - apart from this legal policy noise - adopts a passive attitude towards the sturgeon. There is good cooperation with WWF, ARK Nederland and Sportvisserij Nederland, but the active efforts are left entirely to these NGOs. In view of the very unfavourable conservation status of the species and the sum of obligations under international and European law discussed in this study, it goes without saying that the Dutch government should take an active stance to prevent the species from becoming extinct in the wild in Europe and has a fair chance of recovery.

4.9 Recommendations

The study and above summary may be translated into various recommendations for different actors. Without the intention to be complete, attention is requested for the following recommendations:

1. Contracting parties to the conventions discussed above should take note of the explicit attention that the European sturgeon has received within these legal regimes in the past and reconfirm their commitment and take concrete action to implement the discussed obligations and adopted recommendations and resolutions, in particular the Action Plan on sturgeons under the Berne Convention;
2. Research indicates that the Rhine is particularly suitable for reintroduction of the European sturgeon and for taking other measures that have been recommended in the Berne Action Plan. Given the status of the species as critically endangered and the fact that all contracting parties to the Rhine Convention are also a contracting party to the Berne Convention, it is fair to conclude that the Rhine bordering countries have a special responsibility for the implementation of the Action Plan for sturgeons. In light of this special responsibility, it is striking that the European sturgeon has received no serious attention under the Rhine Convention, contrary to all other treaty systems discussed in this study. It is therefore recommended that the contracting parties to the Rhine Convention put the recovery of the European sturgeon on their agenda as a priority;
3. It is recommended to examine and discuss the Dutch commitment to the recovery of the European sturgeon in the short term. This discussion could also be used to revisit the criteria for Red Listing of migratory species, such as the European Sturgeon, as well as the criteria for designating Natura 2000-sites to support the recovery of this species;
4. The continuing occurrence of the species in the Dutch North Sea could be an argument for the statement that the European sturgeon as a species has never really disappeared from the Netherlands and is still 'present' in legal terms, although critically endangered. The specimens originate from another sub-population but belong to the same species *Acipenser sturio* and the Dutch North Sea is part of the natural range of this sub-population. In view of the legal consequences of this

interpretation, it is recommended to get clarity on the question whether this interpretation is correct or not;

5. In view of the urgency of the matter, it is recommended not to postpone any concrete action in favour of the recovery of the species. In parallel with the wider legal and policy debate, it is necessary to take concrete action to implement the Action Plan for sturgeons and particularly to start a sound re-introduction programme. Promising in this respect are:
    - the fact that in the Netherlands such a program has in 2015 been announced as component of the implementation of the EU Marine Strategy Framework Directive and
    - the fact that the Province of South-Holland has selected the European sturgeon as one of its iconic species to receive special/active protection.

It is hoped that this report may contribute to a better protection and recovery of the European sturgeon. In fact, the species put the system of international, European and national nature conservation law to the test: if even for this highly protected species under many conservation regimes the efforts of governments are ultimately limited and depend on voluntary commitment by non-governmental organisations, fundamental questions would arise about the effectiveness of nature conservation law.

5. ANNEX D: Vienna Declaration on Global Sturgeon Conservation

5.1 Vienna Declaration on Global Sturgeon Conservation

Preamble

Sturgeons and Paddlefishes (Order Acipenseriformes) comprise 27 species of which the vast majority are endangered (see IUCN Red List), while several of these species have reached critical status. This situation calls for more coordinated and concise action to prevent the species from extinction while at the same time sturgeons in this context also serve as umbrella species for other faunal elements that are affected by the same drivers. Sturgeons are excellent ambassadors for habitat related conservation approaches due to the fact that they utilize various habitats during the completion of their life cycle. A consequent protection of habitats for sturgeons will evoke restrictions on the utilization of rivers, coastal and marine waters and the resources associated to them, but these will benefit all faunal elements.

The World Sturgeon Conservation Society (WSCS) published the RAMSAR DECLARATION ON GLOBAL STURGEON CONSERVATION in 2005 outlining the guiding principles for measures urgently needed to ensure the future of sturgeons. To meet the persisting and emerging challenges in sturgeon conservation, the 8th International Symposium on Sturgeons (ISS 8) held from September 10th to 16th, 2017 in Vienna with a participation of about 300 sturgeon specialists from 32 countries felt the need to re-iterate, update and partly revise the key recommendations affecting the effectiveness of conservation management while at the same time emphasizing the requirement to apply best practice when planning or implementing activities to:

1. protect and preserve sturgeon species as emblematic flagship or umbrella species on biodiversity conservation for future generations;
2. account for the need for long-term and adequately resourced sturgeon conservation measures supported by improved governance frameworks;
3. protect and restore rivers as dynamic, disturbance driven systems. Their hydro morphology and ecosystem services depend upon intact functionality as well as longitudinal/lateral connectivity;
4. ensure that attempts to restore and protect sturgeon populations to effective control and combat fraud and illegal, unregulated and unrecorded catch and trade while at the same time supporting sustainable aquaculture as an alternative mode of production of sturgeon commodities.

To serve these targets aiming at increased effectiveness of conservation and restoration of sturgeons, the ISS 8 developed the following recommendations for consideration by the respective sturgeon range states, regional and international agencies dealing with species conservation.

On behalf of the WSCS Board of Directors, of WWF International, the ISS8 Scientific Advisory Committee as well as the ISS8 participants

Neu Wulmstorf and Vienna, April 12th, 2018

Recommendations

Habitat Quality and Restoration

Habitat protection, river regulation, flood protection, and inland navigation

Recommendation 1: Recovery measures through *ex situ* conservation and re-stocking programs require urgent and vigorous *in situ* protection and habitat restoration measures: (a) all spawning habitats of Acipenseriformes must be identified and effectively protected through national and eventually international legislation; (b) the legal frameworks such as the EU Habitats Directive as well as Conventions such as RAMSAR, Biological Diversity, Bern, Oslo-Paris, Helsinki, Bucharest, and Barcelona must be fully implemented to effectively enhance the conservation status of the species through improvements of their different habitats.

Recommendation 2: Flood protection and inland navigation infrastructure have to be planned in an integrated fashion aiming to maintain to the greatest extent possible the natural hydrodynamics as well as to ensure connectivity and functionality of ecosystems. Infrastructure projects that have not been designed in such an integrated fashion must not be implemented.

Damming

Recommendation 3: New dams on sturgeon and paddlefish rivers should not be constructed. However, if unavoidable, they must be designed with state-of-the-art mitigation measures, such as properly designed passage facilities accommodating free upstream and downstream migration of all life phases of sturgeons (adults up to several meters long as well as fragile early life phases), other faunal elements, as well as permit sediment transport. Furthermore, these measures must also protect habitats and benthic communities in the upstream and downstream sections. Design considerations must incorporate climate change effects, anticipating the dynamic changes in precipitation patterns (e.g. extreme floods and extreme droughts) over a time horizon of at least 50 to 80 years, further reducing the proportion of the flow available for energy generation.

Recommendation 4: Dams have eliminated sturgeon spawning and overwintering habitats in river sections upstream or downstream of the installations. The existing facilities have to be retrofitted with structures for effective fish protection and passage both upstream and downstream (for early life phases and adults)***.*** Other dam impacts, for instance, on sediment transport and discharge (e.g. out of season peak discharge, hydropeaking, changes in temperature regime) require mitigation as well. Side channels with at least 30% of the flow under any conditions would massively reduce the impact of such facilities.

Recommendation 5: Where the construction of efficient fish passage is not viable as a result of the low capacity of the existing facilities, the removal of such facilities must be considered.

Recommendation 6: Prioritization of conservation and mitigation measures on sturgeon rivers should be applied at catchment level to maintain the ecological functions and to ensure the highest feasibility and the lowest adverse impact of technical infrastructure.

Fisheries Management

Recommendation 7: Fisheries management (e.g. planning, inspection, supervision, protection, and enforcement) and other conservation actions must be properly integrated at all levels to ensure that both aspects are adequately implemented by personnel with appropriate expertise and resources backed up by an efficient and integrated legal framework.

Recommendation 8: The legal prerequisites of fisheries regulations must reflect the dimension that poaching imposes on conservation efforts and on populations of long-lived species.

Therefore, substantial fines and/or custodian sentences have to be in place. The judiciary should be adequately informed about the context and implications of such offenses to ensure that substantial penalties are imposed.

Recommendation 9: Communities that traditionally relied on sturgeon fisheries for their livelihood have to be supported in generating alternative means of income in order to facilitate compliance with fisheries bans or harvest slots.

Recommendation 10: Fisheries researchers and managers are advised to rapidly develop and implement more selective harvesting methods, thereby preventing (or greatly reducing) the by-catch of sturgeons in fisheries for other target species.

Species Survival and Repositories

Recommendation 11: Preparation of activities to preserve the diversity of sturgeon populations outside of their natural habitat (*ex situ* conservation to save the remaining genetic heterogeneity and to develop potential brood stocks for sturgeon species that are on the brink of exHncHon) must receive priority and timely support in sturgeon rehabilitation programs.

Recommendation 12: Effective organization of *ex situ* stocks must be shared between range countries to reflect the joint responsibility for population management. This will also help to distribute associated costs of restoration as well as to reduce the risk of losses due to local negative events.

Restocking, Recovery and Re-introduction Actions

Recommendation 13: Stocking as a compensation measure is considered a temporary tool to overcome adverse environmental conditions causing recruitment failure or to initiate self-sustaining populations. A management structure at the national or regional level, according to the species distribution, must be established to coordinate the actions and standardize methods for reproduction, rearing and release.

Trade Control

Recommendation 14: Due to the detrimental impact of uncontrolled, illegal fishing on natural populations, the illegal trade in caviar, sturgeon meat and other products from sturgeons must be a focal area of enforcement actions both nationally, regionally, and internationally. Therefore, it has to include the provision of sufficient resources (including manpower, equipment, operational costs, etc.) for all relevant law enforcement agencies to effectively prevent sturgeon species from over-exploitation.

Recommendation 15: Responsible national authorities (e.g. CITES scientific & management authorities, customs, food inspections, law enforcement agencies) are requested to establish formal/informal inter-agency groups (with the involvement of scientific institutions, customs, police, and financial crime specialists) to develop common approaches and harmonized means of tackling illegal wildlife trade, supporting each other in the respective activities and backing up competencies in dealing with legal fraud.

Recommendation 16: Inspections in production and trade are to be carried out unannounced. They must use state-of-the-art techniques (e.g. DNA and isotope analysis) that are necessary to identify the species and origin and thereby guarantee effective monitoring of trade in caviar and other sturgeon commodities. This also needs to include caviar containers with CITES labels, as long as manipulations cannot be ruled out completely.
Recommendation 17: Close cross-border coordination of enforcement actions concerning illegal trade of sturgeon products is required to cope with international criminal networks.

Recommendation 18: Enforcement authorities should increase their attention to the presence and authenticity of labels in line with the latest CITES labeling systems. The professional preparation and the method of application of labels must be standardized at an improved level to prevent misuse and prevent loss of labels during packaging, transport, and storage. Also, the printing quality of the CITES codes should be improved to minimize fraud.

Recommendation 19: To ensure full acceptance in court cases, analytical methods should be harmonized using appropriate scientific and laboratory standards, preferably with regular inter-calibration exercises between laboratories performing DNA and other investigatory analysis.

Aquaculture

Recommendation 20: Sturgeon species produced by aquaculture operations should be routinely monitored in line with national or regional (EU) regulations as well as with regard to environmental compatibility and product safety. To identify and prevent illegal import or laundering of illegally caught fish through aquaculture, the production and trade of sturgeons requires specific monitoring and control measures within the aquaculture industry. To prevent negative interaction between farmed and natural populations/species (e.g. hybridization, disease transmission, misidentification in case of by-catch), effective measures to prevent escapement from the farms should be implemented.

Recommendation 21: The aquaculture industry involved in sturgeon production is strongly encouraged to collaborate in identifying tracking approaches to support enforcement authorities in trade control actions. It is suggested to establish tissue repositories identifying captive stocks to allow a more efficient and fast commercialization of legal sturgeon products.

Recommendation 22: Commercial farms, culturing sturgeons for consumer markets, may in exceptional cases be important partners in conservation programs to bridge the time-window until the required public infrastructure for *ex situ* conservation is in place. Those farms may become conditionally involved and receive support for maintaining publicly owned brood stock of sturgeon species at brink of exHncHon if the following prerequisites are fulfilled:

1. supervision of the rearing process is carried out under the national/regional conservation authorities implementing the sturgeon recovery programs;
2. the wild fish (until F2 generation) are not owned by the farm but belong to the national or regional sturgeon recovery program, and the farmer is held fully reliable for their availability and the appropriate documentation;
3. the breeders are selected for reproduction based on prior genetic analysis and an agreed upon breeding plan. The rearing of offspring is separated from production, implementing the recommendations on *ex situ* rearing;
4. utilization of the surplus production of progeny for commercial purposes must take into consideration the demand arising from restoration programs in the catchment before commercial use is permitted in a case-by-case decision by the coordinating body.

Policy Integration and Awareness-Raising

Recommendation 23: Public awareness will need to be raised in order to support and push for political action towards implementation of all the above-mentioned recommendations. The general public in sturgeon range countries should be made aware of the value of sturgeons to people and nature and their threat status. In particular, caviar consumers must learn how to avoid illegal products. Key stakeholders from various sectors need targeted information about sturgeon conservation. Awareness of key decision makers will have to be raised about the need for integrated policy responses and implementation of above-mentioned recommendations.

This document was presented to and discussed by the participants of the 8th International Symposium on Sturgeons (ISS 8) during the final session and finalized by correspondence through expert contributions.

Edited by:

- *Harald Rosenthal, President, World Sturgeon Conservation Society*
- *Joern Gessner, Treasurer, World Sturgeon Conservation Society*
- *Paolo Bronzi, Vice President, World Sturgeon Conservation Society*

With contributions from WSCS Board of Directors, WWF International, ISS8 Scientific Advisory Committee (SAC), namely by:

Marie-Laure Acolas (France), Jürg Bloesch (Switzerland), Stephanie Bolden (USA), Mikhail Chebanov (Russia), Leonardo Congiu (Italy), James Crossman (Canada), Thomas Friedrich, (Austria), Gertrud Haidvogl (Austria), Tim Haxton (Canada), JuQa Jahrl, (Austria), Irene Lucius (Austria), Raimund Mair (Belgium), Coleman O'Criodain (Kenia), Mohammad Pourkazemi (Iran), Ralf Reinartz (Germany), Stefan Schmutz, (Austria), Andrea Schreier (USA), Beate Streibel (Austria), Ekaterina Voynova (Bulgaria), Molly H. Webb (USA), Qiwei Wei (China), Amy Welsh (USA), Patrick Williot (France), and ISS 8 par5cipants during the Discussion Forum and Closing sessions.

5.2 The 2018 European Sturgeon Conference in Vienna – Key Messages

The overall objective of the Conference – jointly organized by Austria in the frame of the Austrian EU Presidency and the International Commission for the Protection of the Danube River – was to raise awareness to the challenges in place and to trigger comprehensive action for sturgeon conservation and restoration in the Danube Basin as well as at Pan European level. The Conference brought together 50 experts from national administrations, EU and international institutions, academia and NGO representatives, who can all potentially provide the long-term framework of action indispensable for the conservation of sturgeon stocks in Europe. All presentations, relevant background information including the agenda as well as a group picture of the Conference can be accessed here: https://danubis.icpdr.org/event/18288.

The Conference focused on the elaboration of key messages to decision makers in all relevant institutions as a basis for shaping future actions and the way forward for sturgeon conservation to save sturgeons from extinction. Out of the wealth of information received and by incorporating voices from all over Europe, Canada and United States over the two days of the European Sturgeon Conference, the following messages were identified which will serve as a basis for urgently required follow-up sturgeon conservation activities across countries and sectors on all relevant levels.

All Conference participants jointly convened on the following key messages of the European Sturgeon Conference:

- Autochthone sturgeon stocks are on the brink of extinction in Europe. However, the urgency for the needs of action is not properly reflected in the Annexes of the Bern Convention and the EU Habitats Directive respectively. Despite of this, tools are in place and urgent conservation actions are needed for all sturgeon species.

- Utmost need is given to urgently implement *Ex situ* facilities (i.e. *"facilities to save species from the threat of extinction and to maintain the genetic integrity and heterogeneity of a species or population under controlled conditions - IUCN 2013"*) given that these represent the last chance to conserve autochthone sturgeon species for re-establishment programmes in the Danube Basin. Ideally, three ex situ facilities should be set up downstream as well as upstream of Iron Gate. The absolute minimum

required would comprise two installations. In addition, there is further need for ex situ facilities in other regions as well.

- On top of the necessary investment costs, running costs are estimated to be in an order of magnitude of 0,5 – 1,5 Mio Euro per year and per ex-situ facility.

- The life cycle of sturgeons covers inland waters, estuaries as well as marine waters. Protection and connectivity of all sturgeon habitats in all these waters is a prerequisite to avoid interference in their natural habitat, secure their survival and to guarantee the success of re-establishing programs. The protection of sturgeon habitats necessitates the highest level of coordinated action and cooperation across and between countries and sectors.

- Enforcement of measures and sustainable results require a long-lasting stable financial framework. Countries, international institutions and organizations are urged to join efforts in securing sustainable financial frameworks as precondition to the preservation of sturgeons from extinction.

- Ecological connectivity is essential for ensuring the migration corridors for sturgeons. Further deterioration of existing and potential migratory corridors must be avoided. Up to date fish passage solutions are available. Further work is needed to improve the effectiveness of fish passage solutions.

- Inspiring examples for sturgeon action plans and successful implementation are in place. However, more efforts are needed in updating outdated sturgeon action plans or establishing new action plans reflecting latest scientific progress and needs for action. A Pan-European Sturgeon Action Plan under the Bern Convention and a Species Action Plan under the EU Habitats Directive would provide a coherent framework for coordinated actions and should urgently be developed and implemented.

- There exists a strong need for coordination amongst all relevant actors and across countries for a better integration of measures under implementation and for harmonized and effective approaches to monitoring and conservation measures.

- Countries, macro-regional strategies and EU institutions can play an instrumental role in securing a sustainable implementation and providing financial framework for sturgeon conservation. An enhanced engagement at all levels to save sturgeons from extinction is thus called for.

- Deep concerns were expressed about the level of enforcement on sturgeon fishing ban and illegal caviar trade activities, which constitute a severe threat to the future of sturgeons. These illegal activities represent a huge set - back for all conservation efforts and need to be rigorously addressed in particular by relevant competent national authorities with international support.

- Informing the public on all aspects of sturgeon conservation and requirements and promoting public awareness of the plight of the sturgeon is seen as an overriding need. Raising awareness to save sturgeons from extinction is crucial to getting long-term support from key target groups and relevant actors.

Figure 18 - Conference participants remain committed to engage themselves in their field of work, to promote the need for action and to raise public awareness to contribute to save sturgeons from extinction.

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