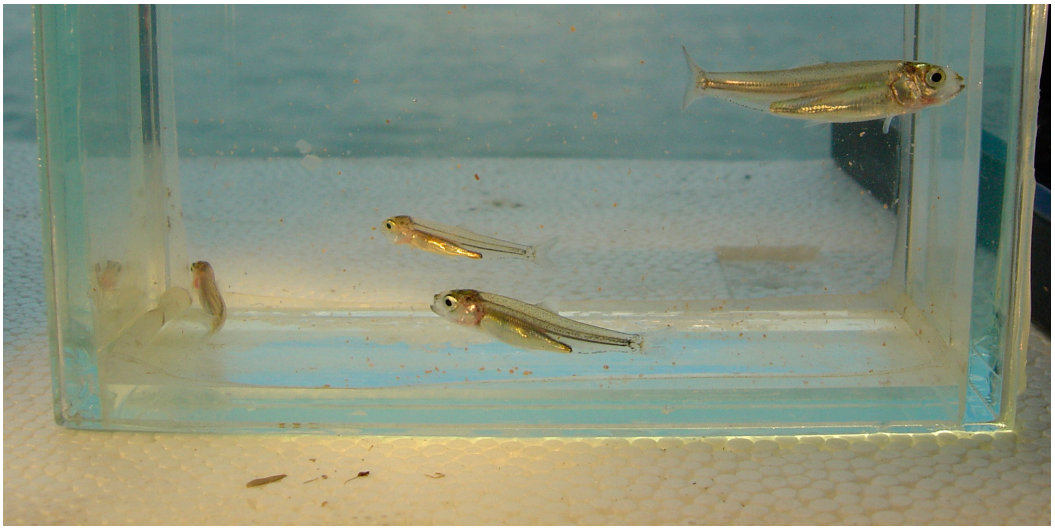
OSPAR COMMISSION

Background Document for Allis shad *Alosa alosa*



Biodiversity Series

2009

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l’Espagne.

Acknowledgement

This report has been prepared by Ms Amelia Curd (France). Thanks are also due for the contributions of Jean-Luc Baglinière, Peter Beeck, Ronald Fricke, Jan Haelters, and Sandra van der Graaf.

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Background Document for Allis shad *Alosa alosa*

Executive Summary

This Background Document for Allis shad – *Alosa alosa* - has been developed by OSPAR following the inclusion of this species on the OSPAR List of threatened and/or declining species and habitats (OSPAR Agreement 2008-6). The document provides a compilation of the reviews and assessments that have been prepared concerning this species since the agreement to include it in the OSPAR List in 2003. The original evaluation used to justify the inclusion of *Alosa alosa* in the OSPAR List is followed by an assessment of the most recent information on its status (distribution, population, condition) and key threats prepared during 2009-2010. Chapter 7 provides proposals for the actions and measures that could be taken to improve the conservation status of the species. In agreeing to the publication of this document, Contracting Parties have indicated the need to further review these proposals. Publication of this background document does not, therefore, imply any formal endorsement of these proposals by the OSPAR Commission. On the basis of the further review of these proposals, OSPAR will continue its work to ensure the protection of *Alosa alosa*, where necessary in cooperation with other competent organisations. This background document may be updated to reflect further developments or further information on the status of the species which becomes available.

Récapitulatif

Le présent document de fond sur l'*Alose vraie* (ou la *Grande Alose*) a été élaboré par OSPAR à la suite de l'inclusion de cette espèce dans la liste OSPAR des espèces et habitats menacés et/ou en déclin (Accord OSPAR 2008-6). Ce document comporte une compilation des revues et des évaluations concernant cette espèce qui ont été préparées depuis qu'il a été convenu de l'inclure dans la Liste OSPAR en 2003. L'évaluation d'origine permettant de justifier l'inclusion de l'*Alose vraie* dans la Liste OSPAR est suivie d'une évaluation des informations les plus récentes sur son statut (distribution, population, condition) et des menaces clés, préparée en 2009-2010. Le chapitre 7 fournit des propositions d'actions et de mesures qui pourraient être prises afin d'améliorer l'état de conservation de l'espèce. En se mettant d'accord sur la publication de ce document, les Parties contractantes ont indiqué la nécessité de réviser de nouveau ces propositions. La publication de ce document ne signifie pas, par conséquent que la Commission OSPAR entérine ces propositions de manière formelle. A partir de la nouvelle révision de ces propositions, OSPAR poursuivra ses travaux afin de s'assurer de la protection de l'*Alose vraie*, le cas échéant avec la coopération d'autres organisations compétentes. Ce document de fond pourra être actualisé pour tenir compte de nouvelles avancées ou de nouvelles informations qui deviendront disponibles sur l'état de l'espèce.

1. Background Information

Name of species

Alosa alosa (Linnaeus, 1758) Allis shad

2. Original Evaluation against the Texel-Faial selection criteria

List of OSPAR Regions where the species occurs

II, III, IV

List of OSPAR Regions and Dinter biogeographic zones where the species is under threat and/or in decline

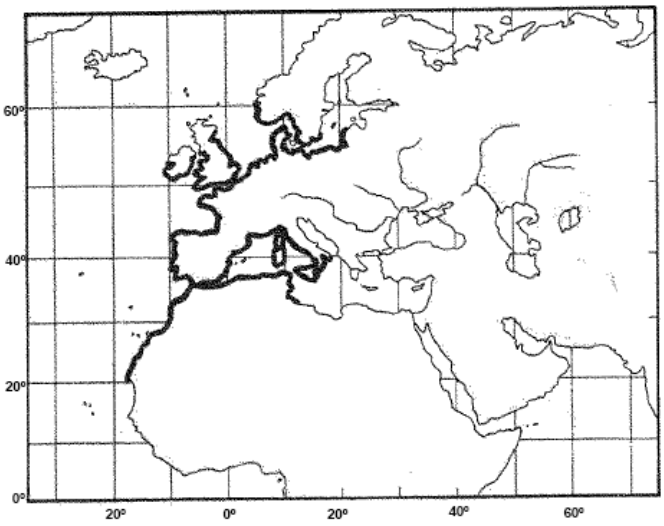
OSPAR Regions: II, III, IV

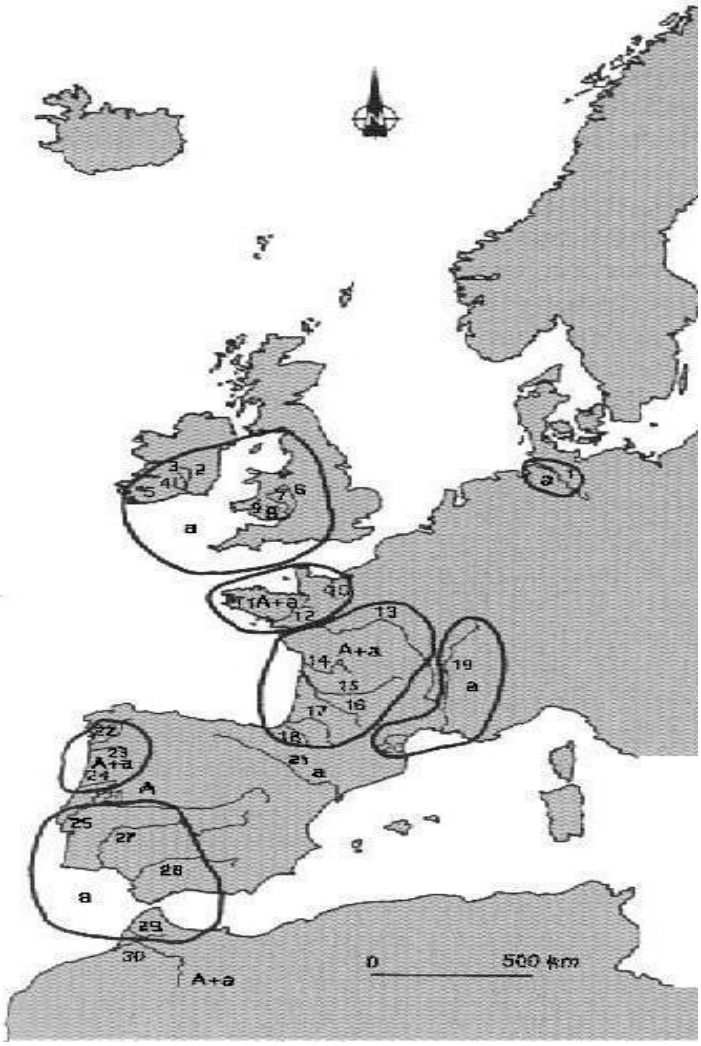
Dinter biogeographic zones: Warm-temperate pelagic waters, Lusitanean (Cold/Warm), Lusitanean-boreal, Boreal-lusitanean, Boreal, Norwegian Coast (West Norwegian), Norwegian Coast (Skagerrak).

Original evaluation against the Texel-Faial criteria for which the species was included on the OSPAR List

A.alosa was selected for inclusion on the OSPAR List on the basis of an evaluation of their status according to the Criteria for the Identification of Species and Habitats in need of Protection and their Method of Application (the Texel-Faial Criteria) (OSPAR 2003). The nomination for inclusion on the list cited the criteria decline and sensitivity, with information also provided on threat. It has been nominated for OSPAR Regions II, III and IV. Table 1 provides an update on this evaluation. The majority of threats to *A.alosa* in the OSPAR region take place on the inland waters used by the migrating fish. Dam construction is the primary menace, with poor water quality and river bed sand and gravel extraction from spawning grounds as secondary concerns. There is little information available on the distribution of this species in the maritime area.

Table 1: Summary assessment of *A.alosa* against the Texel-Faial criteria.

Criterion	Comments	Evaluation
Global importance	Eastern Atlantic: from Bergen (Norway) along the coasts of Europe to northern Mauritania in Africa. Also present in the extreme western part of Mediterranean Sea, although there is some doubt whether its distribution goes as far as the French coast as it is absent from the Rhône. Reported from the western part of the Baltic Sea up to the Kaliningrad Oblast. **Figure 1.** *A.alosa* native range (Whitehead, 1985)  	Qualifies
Regional importance	At present, the most successful spawning rivers are in western France and Portugal. Until the 19th century, the river Rhine had the largest population of *Alosa alosa. In Germany* 150 years ago *A.alosa* was the second most important commercial fish species in the Rhine, spawning in the lower and middle stretches of the river and in its main tributaries	Qualifies

	 **Figure 2:** The main rivers with spawning grounds for allis shad (*Alosa alosa*) (A) and twaite shad (*Alosa fallax, fallax* and *rhodanensis*)(a) along the Atlantic coast (Baglinière *et al*., 2000). No information on this distribution of allis shad at sea is presently available.	
Rarity	Twaite and allis shad were once widely fished in Europe, and were formerly eaten in Britain. In the Severn Estuary during the middle of the 19th Century, shad made up about one-third of all catches, with their value rivalling that of salmon. Both allis and twaite shad have declined across Europe and are now absent from many rivers where they once flourished and supported thriving fisheries. Allis shad are still caught and eaten in parts of France and some other European countries. Most fisheries have now collapsed due to construction of barriers to migration (Taverny *et al.*, 2000; Maitland & Hatton-Ellis, 2003).	Qualifies

Sensitivity	Shoaling species such as shad may be particularly susceptible to marine capture. A marine sample of 55 fish taken by one trawler on one day highlights this problem (King & Linnane, 2004). The sample was dominated by young allis shad, of a size smaller than that encountered in estuarine waters. Major loss of pre-spawning or virgin adult fish would be particularly damaging in the case of allis shad, shown to be predominantly semelparous. Marine interception may have even more widespread implications if mixing of shoals from different geographic areas, such as Ireland and Wales – south-west England, occurs at sea, as might be the case off the Irish southeast coast, although these shoals are likely to be dominated by twaite shad.	Qualifies -very sensitive
Keystone species	Not a species which has a controlling influence on any community within the OSPAR region.	Not applicable
Decline	In the first half of the 20th Century commercial shad catches of greater than 100 metric tonnes were recorded in the North and Baltic seas (Doherty *et al.,* 2004). But, allis and twaite shad populations have declined throughout Europe and most fisheries have collapsed (Maitland & Hatton-Ellis, 2003). Populations formerly existed in the Rhine and Elbe, but these are thought to be extinct due to pollution and obstructions to migration. It may now only breed in a few French and Portuguese rivers. There is no baseline, however, against which to measure this decline; the number of actual records for these species has increased significantly as a result of greater survey effort. Moreover, due to the very recent improvement in a number of rivers oxygen and pollution levels (Seine, Thames), the presence of spawning adults in several northern European rivers is increasing (Belliard, 2008; Colclough, 2002).	Qualifies -severely declined

3. Current status of the species

Distribution in OSPAR maritime area

Allis shad (*Alosa alosa*) are anadromous, and have a pelagic-sea life mainly inshore along the coast migrating to the higher, middle watercourse of rivers to spawn (Acolas *et al*., 2004).Originally, the distribution of allis shad extended to the Atlantic coast from Norway to Morocco. Currently, this species is classified as vulnerable in Europe because of the reduction in its distribution and the threats to its freshwater habitat due to dams, pollution and deterioration of the spawning grounds (Baglinière *et al*., 2003).

Rivers with functional or self-sustainable stocks were thought to be limited to western France and Portugal. However, recently there has been some evidence of recolonisation/recovery since the original evaluation of the species when it was first listed by OSPAR, mainly on rivers in north-west France (Maitland & Hatton-Ellis, 2003). Furthermore, recent studies on the distribution and richness of diadromous fish assemblages in Western Europe showed climatic change might be favourable to the development of allis shad population in the Seine watershed (Lassalle *et al.*, 2008; Béguer *et al.*, 2007; Rochard *et al.*, 2007), providing access to spawning areas within rivers is re-established. The pattern of an apparent northward shift in the distribution of fish species from southerly waters in OSPAR regions I-IV has coincided with recent warming trends in the North-east Atlantic (ICES, 2008).

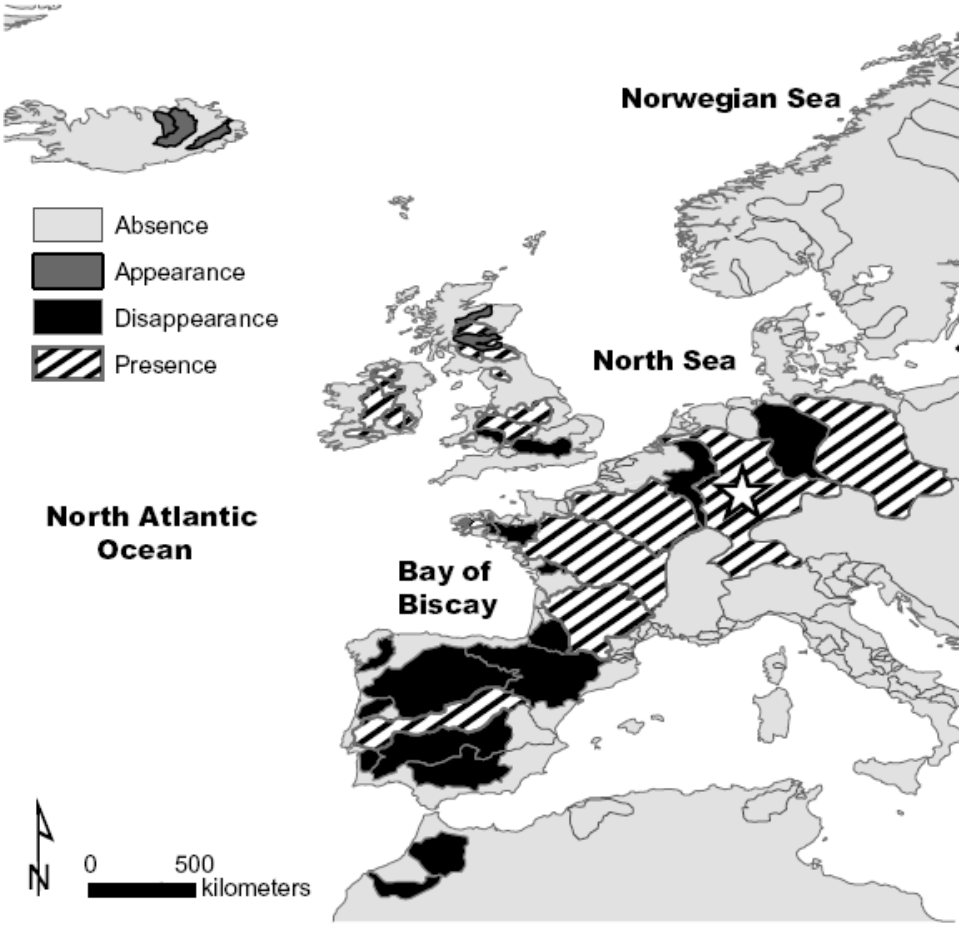


Figure 3 (Lassalle *et al.*, 2008) Potential distribution range of *A.alosa* under projected climate conditions at the end of the 21st century. The Rhine basin is shown with a white star.

Models for *A. alosa* (figure 3) projected that by 2100 there would be a decrease in suitable conditions in Morocco, Portugal (except for the Tagus basin) and Spain but a potential northward expansion into Scotland and Iceland. Under one of the most pessimistic emission scenarios, the 2070–2099 annual temperature in the Rhine basin is projected to be 3°C warmer than the 1900–1910 level. In this warmer environment, the Rhine basin remained suitable for *A. alosa* populations (Lassalle *et al.,* 2008).

Figure 4 is a map derived from the GIS data available on EIONET (European Topic Centre on Biological Diversity) where, in accordance with the provisions of Article 17 of the Habitats Directive, the EU25 Member States reported on the conservation status of all the species and habitats listed in the annexes of the Directive. No data on this species distribution at sea was made available and several countries did not submit shapefiles therefore the absence/presence depicted is inaccurate.

Population (current/trends/future prospects)

The impact of human activities has led to a drastic restriction and fragmentation of the distribution area of allis shad and has contributed to the placement of allis shad on the red list of threatened species in Europe (Table 1, adapted from Baglinière *et al*., 2003).

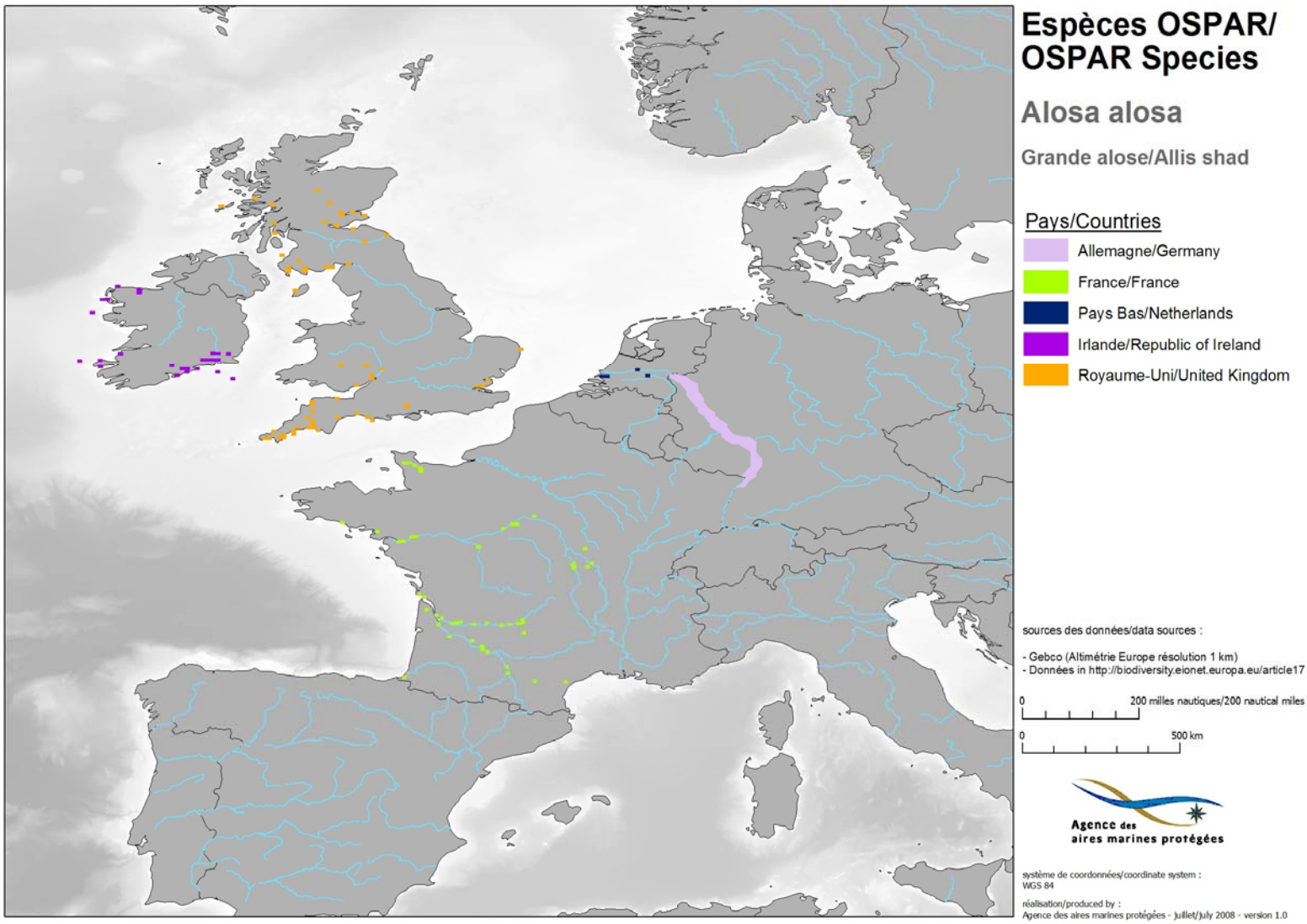


Figure 4: Map issued from Member States data submission to EIONET in accordance with article 17 of the EU Habitats Directive.

Under IUCN criteria, this species is classified as critically endangered (CR) in the HELCOM area, and as a HELCOM high priority species (HELCOM, 2007). The species is listed as critically endangered (CR) by Germany, and as endangered (EN) by Denmark. It was considered not applicable (NA) by Sweden since no reproduction occurs in Sweden.

The requirements of shads at sea are not known, but they appear to colonise mainly coastal and pelagic zones. Allis shad have been reported from depths of 10–150 m, and twaite shad from depths of 10–110 m, with a preference for water 10–20 m deep (Taverny 1991). Allis shad are almost exclusively planktivorous, whereas twaite shad also feed on small fish such as sprats, and this is likely to be reflected in their habitat selection. A suitable estuarine habitat is likely to be very important for shad, both for passage of adults and as a nursery ground for juveniles.

Table 1. Conservation status of allis shad by country in the eastern Atlantic Ocean and western Mediterranean Sea according to IUCN (1994) criteria (adapted from Baglinière *et al*., 2003). * 1) Sweden has not assessed this species (NA), but it is present (see Gärdenfors, 2005). 2) *Alosa alosa* is now critically endangered in Germany (Fricke, in press).

Conservation status	Criteria	Countries
Extinct	There is no reasonable doubt that the last individual has died.	Belgium, Luxembourg
Critically Endangered	Species is facing an extremely high risk of extinction in the wild in the immediate future.	United Kingdom, Ireland, Spain (Mediterranean Sea), Germany*
Endangered	Species is not critically endangered but is facing an extreme risk of extinction in the near future.	Denmark, The Netherlands, Portugal, Spain (Atlantic Ocean)
Vulnerable	Species is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future.	France
Not evaluated	Species has not been assessed against the criteria	Finland
Data Deficient		Sweden*

Twaite shad spawn in the downstream parts of rivers including estuarine zones, whereas allis shad always spawn in freshwater in the middle and upper parts of the river system, as observed in the Loire river (Boisneau *et al.*, 2000). When upstream migration is prevented, allis shad spawn in the lower part of the river on atypical sites or “forced sites” that may be different from the natural ones. This situation has two outcomes: (1) egg survival could decrease strongly in relation to the amount of fine particles deposited on the bottom; and (2) allis shad spawn on the same zones as those colonized by twaite shad, resulting in the hybridisation phenomenon between the two species (Baglinière *et al.*, 2003). Hybrids between the two species are known to occur in several rivers, and are thought to be indicative of a pressure, either in the form of low population levels or of restrictions, natural or man-made, preventing access to spawning (King & Roche, 2008). Where spawning grounds are clearly separated, there is generally no hybridisation.

Condition (current/trends/future prospects)

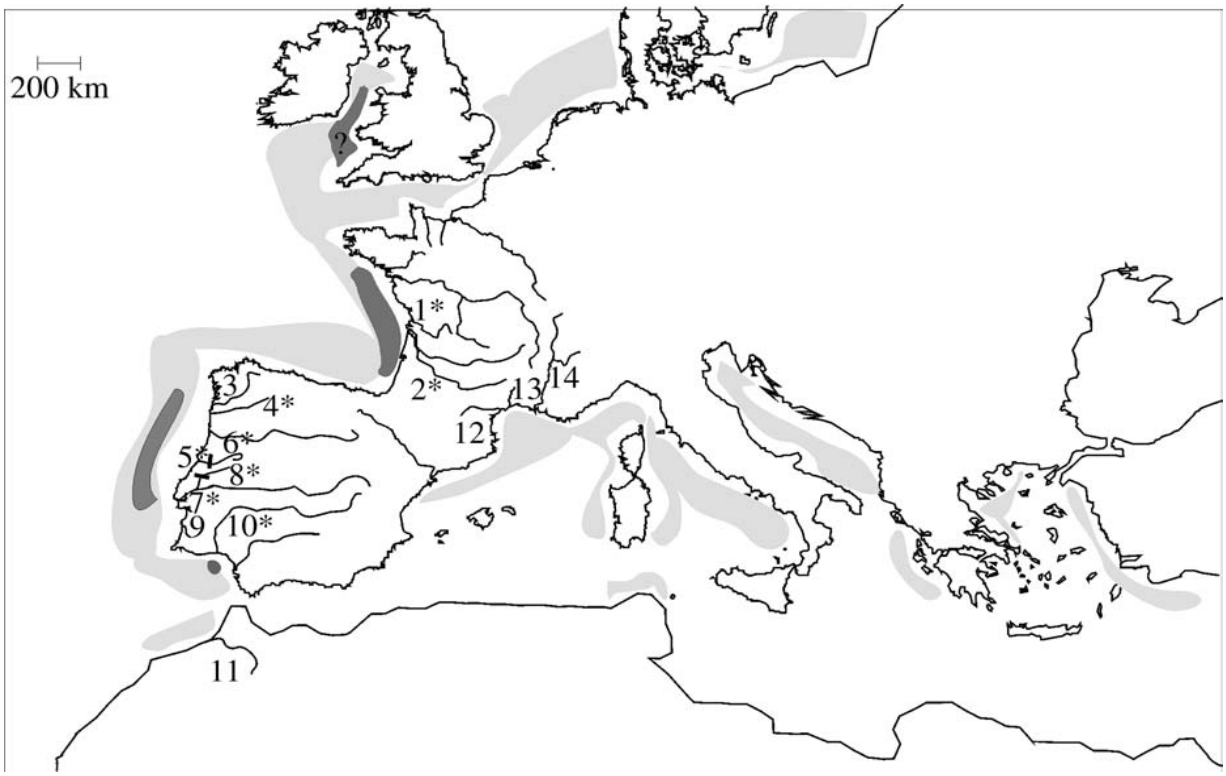


Figure 5. Taken from Alexandrino, 2006. Representation of the present confirmed distribution of spawning populations of Alosa fallax and Alosa alosa with the location of the 14 rivers studied. 1, Charente; 2, Garonne; 3, Minho; 4, Lima; 5, Mondego; 6, Aguieira (landlocked); 7, Tejo; 8, Castelo de Bode (landlocked); 9, Mira; 10,Guadiana; 11, Sebou; 12, Aude; 13, Herault; 14, Rhone. Alosa fallax were sampled from all locations except 2, 6 and 8. Alosa alosa were sampled from rivers marked with *. Hybrids were sampled from rivers 4 and 5. , Dams responsible for the isolation of the landlocked populations.

Figure 5 depicts, in dark grey, the confirmed distribution of spawning populations of allis shad. It seems possible that, since there are no known spawning populations of allis shad left in a number of OSPAR Contracting Parties, reintroduction programmes may be needed. However, given the widespread evidence of the recolonisation of rivers by shad in France and the Baltic, and the regular detection of individual allis shad ascending UK and Irish rivers, a preferred strategy would be to encourage natural recolonisation through the removal or alteration of barriers to migration. If reintroduction of allis shad were to be planned, it will be necessary to know the genetic characteristics between donor and native stocks. In France, the allis shad population is presently greater than that of the twaite shad.

Limitations in knowledge

Relatively little is known about the detailed ecological and habitat requirements of shads, and for this reason it is difficult to define and set absolute targets for favourable conditions based on science.

Information on shad harvest by coastal or offshore commercial fisheries is not easily accessible. As a general characteristic, commercial fisheries are not targeted at allis shad as Atlantic salmon, sea trout, eel (glass and adult), river and marine lampreys and twaite shad are caught according to the country, the geographical position and the fisheries regulations. The FAO reports on fishing statistics present

nominal catches of shad (Aprahamian *et al.*, 2003). Indeed, these data either underestimate or overestimate the catch and do not make the distinction between the two species of shad. It would therefore be more reliable to present data derived from local fishery surveys, but data is only available for a few river systems and no marine fisheries.

More research is needed on the biology and ecology of this species. In 2004 a new method for studying the genetic diversity of *Alosa* spp. by means of microsatellite markers (Faria *et al*., 2004) was developed, and this constitutes a useful tool for studies of population structure and gene flow between two closely related hybridizing species.

Large scale global issues have not been addressed by management plans, however in the context of global warming, basins that were suitable at the start of the 20th century could in the future become unsuitable as the result of climate changes. Continued work on predictive models could be useful as a preliminary tool to prepare long-term conservation plans on European, national and regional scales (Lassalle *et al.*, 2008).

4. Evaluation of threats and impacts

A summary of the key activities which can cause impacts to *A.alosa* is given in Table 2.

Table 2. Summary of key threats and impacts to *A.alosa*

Type of impact	**Cause of threat**	**Comment**
Obstacles blocking access to spawning grounds	Development: Building of dams and navigation weirs/lochs	Studies show that the number of obstacles significantly slows down their migration, making them arrive at an advanced stage in reproductive grounds or forcing spawning to take.
Poor water quality	Water pollution: sewage, pesticides/herbicides	This is particularly pronounced during the summer months. Twaite shad, being more carnivorous than allis shad and therefore having a diet which includes higher trophic levels, are more susceptible to bioaccumulation of Mercury (Lochet *et al*., 2008) and other contaminants. The difference in estuarine residence time between the juveniles of both species also makes twaite shad more susceptible to contamination.
Loss of substrate for spawning	Riverbed sand and gravel extraction	Although allis shads home to their natal river, it is not known if adults return to their natal gravels or the same gravels over which they may have previously spawned. Many traditional spawning grounds for shad have been damaged by the removal of gravel, a common practice in some areas.
Overfishing	Fishing: fixed and mobile netting (seine) and pelagic trawling	Possible cumulative impact when the stock abundance has been strongly decreasing. Overfishing has been certainly one of the main negative factors for the extinction of allis shad stocks in the Rhine river.

Habitat modification resulting in uniform channel structure	Development: land claim	Loss of spawning pools; changes in river flow
Juvenile mortality	Climate change	A study by Boisneau *et al*. (2008) showed that increased water temperature in the Loire river modified the pattern of young-of-the-year downstream migration. On certain large rivers, too great an increase in summer water temperatures could lead to mass juvenile mortality.
Juvenile mortality	Power stations water intake	Some shad are taken in at the water intakes of power stations. Henderson (2003) estimated that as many as 50 000 juvenile twaite shad may be entrained annually on the screens of the power stations in the Bristol Channel. Paradoxically, such catches have proved a valuable tool in monitoring and understanding the relationships between adult run size, recruitment and temperature. Similar problems ave been experienced elsewhere, especially in France (Taverny & Elie 1988; Elie & Taverny 1989; Taverny 1990) and any new proposals for power stations should be subject to rigorous environmental assessment.

The hybridisation process, thought to be a symptom of restricted access to spawning grounds, leads to genetic loss. This introgression would ultimately lead to a population resembling most closely the predominant or favoured species. Carstairs (2000) concluded that this process might have led to the decline of, and in some cases demise of, allis shad in some UK channels. Improvement in fish passage facilities could permit a spatial, and hence genetic, separation of allis and twaite shad in the same catchment.

5. Existing Management measures

Improved water quality has led to the upstream displacement of the major shad spawning areas in several European rivers (King & Roche, 2008) and contributed to the re-appearance of shad in the Thames and the Clyde (Colclough *et al.*, 2002). Implementation of the EU Water Framework Directive (WFD), the Nitrates Directive and the Urban Wastewater Directives should be conducive to the improvement of water quality in European rivers and estuaries, which could, in turn, be conducive to shad conservation (King & Roche, 2008). The recent occurrence of adult allis shad presenting spawning marks in the River Seine upstream of Paris (Belliard *et al*., 2008) indicates an important reduction of water pollution which has also led to the return of other migratory species such as the sea trout and the Atlantic salmon in the estuary of the River Seine and more recently in some parts of the river network. This also coincides with a regional improvement of allis shad situation leading to an increase of its distribution in the north-western part of France. Notably, this species has colonised some small coastal streams in Brittany and Normandy once again, some of them, like the Vire or the Orne close to the River Seine (Baglinière *et al.*, 2003, Rochard *et al.*, 2007). Their presence in the UK is linked to the northerly migration of marine fish stocks currently underway (ICES, 2008).

It is suggested that in future and in light of their inextricable biological interactions both shad species should be considered for inclusion on the OSPAR List, as is the case in the EU Habitats Directive, as protection measures for *A.alosa* will also afford protection to the twaite shad *A.fallax*.

6. Conclusion on overall status

Generic conservation objectives are regarded as feasible and, if achieved, of significant benefit to shad populations, but these may require adjustment in the light of future knowledge. In view of the lack of detailed information on the ecological requirements of the species, it is clear that initiatives to restore chemical and physical conditions in the rivers concerned to those pertaining when shad were more widespread would be sensible (Maitland & Hatton-Ellis, 2003).

It is considered that future threats are the same as the present pressures. The French allis shad stock in the Gironde-Garonne-Dordogne river system is currently plummeting, but whether this is a natural variation or tendency which will continue is not known. Shad are members of the Clupeidae (herring) family and like all clupeids they are subject to a very high variability in abundance, which is linked to sharp fluctuations in recruitment from one year to the next due to environmental factors.

Implementation of Water Framework Directive (WFD) requirements should lead to improvements in water quality attributes in estuaries and rivers. This may, in turn, facilitate habitat use by diadromous fish. In addition, physical barriers to upstream migration, particularly for allis shad, may also come under scrutiny under WFD, which requires that 'connectivity' exist in watercourses. Such geomorphological connectivity would benefit biological connectivity and would benefit all life history stages of all diadromous fish species. It is worth noting that the needs of shad in crossing dams are far greater than those of salmonids.

7. Action to be taken by OSPAR

Action/measures that OSPAR could take, subject to OSPAR agreement

As set out in Article 4 of Annex V of the Convention, OSPAR has agreed that no programme or measure concerning a question relating to the management of fisheries shall be adopted under this Annex. Where the Commission considers that action is desirable in relation to such a question, it shall draw that question to the attention of the authority or international body competent for that question. Where action within the competence of the Commission is desirable to complement or support action by those authorities or bodies, the Commission shall endeavour to cooperate with them.

It is proposed that OSPAR should recommend that relevant Contracting Parties (*i.e.* those having rivers which host or have historically hosted populations of *Alosa alosa)* should take into account the need for the protection of *Alosa alosa* in the development and application of river basin management policies and plans with a view to:

a. maintaining access to spawning grounds and safe passage for the juveniles on the out-migration of Alosa alosa,

b. maintaining the following habitat features in rivers hosting or having historically hosted Alosa alosa:

- Deep pools where the adults can congregate prior to spawning
- Silt free spawning gravels to ensure that the eggs do not suffocate
- Areas of reduced currents/backwaters as these are the preferred habitat of the juveniles in fresh and estuarine waters.

c. giving special protection to sanctuary areas important for the persistence or recolonisation of the population. For example on the river Garonne at Agen (France) a sanctuary for *Alosa alosa* was created by Ministry decree in 1981. The site measures 4.78 km2 and is one of the main spawning areas on the river. Prior to 1981 the size of the spawning ground was decreasing because of gravel extraction. The effect of the decree

is to ban exploitation of the species, any flood defence works and gravel extraction in the area.

d. taking action to maintain water quality at good status in relevant water bodies in accordance with the EC Water Framework Directive.

The OSPAR Commission should establish a mechanism by which Contracting Parties report back on the implementation of the above recommendations so that the development of the necessary measures can be evaluated in conjunction with the future assessment of the status of the species. As a first step Contracting Parties still having rivers which host *Alosa alosa* should make an assessment of the effectiveness of the regulations they already have in place for the protection of *Alosa alosa*, consider how those regulations might be made more effective through improved monitoring, control and surveillance and report the results to the OSPAR Commission.

To complement these actions, the OSPAR Commission should:

a. communicate to the European Commission and other relevant fishing authorities the need for increased transparency in commercial catch statistics of diadromous fish species (salmon, sea trout, eel (glass and adult), lampreys, twaite and allis shad);

b. emphasise to relevant scientific funding bodies the following research needs with respect to *Alosa alosa:*

(i) international collaboration to investigate the genetic diversity and relationships among the various populations of alosa alosa in Europe.

(ii) research to investigate further areas where adult shad are regularly found but spawning sites are unknown.

(iii) research to explore measures such as reduction of exploitation or bycatch, both at sea and in estuaries, and to assess the feasibility of a husbandry programme to augment the impoverished stocks to the level of favourable conservation status — a level required under the Habitats Directive

(iv) research to develop the capacity for reintroduction of allis shad to one or more of its historic sites if natural recolonisation cannot be achieved;

(v) development of decision-support tools such as microsatellite markers and biogeographical models.

Table 3: Summary of key priority actions and measures which could be taken for *A. alosa*. Where relevant, the OSPAR Commission should draw the need for action in relation to questions of fisheries management to the attention of the competent authorities. Where action within the competence of the Commission is desirable to complement or support action by those authorities or bodies, the Commission shall endeavour to cooperate with them.

Key threats	◎ Dams, barrages, weirs, sluices, etc., even if passable by salmonids. ◎ Water intakes, especially from power stations or other industrial processes. ◎ Habitat modification resulting in uniform channel structure. ◎ Poor water quality, especially in summer (juvenile phase) ◎ Overfishing.
Other responsible authorities	EC, FAO, RFMOs

Already protected? **Measures adequate?**	Habitat & Species Directive Annex II &V (under the name *Alosa* spp.) Bern Convention Appendix III IUCN Red List DD (Data Deficient)	One of the first steps Contracting Parties are recommended to take is an assessment of the effectiveness of the regulations they already have *in situ*, and how those regulations might be made more effective through improved monitoring, control and surveillance.
Recommended A+M	Improvement of fish passage facilities (Contracting Parties) Enhanced estuarine water-quality conditions (Contracting Parties) Increase international collaboration to investigate the genetic diversity and relationships among the various populations of allis shad in Europe. (Research need) Carry out further research on shad in areas where adults are regularly found but spawning sites are unknown. (Research need) Consider, and carry out research relevant to, the reintroduction of allis shad to one or more of its historic sites if natural recolonisation cannot be achieved. (Research need) Increased research into decision-support tools such as microsatellite markers and biogeographical models (Research need) Increased transparency in commercial catch statistics of diadromous fish species (salmon, sea trout, eel (glass and adult), river and marine lampreys and twaite and allis shad. (Communicate to the EC and other relevant fisheries authorities)	

Brief summary of the proposed monitoring system (see annex 2)

Relatively little is known about the detailed ecological and habitat requirements of shads, and for this reason it is difficult to define and set absolute targets for favourable condition based on science (Maitland & Hatton-Elllis, 2003).To conserve and enhance the allis shad, priority areas for further research include ecology of the juvenile stage in freshwater, the degree of homing, the marine phase, and detailed population dynamics (Baglinière, 2003). It is worth noting that the allis shad does not have a strict homing migration: only ~40% return to their original spawning ground (Lepage, *pers. comm*.), which means riverine sanctuary areas would not necessarily be effective on their own.

It may be necessary to assess the feasibility of a husbandry programme to augment impoverished stocks to the level of a favourable conservation status – a level required under the Habitats Directive. Stocking programmes are in their infancy as until very recently artificial culture had not proved reliable. On the 30th of June 2008 the French agricultural and environmental engineering research group CEMAGREF transferred ~1500 allis shad alevins to the aquarium of La Rochelle. The aim is to keep them for 3 years before re-introducing them into the River Rhine system, where the present spawning population of *Alosa alosa* is very small, as part of a European LIFE-Nature Project where the plan is to stock the Rhine with 5 million shad larvae. Details of this project which will continue running until December 2010 and is led by the State Office for Nature, Environment and Consumer Protection in North-Rhine Westphalia, can be found in Annex 4 of this assessment.

Annex 1: Overview of data and information provided by Contracting Parties

Contracting Party	**Feature occurs in CPs Maritime Area**	**Contribution made to the assessment (e.g. data/information provided)**	**National reports** **References or weblinks**
Belgium	Extinct-twaite shad only	Y	Haelters, J., 2005. Een zootje Fint *Alosa fallax* nader bekeken (A closer look at a heap of Twaite Shad *Alosa fallax*). De Strandvlo 25(3-4):109-112.
Denmark	extinct		
European Commission	Y		
France	Y	Y	Baglinière, J. L. and Elie, P. (Eds), 2000. Les aloses (*Alosa alosa* et *Alosa fallax* spp.). Ecologie et variabilité des populations. INRA Editions (coll. Hydrobiologie et Aquaculture), Versailles (FRA) .275pp.
Germany	Y	Y	Fricke R., 2004. Der Maifisch (*Alosa alosa*). Offenbach am Main (Verband Deutscher Sportfischer), 39 pp.
Iceland			
Ireland	Y	Y	Allis shad (*Alosa alosa*) (1102) & Twaite shad (*Alosa fallax*) (1103) Conservation Status Assessment Report http://www.npws.ie/en/PublicationsLiterature/HabitatsDirectivereport07/Species/
Netherlands	extinct	Y	http://library.wur.nl/way/bestanden/clc/1883069.pdf http://www.milieuennatuurcompendium.nl/indicatoren/nl1226-Elft-in-Rijn-en-Maas.html?i=19-135 http://www.synbiosys.alterra.nl/natura2000/documenten/profielen/soorten/profiel_soort_H1102.pdf (species profile, in Dutch, for the habitat directive)
Norway			
Portugal	Y		Costa M.J., Almeida P.R., Domingos I.M., Costa J.L., Correia M.J., Chaves M.L. and Texeira, C.M., 2001.Present status of the main shad's populations in Portugal. *Bulletin français de la pêche et de la pisciculture* 362/363: 1109-1116.

Spain	Uncertainty over status		
Sweden	Y		www.fiskeriverket.se www.artdata.slu.se Gärdenfors, U (ed). 2005. The 2005 red list of Swedish species. Uppsala (ArtDatabanken).
UK	Y	Y	Maitland, P.S. & Hatton-Ellis, T.W., 2003. Ecology of the Allis and Twaite shad. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough. 28 pp. http://naturalengland.communisis.com/naturalenglandshop/docs/ecology-shad.pdf

Summaries of country-specific information provided

Belgium. Allis shad is extinct in Belgium with no recent records. Haelters (2005) examined a number of shad, but all proved to be twaite shad. Twaite shad is regularly found in Belgian marine waters. Since 1996 the species is being caught again in the marine part of the Scheldt, near the Belgian-Dutch border, and since numbers have increased, this is probably a consequence of increasing oxygen levels. There are no indications that the species reproduces in the Scheldt. Twaite shad are regularly caught by recreational beach fishermen.

Britain. In the British Isles, the allis shad was formerly not uncommon around coastal areas. In England and Wales, it certainly spawned in some rivers, notable among which was the River Severn where it formed the basis of an important fishery (Aprahamian, 1982). It originally migrated over 100 km upstream as far as Welshpool but as more and more navigation weirs were constructed (*e.g.* at Gloucester, Tewkesbury, Worcester and Shrewsbury during the 1840s) numbers declined and today the species is virtually absent from the Severn area, with only occasional individuals being caught.

Nowadays, both shad species are considered to be nationally rare and vulnerable, the allis shad (*Alosa alosa*) more so than the Twaite (*Alosa fallax*). Data is needed to confirm the absence/presence of these species, and whether they are spawning. Nationally the Environment Agency, Countryside Council for Wales and English Nature are involved in a joint work programme to identify key rivers and spawning sites for both species. Elsewhere around the English and Welsh coasts, allis shad are still found occasionally, but only in very small numbers. The only reported spawning population in the UK is that of the River Tamar, although the appearance of sub-adults and mature adults near the Solway Firth may indicate a spawning site and adults have also been recorded in the English and Bristol Channels (Maitland and Hatton-Ellis 2003). Since 2006, the presence of juvenile allis shad in the river Severn has been recorded (Aprahamian, *pers.comm*). It is possible that British caught specimens are part of the Loire-Gironde population (Henderson, 2003). In Scotland, the species is taken in coastal nets and at sea from time to time but has never been shown to have a spawning population. A study by Maitland *et al.* (2005) demonstrates that the tidal waters of the Rivers Cree and Bladnoch are important areas in terms of rare fish and their conservation. The area is a probable spawning ground for Twaite Shad. Further research is required to confirm the actual spawning grounds of Twaite Shad

and the reproductive behaviour of Allis Shad. Both species are included in Section 9 (4) (a) of the Wildlife and Countryside Act (1981), (amended April 1998), which makes it an offence to intentionally obstruct access to spawning areas or to damage or destroy gravels used for spawning. The Twaite shad is also protected under Section 5 of the Wildlife and Countryside Act (1981). Both species are Priority Species in the UK Biodiversity Action Plan.

Iceland: There is one record of a single *A.alosa* haven been caught in 2006 (J. Pálsson , *pers. comm*.)

Ireland: In Ireland, it is uncertain if there were ever spawning populations of allis shad, though the species was, and still is, caught from time to time in estuaries and around the coast. However, there are a few records of the species in fresh water, one from the Foyle, two sites in north Mayo and in the River Shannon. A recent study (King & Roche, 2008) analysing by-catch from estuarine commercial salmon netsmen in four Irish Special Areas of Conservation (SACs) designated for Twaite shad, *Alosa fallax*: the estuarine reaches of the Rivers Munster Blackwater, Suir, Barrow-Nore and Slaney. The paper by King & Roche (2008) confirms the presence of shad of both species in reproductive conditions in all four areas, but puts into evidence that the population size of both species is low. Since 1994, the allis shad has been recorded from fourteen 50 km grid cells around the Irish coast – this area (35 000 km^2) is taken as the extent of its current range.

France: The large rivers of western France, notably the Gironde-Garonne-Dordogne river system, have suffered a dramatic decline in stocks in recent years. The shad river fisheries of the Atlantic coast are either shut for 5 years or shutting (Adour). However, the Loire and smaller rivers in Brittany such as l'Aulne and the Vire have had an increase in population, with the Vire now counting between 8000 and 9000 adults annually. The highest population of hybrid shad is found in the Loire, followed by the Gironde.

The study of the offshore distribution of allis shad and twaite shad in the Bay of Biscay reveals aggregations located in the river mouths of the most important watersheds (Gironde, Loire).Sea catches recorded near the Aquitaine, France, coast exceeded catches in French rivers other than the Gironde system during the years 1994–1999 (Baglinière, 2003). Thus, it appears that ocean landings are increasing (Taverny & Elie, 2001), however, unlike research on the freshwater phase, information on the marine phase of this species within French waters remains very general. Within the Bay of Biscay, both shad species remain in coastal waters, with highest abundances recorded at the beginning of winter in southern Brittany followed a spring high abundance along the southern Atlantic coast (Taverny & Elie, 2001).

Germany: *Alosa alosa:*

No spawning populations have been detected in Germany after the breakdown of the populations in the first half of the 20th century yet. Some allis shad are detected in the Rhine every year in the new fish passes in Iffezheim and Gambsheim in the Upper Rhine (since 2001) or by accidental fishermen catches (annual numbers <10). In addition there were single detections from the Weser and Elbe River in recent years. The fish are considered as strays. This hypothesis is supported by recent genetic studies from the Rhine (Klee & Schliewen, 2003).

The species is critically endangered according to the German freshwater and marine fish red lists (Freyhof *et al*., 2009, Fricke *et al.* in press, 2008). Natura 2000 sites have been established in River Rhine.

Alosa fallax: Small populations are present in the Weser and Elbe, where spawning sites were documented. There is a small population in the Ems, but spawning sites were not yet observed. *Alosa fallax* is regularly found in the German North Sea during the winter months. The species is endangered according to Fricke *et al*. (in press, 2008).

Portugal: The species is still present along the coast of Portugal in the Minho, Lima, Vouga, and Mondego rivers. However, abundance has decreased sharply since the beginning of the 1960s in the Minho River and very recently (1998) in the Lima River. In contrast, abundance has recently increased in the Mondego River owing to improvement in habitat quality. An additional threat to the species in Portugal is illegal fishing, as allis shad are a by-catch in illegal glass-eel fisheries (Costa *et al*., 2001). Three different river stretches as sites were included in the European Natura 2000 network (Minho, Lima and Vouga rivers), using the presence of diadromous fish as one of the criteria for the choice. The Ministry of Agriculture and Fisheries designated several river stretches in the Lima, Cávado, Vouga and Mondego watersheds as Professional Fishing Areas in order to ensure a better management of this activity. Finally, it should be mentioned that there are two landlocked populations of allis shad, one in the Aguieira dam reservoir (Mondego river basin) and the other in the Castelo de Bode dam reservoir (Tagus river basin), that were prevented from returning to the sea after the construction of the dams, in 1981 and 1951, respectively.

The Netherlands: The Allis Shad used to be common in the Netherlands, but numbers have gone down since 1910 and the species has disappeared since 1930. The decline was mainly caused by overfishing. Other reasons for the decline were the low water quality, loss of suitable spawning sites and the blockage of passages through sluices and dams. Even though the water quality has increased in the past years and special fish-passages have been constructed the Allis shad has not come back to the Netherlands yet. In 2004, 4 individuals were caught, a sign that the species is returning in the Rhine.

(supply to auction, number (in thousands)
See: http://www.milieuennatuurcompendium.nl/indicatoren/nl1226-Elft-in-Rijn-en-Maas.html?i=19-135

Spain: In Spain a landlocked population of *A.alosa* exists in the River Guadalquivir (Moron, *pers.comm*).

Sweden: In Sweden *A.alosa* have been caught in the river Dalälven (Nathanson, *pers. comm*.). Isolated specimens may be found primarily in the Skagerrak and the Kattegat, but also in the Baltic Sea as far north as Hudiksvall (the province of Gävleborg). The species is reported once or twice per decade, as a rule, but during the 1990s no less than ten observations were made. Allis shad in Swedish coastal waters may be regarded as stray individuals. Allis shad is listed on the Swedish Red List as “Not Applicable” (NA). The reason for the listing is that it does not meet the criteria for a domestic species, i.e. that it does not reproduce in the country. Prospects of an establishment in Swedish waters are considered to be low.

Annex 2: Detailed description of the proposed monitoring and assessment strategy

A protocol for monitoring allis and twaite shad (*Alosa alosa* and *Alosa fallax*) has been produced as part of Life in UK Rivers (Hillman *et al*., 2003) – a project to develop methods for conserving the wildlife and habitats of rivers within the Natura 2000 network of protected European sites. The project's focus has been the conservation of rivers identified as Special Areas of Conservation (SACs) and of relevant habitats and species listed in annexes I and II of the European Union Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (the Habitats Directive). Given resource constraints, this protocol seeks to develop a programme that can monitor compliance with conservation objectives in a realistic and cost-effective way. For a more detailed protocol on the monitoring of twaite and allis shad please see http://www.english-nature.org.uk/LIFEinUKRivers/species/shad_monitoring.pdf

Rationale for the proposed monitoring

It is recommended that the following data are collected:

- Juvenile density (represented by catch per unit effort, CPUE). Micromesh seine netting is the most appropriate sampling method to assess juvenile shad CPUE in the lower river/upper estuaries, to compare against a set target for each river.
- Adult run size. Fish counters should be used to monitor the time and approximate size of the adult spawning migration, but the exact size of the adult spawning population cannot be derived using existing equipment.
- Spawning distribution within each river. Spawning surveys should be used to monitor the extent and prevalence of spawning within SAC rivers.

Use of existing monitoring programmes

Initial baseline survey

Spawning surveys

- Undertake comprehensive surveys on rivers within the OSPAR region with spawning shad populations to map all spawning sites as a baseline.
- In addition to baseline surveys at all historical spawning sites, River Habitat Survey techniques should be used to identify new potential spawning sites for surveying.

Juvenile netting surveys

- In rivers with shad populations select six potential netting sites.
- A minimum number of seine net hauls should be taken at each site, every month from July to October inclusive (three days sampling per month).
- Based on the mean catch at each site, the variance, catch efficiency between months and ease of access, three of the six sites should be selected for use in a routine monitoring programme.
- Using data from the selected three sites, calculate the mean catch density and the variance per site, on each river.
- Using the calculated density and variance per river, calculate the required sample size (nets, tides, hours or days) at different levels of confidence and precision.

- Select the maximum level of confidence and precision that can be afforded, in terms of monitoring costs.

Routine monitoring

Fish counters

- Count shoals of migrating adult shad and record deflected energy.
- Record date and time of shad migration.
- After first six-year monitoring period when target shoal counts have been set, compare number of shoals with the target.

Spawning surveys

- Randomly select 50% or 10 (whichever is greatest) of the known spawning sites per *Conserving Natura 2000 Rivers* designated SAC river and search for eggs by kick-sampling.
- The absence of eggs from more than 50% of sites surveyed will denote an adverse change in the spawning distribution in the river.

Juvenile netting surveys

- On at least one day per month (depending upon the number of samples needed to permit statistical confidence in the data set, calculated in the preliminary study), from July to October inclusive, undertake three nettings, at each of three sites, per SAC river (or the associated estuary). Where possible, measure 30 juvenile shad in the field for length-frequency analysis.
- Calculate density and catch variance per river using data collected annually.
- Retain samples for measurement of body length and calculate the proportion of 0+ and 1+ group fish in the population.
- Examine the gill rakers to assess the proportion of twaite and allis shad in the populations.
- Produce a yearly CPUE, per SAC river (or associated estuary).
- Compare annual CPUE to the targets/limits set using data from the first six-year monitoring period.

Synergies with monitoring of other species or habitats.

Similar sampling methods could be applied to other diadromous fish species present on the OSPAR list, *i.e.* the Atlantic salmon *Salmo salar*, the sea lamprey *Petromyzon marinus* and the European eel *Anguilla anguilla*.

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Annex 4: Details of the LIFE – Project Allis Shad in the Rhine system 2007-2010

Life Project – Allis Shad
The reintroduction of the Allis shad (*Alosa alosa*) in the Rhine system

Applicant: State Office for Nature, Environment and Consumer Protection in North Rhine-Westphalia, Germany

Duration: January 2007 - December 2010 Projektbudget: 956.348 €

Partner:

Centre National du Machinisme Agricole, du Génie Rural, des Eaux et des Forêts (CEMAGREF)
Association Migrateurs Garonne Dordogne (MIGADO)

Co-Financing:

Ministry of Environment, Federal State Hesse, HIT Umwelt- und Naturschutzstiftungs GmbH (Environment Fund), Rheinfischereigenossenschaft NRW (Rhine Fisheries Association, Federal State North Rhine Westphalia), Sportvisserij Nederland (Dutch Sportfishing Association)

Project management: Dr. Peter Beeck, Stiftung Wasserlauf

Website: www.alosa-alosa.eu

SUMMARY OF THE PROJECT

Project title: The re-introduction of allis shad (Alosa alosa) in the Rhine System

Objectives

The overall objective of the project is the conservation and protection of allis shad in Europe. The distribution range of the species has decreased dramatically and as a consequence allis shad is listed as priority species in Annex II and V of the Habitats Directive. In this unique European project with financial and practical support of three Rhine bordering countries (Netherlands, Germany, France) the project objective is the re-introduction of allis shad in the Rhine System. Only 150 years ago several hundred thousand allis shads have been caught annually in the Rhine System and they were an important economic factor for the local population. With the stocking of allis shad larvae it shall be achieved that mature allis shad will migrate into the river again and build a healthy population which will not need accompanying stocking activities in the future.

Actions and means involved

Extensive preliminary studies have been carried out which allowed a characterisation of the necessary actions to implement the project objectives. With the help of techniques developed for the successful re-introduction of the closely related American shad (Alosa sapidissima) in many rivers along the North-American East Coast it is planned to produce 5 million allis shad larvae which will be stocked in the Rhine system. All larvae will be marked before stocking to determine the success of the re-introduction project. The practicability of these techniques has been tested successfully in the preliminary studies. Additional actions such as mapping of spawning and stocking habitats, assessment of the influence of shipping for the life cycle of allis shad, a diversified public awareness campaign and the integration of the existing knowledge about this species in the project will accompany stocking activities and ensure an optimisation of the actions within the duration of the project.

Expected results

One of the main results of the project will be the development of mass production techniques for allis shad breeding and the transfer in praxis. With the help of these techniques 5 million allis shad larvae will be produced for the re-introduction of allis shad in the Rhine system. If an existing allis shad population in Europe will suffer from extinction in the future, these techniques can be used to support and protect the population. With respect to the experience from American restoration programmes it is expected that 20 000 mature allis shad will return to the Rhine system due to the stocking activities and maturing allis shad are expected to be found in the Rhine estuary and the North Sea.

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OSPAR's vision is of a healthy and diverse North-East Atlantic ecosystem

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