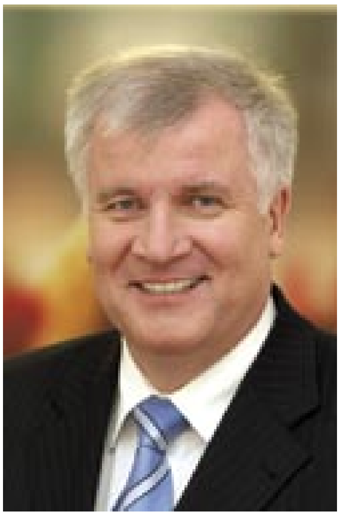
Federal Ministry of
Food, Agriculture
and Consumer Protection

Aquatic Genetic Resources

German National Technical Programme on the Conservation and Sustainable Use of Aquatic Genetic Resources

Preface



Dear readers,

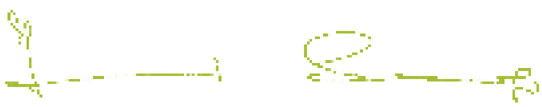
the fishing industry in Germany has always provided the population with a valuable supply of high-quality foods which constitute an integral part of a healthy and balanced diet. If our seas and inland waters are fished sustainably and if our stocks are protected, it will be possible to continue achieving this aim in the long term.

Sustainability also includes protecting the many genetic resources of maritime organisms. With this National Technical Programme on conservation and sustainable use of aquatic genetic resources, the Federal Republic of Germany is fulfilling its international and national commitments to protect biological diversity in this area for the present and coming generations and also to use these resources sustainably. Most of the programmes and measures to protect the organisms used in deep-sea fishing and offshore fishing are also integrated within the European Union's Common Fisheries Policy. We have also recently established a close alliance with our European partners in respect of the protection of sea resources and measures to combat illegal, unregulated and unregistered fishing.

The aim in lake and river fishing must also be to maintain and replenish fish stocks and to protect genetic resources in their natural habitats. Some things have already changed for the better: Salmon, which is the main focus of many different migratory fish and reintroduction programmes, is symbolic for the improvement of living conditions in our rivers.

The fishing sector with the greatest potential for growth is aquaculture. Eighty percent of fish produced in inland fisheries already come from aquaculture. New markets are being developed, particularly in the aquaculture sector, and consumers are being provided with fresh fish or high-quality processed fish products. This trend must therefore always be borne in mind when conserving stocks and resources.

The overall impact of the "National Technical Programme" is that it provides the framework within which fishers, anglers, associations, scientists, politicians and administrative experts, and indeed consumers themselves, can make their own contribution towards, and meet their joint responsibility for, the conservation of genetic resources in the fishing sector.



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1 Introduction

The Convention on Biological Diversity (CBD) constitutes the legal basis at the international level for the protection and sustainable use of genetic resources as a part of biodiversity. It took effect in 1993 and has so far been ratified by 188 states, including Germany and also the European Union. Objectives of the Convention are the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of biodiversity. The states adopted programmes of work regarding the biodiversity in inland waters as well as in maritime and coastal areas at the Conference of the Parties to the Convention on Biological Diversity. The resolutions commit the contracting states to engage in concrete activities, for example, to draw up national strategies, plans and programmes to achieve the CBD objectives. The states are called upon to integrate biodiversity in the national and European legislation respectively and sectoral policy areas.

In this regard, the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV, formerly: BML) drew up an overall concept on the conservation and sustainable use of genetic resources for food, agriculture and forestry in 1999 and published it in the BML publication series (volume 487). The national programme envisaged by the concept consists of sectoral technical programmes concerning the individual sub-sections of genetic resources. Germany meets the commitments entered into for the sub-section of aquatic genetic resources by presenting this technical programme. This programme is the result of the work performed by an expert group headed by Prof. Dr. Steffens that had been set up at the suggestion of the BMELV with the approval of the officials in charge of fisheries in the Länder. The expert group is composed of representatives from the fisheries administration, research and associations.

The CBD defines genetic resources as genetic material of actual or potential value and genetic material as any material of plant, animal, microbial or other origin containing functional units of heredity. In this sense, aquatic genetic resources also comprise all water-dwelling genetic resources. However, this technical programme at first confines itself to the bony fishes, cyclostomes, mussels, Decapoda as well as their spawning or larval stages. With 25,000 species, the bony fishes are just as diverse as all the other vertebrate animal groups taken together. This great diversity and also the availability that has long been seen as limitless have turned aquatic genetic resources worldwide into one of the main sources of protein of the human diet. The insight that natural resources are finite, last but not least, virtually requires a more precise analysis of the different natural habitats and also of the options of aquaculture especially. For example, fish is regarded as the most endangered group of vertebrates in Germany, too. We plan to extend the technical programme to cover cartilaginous fish, marine mammals, octopuses or aquatic plants etc. in a future update.

Under the global aspect of sustainability, this technical programme primarily aims at conserving and using the diversity of aquatic genetic resources in the long-term in a way that is backed up by science.

2 Importance and vulnerability of aquatic genetic resources (AGR)

2.1 Definition of terms

Aquatic genetic resources

Genetic resources form part of biodiversity. The Convention on Biological Diversity (CBD) defines them as „genetic material of actual or potential value“ as „any material of plant, animal, microbial or other origin containing functional units of heredity“.

The aquatic genetic resources comprise all water-dwelling genetic resources. Within the scope of this technical programme, the aquatic genetic resources are first confined to fish, cyclostomes, mussels and decapods as well as their spawning and larval stages. These are grouped together under the generic term of „fish“ in the following in conformity with most Länder laws on fisheries. We plan to extend the range of aquatic genetic resources to be included in the technical programme to also cover other resources such as marine mammals, cartilaginous fish, octopuses or aquatic plants in a future update of the technical programme.

Cod

In-situ conservation

According to the CBD, in-situ conservation means „ the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties“.

Ex-situ conservation

According to the CBD, ex-situ conservation means „the conservation of components of biological diversity outside their natural habitats“.

Sustainability

According to the Council for Sustainable Development, sustainable development means to consider environmental aspects on an equal footing as social and economic aspects. Hence, sustainable management for the future means that we must leave to the following generations an intact ecological, social and economic fabric.

The Council Regulation (EC) No. 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy defines sustainable exploitation as the exploitation of a stock in such a way that the future exploitation of the stock will not be prejudiced and that it does not have a negative impact on the marine eco-systems.

Neozoa and neophytes

According to the Federal Nature Conservation Act [(BNatSchG 2002 Section 10 (6)], neozoa and neophytes are alien species, i.e. any wild species of flora and fauna that has either not occurred in the wild in the area concerned or no longer for over 100 years. Any introduced wild species of flora of fauna is deemed native, if the flora or fauna of the species concerned that became wild, or were introduced through anthropogenic activities, gave rise to the establishment of a population in the wild that has survived as a population within the country over several generations without human assistance.

Inland fisheries

Use of inland waters for fishing by lake and river fishing, pole-and-line fishing and aquaculture.

Coastal and deep-sea fisheries

A distinction is made between coastal fisheries, middle-water and distant-water fishing. Sea fisheries starts at the coastline given mean high water as well as at the seaward limit of the inland waterways that is defined in greater detail by the Act on the Federal Waterways. According to the United Nations Convention on the Law of the Sea, the territorial waters stretch up to 12 nautical miles seaward of this baseline.

Small boats or cutters engage in coastal fisheries. The river estuaries and the coastal waters as well as the adjacent sea „within visibility distance of the coast“ constitute the fishing grounds.

Middle-water fishing deploys deep-sea cutters (<500 GT) mainly for fishing in the North and Baltic Sea, north of the Shetland islands, in the English Channel, in the sea area off Ireland and Iceland and the Faroe islands and in Norwegian waters.

Distant-water fishing deploys vessels with a large operating range (>500 GT), mostly freezing trawlers, that also operate in distant fishing grounds outside of Community waters. These catch areas are located on the high seas or in third country waters in the North and Middle Atlantic. Deep-sea fishing vessels require a licence to operate that is valid worldwide.

Marine blue mussel

Crayfish

Lake and river fishing

Fishing for profit-making in inland surface waters. Key tasks of lake and river fishing lie in the management and use of fish stocks in line with the fisheries legislation of the Länder.

Pole-and-line fishing / recreational fisheries
Non-commercial fishing in surface waters.

Aquaculture

Aquaculture signifies controlled fish farming in water bodies and in artificial fish farming systems. The fish farmer owns the organisms from the beginning of husbandry until the harvesting. Aquaculture can be conducted in saline water, brackish water or in freshwater. Fish farming facilities range from net cage systems in the ocean to closed recirculation systems. In Germany, pond farming to rear trout and carp currently prevails. Due to its minor scope at present, marine aquaculture (mariculture) is classified under aquaculture. Traditionally, blue mussel farming is deemed a key line of business of coastal fisheries and is mentioned in the technical programme.

2.2 Structure of the fisheries sector in Germany

The structure of fisheries in Germany heavily depends on the different habitats of aquatic genetic resources. The natural habitats can be subdivided into the marine sector with coastal and deep-sea fisheries and the limnic sector with lake and river fishing as well as pole-and-line fishing (recreational fisheries). In Germany, aquaculture is mainly carried out in inland waters. Pole-and-line fishing or recreational fishing can be conducted in inland waters and in the ocean.

2.2.1 Structure of coastal and deep-sea fisheries

The structure of German sea fishing is marked by a great diversity of the fishing fleet and a great diversity of catch opportunities and fishing techniques. In 2006, 2017 vessels flew the German flag. These vessels of a length of 2.80 m to 125 m were registered for fishing for fish species subject to quotas. 2008 vessels of which were smaller than 12 m and assigned to coastal fisheries in the North and Baltic Sea. North Sea beam trawlers represent the second largest group with 278 vessels. They are up to 24 m long and have an engine power of up to 221 kW according to the beam trawler lists 1 and 2. They are authorised to engage in beam trawling in the flatfish protection zone. The other vessels are trawlers in the North and Baltic Sea, gillnet cutters, large cutter beam trawlers over 24 m and special purpose vessels. 86 mussel cutters are deployed to produce common mussels on farmed areas in the Wadden Sea of the North Sea coast. 9 vessels are engaged in distant-water fishing with 3 vessels specialising in the catch of shoaling pelagics. The German fleet accounts for approx. 3 % of the vessel capacity in the EU. Within the scope of the Community management of stocks by the EU, German sea fisheries is allowed to fish for around 9 % of the catch level of species subject to quota allocation. The total annual landings of German sea fisheries at home and abroad added up to 261.070,4 t in 2006. 100.870,6 t were landed in German ports. In the order of their quantitative shares in German domestic landings in 2006, the main target species among sea fish were herring, blue whitling, sprat, macerel, north sea shrimp, horse mackerel, pollack, cod mussels. The ranking can vary depending on the respective year (Table 1).

~~High seas~~ trawler

Alongside the North and Baltic Seas, the fishing grounds of the fleet also encompass the waters in the North-East, North-West and Middle-East Atlantic. In addition, a larger number of part-time fishermen and anglers with or without vessels also exploit the fish resources in the German coastal waters.

The locations of the fishing industry and downstream economic sectors are by definition spread throughout the coastal region. Artisanally-structured coastal fisheries that is spread out over many small port cities accounts for most domestic landings. Going beyond the fishing sector, coastal fisheries is of major importance for tourism. The locations of Bremerhaven, Cuxhaven, Sassnitz and Rostock boast considerable industrial processing capacities for fresh fish and frozen fish. Some 2,500 persons working on board German fishing vessels are employed in the German fishing industry. Within the framework of EU stock management, the resources are harvested together with the fleets of other Member States since the stocks usually straddle national boundaries.

Table 1: Landings of German sea fisheries (coastal and deep-sea fisheries) of fresh sea fish, mussels and shrimp in Germany in 2006

Source: Federal Agency for Agriculture and Food (BLE)

Fish species	2006 Quantity t	Value T€
Herring	79.787,0	28.824,1
Blue Whitling	36.423,2	9.034,9
Sprat	30.796,9	3.620,0
Mackerel	16.653,4	15.130,4
North Sea Shrimp	15.972,0	37.747,4
Horse mackerel	12.612,8	5.528,3
Pollack	12.337,4	14.761,9
Cod	12.308,4	32.627,0
Mussels	5.162,7	7.110,0
European Plaice	3.655,3	7.425,7
Greenland Halibut	3.235,4	13.420,3
Ocean Perch	3.112,1	8.904,1
Other Flatfish	1.197,9	3.994,8
Other crustaceans and molluscs	**655,7**	**4.281,1**
Total	**261.070,4**	**215.042,2**

2.2.2 Structure of inland fisheries with lake and river fishing, pole-and-line fishing and aquaculture

The main lines of business of German inland fisheries are trout farming, carp ~~pond~~ farming and lake and river fishing. Apart from this, pole-and-line fishing plays a key role. All in all, approx. 1,000 full-time enterprises and an estimated 21,000 part-time and hobby farms as well as approx. 1.5 million anglers operated in domestic waters in 2005 (Annual Report on German Fisheries, 2006).

The total fish ~~resources~~ of this year amounted to 50,663 t, with their proceeds being estimated at € 196 million. The value-added generated by pole-and-line fishing is left out of account here (Table 2). An estimated amount of 10-15 kg/year is being caught per angler.

Table 2: Total volume of ~~catches~~ in inland fisheries in 2006 (estimates)

Source: Annual Report on German Fisheries 2006, BMELV

	Total volume of catches in t	Share in inland fisheries %	Proceeds in € million
Lake and river fishing	**3,086**	**6**	**9,4**
Pole-and-line fishing[1]	**7,246**	**14**	
Aquaculture in total[2]	**40,331**	**80**	**187**
Trout farming	**23,890**	**48**	**123,5**
Table trout	18,850		
Trout for stocking	2,741		
Accompanying fish[3]	2,298		
Carp ~~pond~~ farming	**15,206**	**30**	**49,2**
Food carp	10,461		
Carp for stocking	3,752		
Accompanying fish~~4~~	993		
Technical fish farming systems	**1,073**	**2**	**13**
Eel	567		
Sturgeon	227		
European catfish	146		
Koi carp	123		
~~North african~~ catfish	4		
~~European perch~~	4		
Pike-perch	2		
Inland fisheries in total	**50.663**		

1 Some of the data from pole-and-line fishing are from the previous year, are not complete or estimated in some cases.
2 The data from aquaculture are the sums indicated by the Länder. Some Länder only provided estimates or no data at all.
3 Accompanying fish from trout farming are ~~common~~ trout, char, grayling, inter alia.
4 Accompanying fish in carp pond farming are pike, pike-perch, tench, inter alia.

Lake and river fishing

In 2006, approx. 800 full-time or part-time fishing enterprises managed just under 250,000 ha lakes, dams and rivers. Diverse anthropogenic influences such as river barriers and water pollution almost caused a complete collapse of river fishing that used to be important. The focus of commercial fisheries now lies in the Länder of Mecklenburg-Western Pomerania, Brandenburg, Bavaria, Baden-Württemberg and Schleswig-Holstein that are rich in lakes.

Lake Constance holds a special position. All riparian parties jointly regulate the management. In terms of figures, the German riparian Länder of Baden-Württemberg and Bavaria catch fish in 31,000 ha of the area of Lake Constance. Both Länder hold 59 and 13 patents respectively of a total of 139 patents with regard to the upper lake of Lake Constance. 30 professional fishermen from Baden-Württemberg and 10 professional fishermen from Thurgau ~~fish~~ catch fish in the lower lake.

In 2006, the yields of lake and river fishing came up to 3,086 t of fish, i.e. 6 % of the total volume of catches of inland fisheries. The composition of catches in terms of species varies depending on the prevailing types of lakes for fishing. In the Lake Constance and in the Bavarian lakes in the Alpine foothills, chub was the most important commercial fish, followed by perch and bream. Cyprinoid fishes predominate in the lake-rich regions of Northern Germany, chiefly roach or bream. Eel, pike and pike-perch are other key commercial fish species. The bulk of the catches is traditionally marketed as fish for food. In the

Fisherman

Recreational fisheries

process, direct marketing or sales via the catering trade or retailing occupy centre stage. The sale of fish for stocking to angling clubs is also significant to some degree.

Pole-and-line fishing

In the same year under review, pole-and-line fishing produced with estimated 7.186 t a total volume of catches that is more than twofold that of commercial lake and river fishing.

Many anglers are organised in clubs and associations. Most associations form part of one of the umbrella organisations “Verband Deutscher Sportfischer e.V.” (VDSF) or “Deutscher Anglerverband e.V.” (DAV). This branch of fishing does not owe its importance to the value-added through yields for the human diet, but to the recreational and leisure sectors.

Aquaculture – trout farming

Trout farming, being the key sector of inland fisheries, generated 23,890 t of table trout, trout for stocking and accompanying fish in 2006. This corresponds to 48 % of the total volume of catches in inland fisheries. Rainbow trout made up 95% of the fish farmed and the so-called accompanying fishes, mainly char, ~~common~~ trout and grayling, accounted for the rest. Trout fish is ~~chiefly~~ reared in part-time farming. Here, 440 full-time fish farms are engaged in trout farming compared with 9,981 part-time and hobby farms. Over two-thirds of the full-time trout farms are located in Bavaria and Baden-Württemberg. More than half of the part-time and hobby facilities can also be found in

Fish farming of Rainbow trout

Southern Germany. Other important trout farmers are in Lower Saxony, Hesse, Thuringia and North Rhine-Westphalia.

Trout is bred in different rearing systems. Rearing is increasingly being conducted in concrete ponds or in ponds and raceways of a different design. Trout from smaller installations is mainly subject to direct marketing. A general trend towards a greater supply of processed goods can be observed. The importance of the sale of fish for stocking to angling clubs varies from region to region.

Aquaculture – carp ~~pond~~ farming

In 2006, approx. 40,000 ha of pond area was managed by 192 full-time farms and about 12,000 part-time and hobby pond farms. A total ~~volume of catches~~ of 15,206 t of food carp, carp for stocking and accompanying fish generated over one quarter of the ~~fishing~~ yield of inland fisheries. Accompanying fish produced by pond farming are, for example, pike, pike-perch and tench. Apart from this, there are ornamental fish, crustaceans or species in demand for stocking purposes such as red-eyes, bitterlings and crucian carp, for instance. Bavaria, Saxony and Brandenburg are traditional carp producers. In the eastern Länder, the full-time pond farms with large pond areas of 150 ha, on average, prevail. This is in contrast to two-thirds of part-time or hobby pond farms managing relatively small pond areas of a few hectares in size in Bavaria. Carp is either regionally marketed and sold directly from the farm or marketed via wholesaling or in the hotel and restaurant industry. In the process, an above-average trend towards the sale of processed products (fillets and smoked goods) compared with freshly slaughtered or live animals could be observed. Aquaculture in technical fish farming facilities

Alongside conventional pond farms, aquaculture in technical fish farming facilities only accounts for a share of 2 % in the total production of inland fisheries with 1.073 t. Many of these aquaculture pens are either in a trial or in a startup stage. Production focuses on the rearing of eel, sturgeon and European catfish. Other species produced in these farming systems are Koi carp, ~~North african~~ catfish, ~~European perch~~ and Pike-perch. Other species are subject to practical trials. This sector is highly expanding. This is also fostered by the EU (A strategy for the sustainable development of European aquaculture, Council document 12137/02).

2.3 Importance, vulnerability and use of aquatic genetic resources

With 25,000 species, bony fishes are just as diverse as all the other vertebrate animal groups taken together. This great diversity is due to the close link-up with the respective aquatic habitats. On a global scale, mussels are also represented by ca. 25,000 species and decapods by around 8,000 species. This chapter does not yet deal with cartilaginous fish such as sharks and rays, marine mammals and aquatic plants. These groups of organisms will be addressed in an update on the National Technical Programme.

This great diversity and also the availability that has long been seen as limitless have turned aquatic genetic resources worldwide into one of the main sources of protein of the human diet. The insight that natural resources are finite, last but not least, requires a more precise analysis of the different natural stocks, their interplay in the entire aquatic ecosystem and of the options of aquaculture.

2.3.1 Importance, vulnerability and use of aquatic genetic resources in coastal and deep-sea fisheries

The genetic resources of the oceans constitute a good that has only been insufficiently researched up to now. Hence, it still happens fairly regularly that previously unknown animal species are described, mainly from the deep sea. In the course of the evolution, the oceans as habitats have not undergone as many dramatic changes as the mainland and inland waters and generally tend to be more homogeneous. The oceans form a continuum in some parts that theoretically, at least, allows the individuals of one fish species to migrate into another territory at any time. Hence, it is always possible to exchange genetic information between different groups and populations of one species. Genetic isolation and the resultant possibility of small-scale variations are therefore far less likely than in terrestrial or limnic ecosystems. A further difference between marine and limnic species lies in the frequently vast number of individuals that occur in marine species, notably in species living in the open water zone such as herring, sprat and mackerel. The immense size of the habitat makes this possible.

2.3.1.1 Importance of the fish stocks and range of possible uses in the marine sector

Fish fauna of the North Sea and the Baltic Sea

In the North East Atlantic, the International Council for the Exploration of the Sea (ICES) is responsible for assessing possible uses and the possible endangerment of fish stocks. The total allowable catches (TAC) and catch quotas for the individual EU Member States are set by the Fisheries Council of the EU. As a rule, EU decisions constitute compromises between social and economic aspects and the scientific recommendations made by the ICES that are exclusively based on ecological reasons or on the scientific knowledge of the fish stocks. The ICES bodies classify the state of commercially harvested fish stocks in terms of the reproductive capacity and the fishing pressure brought to bear upon them. It should be pointed out that a stock that is “not sustainably used” (excessive fish harvesting) or whose “reproductive capacity is inadequate” (insufficient biomass from parent animals) may be exploited far above the optimum, but is not endangered as defined by the criteria set by CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), the IUCN (International Union for the Conservation of Nature and Natural Resources) or the Red List of Endangered Animals.

Three groups of different ichthyofaunistic origin are mixing in the North Sea: the boreal, lusitanic and atlantic group. Over 230 fish species populate the North Sea that can, in turn, be divided into a number of ichthyofaunistic communities. Due to the lower salinity that decreases towards the East, the Baltic Sea contains fewer species than the North Sea with well below 200 species. In the North Sea, the distance to the coast seems to determine the structure of the fish communities, in particular. In the Baltic Sea, the salinity gradient from West to East constitutes the determining factor. New entrants to the Baltic Sea are some fish species that are specifically adapted to the brackish water conditions of the inland sea and whose marine natural range ends in the western part of the Baltic Sea. The number of species that are subject to commercial exploitation due to their stock density and/or their size is negligible with less than 20 stocks in the North Sea, Skagerrak and Kattegat and 8 stocks in the Baltic Sea. Commercially important species that are caught for human consumption are mainly confined to the representatives of four families/orders: Gadidae, herring-like fish (Clupeidae), flatfish (Pleuronectiformes) and mackerel (Scombridae).

Commercially harvested fish species in the North Sea and Baltic Sea

A general appraisal of commercially used fish stocks in the North Sea shows that a number of stocks are declining, leaving aside the North Sea herring and a few other stocks, or persists at a low level. Based on the scientific knowledge of fish stocks, ICES recommends a substantial reduction in fishing mortality for many stocks and a cessation of fishing for individual stocks until the stocks have visibly recovered. In contrast, ICES recommends an increase in catch levels for other stocks (Table 3).

Table 3: Stocks with limited reproduction and stocks for which data are lacking

Sea area	Species	Stock status	Note
Baltic Sea	Herring in the central Baltic Sea	Unclear Harvested sustainably	
	Flounder, Turbot, Plaice, Dab	Unclear	
	Cod in the western Baltic Sea	Reduced reproductive capacity	management plan adopted
	Cod in the eastern Baltic Sea	Reduced reproductive capacity	management plan adopted
North Sea	Horse mackerel	Unknown	Uncertainty about ~~bsolute~~ level of spawning stock biomass and fishing mortality
	Whiting	Overexloited	
	Plaice	Harvested sustainably	
	Haddock	Harvested sustainably	
	Saithe	Harvested sustainably	
Widespread stocks	Hake, northern	Harvested sustainably	
	Mackerel	Harvested sustainably	
European shelf, limnic area	Eel	Insufficient reproductive capacity	Stock recovery plan adopted

The data refer to the total global catches or stocks in the specified areas.

Other species

Anadromous species that migrate into freshwater for spawning are chiefly endangered by obstacles to ascent in rivers and by the destruction of spawning habitats (table 4). Furthermore, other hazards under discussion are by-catch, power plants, high-voltage cables and submarine acoustic emissions.

Table 4: Endangered stocks and stocks of anadromous species in the German EEZ for which data are lacking (as listed in Annex II to the FFH Directive)

Species	Stock assessment
European river lamprey *(Lampetra fluviatilis)*	There are indications that stocks have been substantially increasing in the inshore area for some years.
Sea lamprey *(Petromyzon marinus)*	It is hard to assess the status since catches are frequently not split up into river and sea lamprey. The catches of sea lamprey in the offshore area are minor.
Sturgeon *(Acipenser sturio)*	It is deemed extinct in the North Sea. Restocking is planned in the North Sea and Baltic Sea. The animals intended for the North Sea are to come from the residual sturgeon population in the Gironde region (France). The Baltic Sea is to be stocked with sturgeons from North America (Acipenser oxyrinchus). Sturgeons of American origin have been living in the Baltic Sea for approx. 1000 years and ousted or replaced the European sturgeon. They have been deemed extinct since 1996.
Twaite shad *(Alosa fallax)*	Shad is mainly spread in the German Bight and the river estuaries of the rivers Elbe and Weser. It regularly forms part of the catches of inshore surveys conducted by the Federal Office for Fisheries. Its increasing frequency makes it seem doubtful to still classify it as a species in need of protection.
Allis shad *(Alosa alosa)*	It had been deemed extinct for a long time. Individual specimen are occasionally being caught in the river Rhine in Baden-Württemberg. The current spawning and nursery biotopes have not yet been determined, however.
Houting *(Coregonus oxyrhynchus)*	Due to the recovery of Danish residual populations, they have increasingly been found again in inshore stake net fisheries in the North Friesean Wadden Sea for some years now. They occur in greater numbers in the Lower Rhine and Lake Ijssel after restocking.

Herring

Cod

Mackerel

Common sole

European plaice

2.3.1.2 Causes of danger

The vulnerability of the genetic resources of marine fish species has various causes:

Marine pollution and pollutant inputs

Ocean pollution caused by industrial effluents and wastewater of private households has severely damaged the habitats of many fish species in the past. The nutrient input through farming has resulted in algal blooms on an unprecedented scale and upset the balance of the production of plant and animal plancton. Oil tanker disasters causing oil spills destroyed entire coastal areas.

Evidence has shown that the entry of pollutants has an adverse impact on the organism of fish. These substances can cause a loss of general fitness of the animals that then become more susceptible to diseases, remain stunted in growth and become less fertile. More profound synergetic effects affect the food resources of many animals and impair their habitats. The result is usually a decline in numbers that mostly turns out to be reversible though if the causes can be successfully eliminated. Even a local incidence of individuals of one species that is confined to a small habitat can already sustain losses of genetic diversity. The only reason why this cannot be proven is that relevant data to describe the genetic diversity in the time period before the adverse impact is not available in most cases.

Global warming

Global warming is a problem that will increasingly affect the oceanic fish communities in the future. The changes in temperature render habitats less attractive to some species and more attractive for others. We cannot yet tell which consequences this will have for the composition of future biological communities and whether this will entail a loss of genetic diversity. However, we can assume as certain that these communities will also change through the influx of other species.

Wind power stations

A number of wind mill farms at an advanced planning stage can be found along the German North Sea coast. Some, for example, Butendiek with 80 wind turbines 34 km off the island of Sylt, have already been approved. They harbour many

Wind power station

potential sources of danger for fish and marine mammals. Acoustic emissions, electromagnetic radiation and vibrations into the water can be harmful for fish and mammals. The construction of wind power stations results in new secondary hard substrates and can entail a change in the composition of fish fauna. However, this should be qualified by noting that the formation of secondary hard substrates associated with a ban on fishing inside the wind power stations can actually increase the fish fauna. Increased boat traffic during construction and repair work can adversely affect marine mammals. It should be taken into account that this boat traffic is insignificant gauged by the customary boat traffic in parts of the North Sea where wind farms are planned. The normal boat traffic from the locations of wind power stations is diverted to the other areas and causes an additional strain there.

Overfishing

Fisheries can jeopardise the intra-specific genetic diversity through overexploitation. The large numbers of many marine fish species and the wide ranging habitats make it seem virtually impossible that one fish species could be eradicated through overfishing. However, fisheries can drastically lower the numerical abundance of individual stocks or even entire fish species as shown by the example of various cod and herring stocks in the North Atlantic (Labrador, Norwegian Sea, North Sea). The size of the cod stock in the North Sea currently amounts to only a fraction of the size required for a healthy stock. 56 million adult animals only inhabit the North Sea. At the same time, the average age and size of the animals when attaining sexual maturity has clearly dropped.

These phenomena can, inter alia, be attributed to fishing that helps to select genetic material by giving preference to smaller and early maturing animals in the stock. This seems problematic because the reproductive success of young fish is lower than that of older fish. A stock that mainly consists of first-time spawners is also more susceptible to climatic changes or overfishing. Whether this development can be reversed is currently under discussion. A later reaching of sexual maturity in the North Sea herring stock has been observed for some years. This stock has almost fully recovered.

Yet, the example of cod stocks off Labrador and on the Grand Banks demonstrates that commercial fisheries is able to permanently modify the ecosystem due to the strong depletion of individual elements of the food web. Despite the cessation of cod fishing many years ago as a result of the collapse of stocks, they have not yet recovered. At the same time, the short-lived and faster reproducing species (especially invertebrates) have multiplied. They had been decimated by cod in the past.

Research vessel „Clupea“

2.3.2 Importance, vulnerability and use of aquatic genetic resources in lake and river fishing

2.3.2.1 Importance and use of fish in natural water ecosystems

The importance of fish in natural water ecosystems is not only due to the taxonomic superlative of species diversity. As the intermediate and final links of the food webs, fish are closely interlinked with other biocenoses in the inland water ecosystems through predator-prey or symbiotic relations and fulfil diverse functions. Changes in the qualitative and quantitative composition of fish species communities also invariably have an impact on other components of the ecosystem. Modified morphological or biocoenotic environmental conditions likewise entail responses in the fish fauna. The above-mentioned reliance of fish fauna on morphological or biocoenotic environmental conditions manifests itself in the traditional zoning or typing of flowing water bodies and lakes according to the most frequently occurring fish species or the selection of fish as indicators for the ecological assessment of water bodies under the EC Water Framework Directive (WFD). Hence, for instance, bitterling, due to its breeding symbiosis with large mussels, can only constitute a reproductive stock in those waters where these mussels occur as well.

The historic as well as current settlement of fish in German inland waters has been presented by the Länder in the form of fish species registers, an up-to-date compilation can be found in the online documentation AGRDEU (http://www.genres.de/agrdeu).

The catchment areas of the larger rivers Danube, Rhine, Weser, Elbe or Oder vary widely in terms of their settlement history and zoogeography with respect to fish coenoses. These variations manifest themselves, for instance, in the presence of endemic species such as zingel, streber, schraetzer in the Danube as well as shad and twaite shad in the Rhine area. But also at levels beneath the species level, there are examples of the genetic or also phenotypic demarcation between breeds or local populations of different catchment areas or, in isolated cases, even of different hydrological networks in the same catchment area that would indicate a separate development over longer periods of time (e.g. bullhead within the Rhine system and inside the upper Danube).

This local differentiation and the associated specific adjustment to concrete environmental conditions has increasingly been the focus of attention of fishery research and practice in the past few years. Greater attention is now paid to population genetic aspects in stocking, in particular, and in fisheries management. Hence, for example, the catchment areas of the Rhine and the Danube are treated separately in Baden-Württemberg with regard to the exploitation of fishery resources. Stocking with fish from the other catchment area respectively is not allowed. The same holds true for most Länder where fish for stocking comes from stocks or progeny breeding that are, in ecological terms, as close as possible to the water body to be stocked.

The aquatic genetic resources are significant in economic, social and socio-economic terms in professional and recreational fishing. Fisheries underwent drastic transformations in the course of the 20th century. Due to numerous development schemes and anthropogenic influences that worsened the water quality, traditional professional river and lake fisheries has steeply declined. Even through the biological quality of rivers and streams has now generally improved again, commercial fisheries is now mainly restricted to lakes. They supply high-quality fish that are for the most part marketed via retailing and the restaurant and catering sector.

As in other European countries, non-commercial line fishing has been popular in Germany for many years. Both groups, professional and recreational fishers, play a major role. They take care of the preservation of rivers and lakes that has been ordered by the fishery legislation. Thus, line fishing is not only a leisure activity, but trains the regular angler in the responsible management of the environment and resources. According to the 2006 annual report on the German fishing industries issued by the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), the expenses of pole-and-line fishing on stocking, training, studies, river maintenance, conservation of fish species and reintroduction measures amounted to around € 8.5 million in 2006. Apart from this, this branch is also economically significant because of the turnover achieved by angling shops, technical journals etc.

With regard to the type and scale of the use of fish stocks and hence the influence of professional and leisure fishing on the aquatic genetic resources, there are major differences between the individual fish species. Of the 86 fish species or forms in German inland waters listed in Annex I, 28 are not subject to any direct human use or support. It is true that these species, too, are subject to anthropogenic influences, e.g. through river barriers or nutrient inputs, but a direct interference with populations cannot be recorded. In contrast to this, 45 species and forms are directly harvested by professional and leisure fishing, including 19 merely as catches and 26 as catches and as fish for stocking. Whereas the respective natural water-specific growth is harvested by catches and the fishery legislation for conservation and

Bitterling with bivalves

European perch

Bullhead

Sea lamprey

protection is designed to largely rule out threats to aquatic genetic resources, a type of stocking that is in technical terms insufficiently secured, as described above, can involve genetic risks. A further ten species are currently subject to stocking measures without being used for catches.

Salmon, sturgeon, salmon trout, common sturgeon and North Sea houting have been integrated in reintroduction and species conservation programmes. Using these species will only be possible again after stable stocks have been established. As shown by the examples of bitterling, gudgeon, moderlieschen (Belica), bullhead or minnow, the stocking measures are locally mainly aimed at the stock rebuilding of endangered small fish species without pursuing any economic or catch interests.

2.3.2.2 Causes of danger

The natural habitats in freshwater are more circumscribed spatially and more diversely structured than in the ocean. Anthropogenic changes in the aquatic habitats as well as a poor water quality largely jeopardise the limnic fish fauna that is far richer in species, but poorer in numbers. The key causes of danger are explained in the following:

Alongside fisheries, inland waters are subject to diverse uses. In line with the needs, the running water bodies especially have undergone drastic morphological changes. Since the Roman times already, measures for the purpose of flood control, timber rafting, to store drinking water and industrial water as well as to irrigate farmland have been known. At the dawn of industrialisation, people embarked on a reshaping of aquatic habitats in line with the requirements of the transport and energy technologies of the day.

River obstructions and use of hydro-electric power

The straightening of watercourses results in their shortening and entails drastic changes in the runoff coefficients. Already between 1817 and 1876, the length of the river Rhine had been shortened by one quarter due to straightening between Basle and Mannheim.

Steeper slopes result from this because the altitude difference does not change in the process. This therefore causes accelerated runoff with increased vertical erosion, a monotonisation of the substrate and more transportation of sediment load. In the case of sensitive species such as nase, grayling and trout, the changes in spawning substrate alone and the flow rate impede reproduction. The erosion of the streambed

Burbot

Weatherfish

Common whitefish

decouples the main water body from its dependent branches, cutoff meanders and floodplains. Many habitat structures that are required for the reproduction and growth of juvenile fish are lost in the process. This entails the decline of species that are characteristic of running water bodies, e.g. pike.

Transverse structures are intended for energy generation or for the regulation of the water level required for shipping. They destroy the free-flowing water continuum and thus relegate the flowing water bodies to a chain of dam water basins. The self-purification power of stretches of streams is reduced, the soil silts up with spawning substrates being covered and the physical water properties are modified. The barriers against spread cause an interruption of the gene flow between neighbouring populations and isolate them. The hydraulic diking of the former area-wide floods reinforce this trend. In case of a small isolated stock, this can result in a genetic impoverishment through inbreeding in the long term. Species-specific migrations to spawning and feeding grounds can no longer take place.

If the population of a fish species drops below a critical size, it forfeits its survival capacity. If long-distance migratory fish such as eel, ~~salmon~~ trout, salmon, shad, sturgeon as well as river lamprey and sea lamprey migrate downstream, turbine blades frequently constitute a lethal trap for them. This also affects migratory fish covering short and middle distances that are seeking spawning grounds or protected zones or resting sites or migrate to offset different stocking densities. ~~hezonen sind oder Wanderungen zum Ausgleich unterschiedlicher Bestandsdichten ausführen, sind davon betroffen.~~

Shipping

Shipping, too, exerts a direct influence on the hydrological network. The wash of the waves caused by ships, their water displacement and the suction of their propeller causes an erosion of the riparian zones with fish roe and juvenile fish habitats being at risk. In addition, the noise caused by propellers can interfere with the sense of orientation of long-distance migratory fish.

River maintenance

Most regulated flowing waters must be regularly maintained to preserve their runoff performance, to safeguard flood control and, if relevant, to enable shipping. This impairs the structural diversity in the river bottom and riparian zones and damages many habitats and spawning grounds of domestic fish species.

Straightened river Kinzig

From the natural succession ensues a silting-up of slow-flowing and stagnant waters. This also concerns the artificially constructed ditches and ponds. To preserve these habitats, the water bodies concerned must be regularly cleared of aquatic plants and silt.

When conducting water maintenance measures, the ecology of the flora and fauna living there must be taken into account. Desilting measures in ditches, flowing water bodies and abandoned meanders should therefore be carried out in subareas so that a repopulation with the flora and fauna that used to be there can emanate from the remaining areas. This applies especially to the less mobile small fish species such as pond loach and stone loach.

Nutrient inputs

Pictures of white crests on rivers from the mid-1960s remind us of the high inputs of phosphorus and nitrogen compounds at that time that were caused by municipal and industrial wastewater. The nutrient input in rivers and lakes can cause a mass propagation of algae and then trigger a chain of events that can result in the dying-off of plants and thus in an oxygen deficiency and deposition of dead plants. Lack of oxygen and substrate changes weaken the fish fauna, impede the development of soil-dwelling animal species and the amount of roe. This results in a modification of aquatic biocenoses. Instead of many species with a lower stocking density in the past, only a few species in large numbers now exist. ~~Soil-~~spawning species with high oxygen requirements

Weir in Lüneburg with fishway on the river Ilmenau

such as ~~common~~ trout, grayling and char become rare whereas plant-spawning species with minor oxygen requirements such as chub, roach and perch occur more frequently.

The situation has been eased notably by the use of phosphate substitutes in detergents and phosphate precipitation in sewage treatment plants. However, the water pollution through sewage waters, contaminated sediments as well as through the washout of fertilizer substances from agricultural land into our running water bodies and lakes is still excessive.

Discharges of polluting agents and toxic substances

In spite of continuously improved purification techniques, running water bodies notably are still contaminated by various toxic substances and compounds. Yet, the pollutant load has dropped sharply over the past few decades. There are also nonpoint sources besides the concentrated loads. This includes washout from farmland, diffuse airborne pollutant inputs that may result in pH changes (acidification) as well as the resuspension of toxic substances from the sediment. The latter, in particular, poses a long-term problem. This does not usually result in a spectacular fish kill, but in a number of minor strains, in fact, that only show their impact as a sum total.

The discussion revolves around sublethal impairments that may first result in a reduced reproductive rate in fish, harm to fish fry as well as in a diminished disease resistance and infertility. The specific impact is often hardly known and depends on a number of water-specific factors. On top of this is the fact that specific toxins are either not or difficult to degrade by organisms and therefore accumulate in the food chain. Predator fish are therefore particularly at risk.

A large-scale research programme in Switzerland (www.fischnetz.ch) examined many possible causes of the depletion of trout stocks. The upshot of this study was that clear-cut causes applying to all water bodies could not be found so that each water body must be viewed individually.

The hypothesis, in particular, that the input of endocrinically active substances substantially or drastically worsens the natural reproduction of stocks could not be confirmed. Whereas isolated changes were noted in fish below clarifier inlets, they did not amount to a dwindling of fish stocks.

Tourism and recreational use

There is an increasing trend towards the use of surface water bodies for leisure activities. Alongside swimming, boat trips and surfing, extreme sports such as rafting and canyoning increasingly impair areas of unspoiled nature.

In running waters, fish are frequently disturbed by heavy leisure boat traffic to such an extent that they no longer leave their shelters and reduce their feed intake. Leisure boats severely impair the otherwise inaccessible resting places in the alluvial waters of the lowland rivers. Spawning seasons and spawning grounds of fish, breeding seasons and moulting periods of aquatic fowl are often ignored. The disturbance caused by organised crowd events is particularly harmful. Grayling, nase and barbell are particularly at risk due to their relatively late spawning season.

The destruction of rushes in the riparian zones of some stagnant waters has led to the loss of numerous spawning and feeding grounds of domestic fish species. The construction of jetties and river- and lakeside paths as well as trampling damage seriously damaged the riparian and shallow water vegetation in various places.

In winter, ice-skaters, curlers and divers disturb fish in their hibernal resting period due to the noise pollution emanating from them. The animals try to escape and consume energy they would normally need to survive in the cold water. The premature loss of energy weakens the immune system and renders them more susceptible to diseases.

Influence of fish-eating birds

The locally and temporally high incidence of fish-eating birds such as cormorants and grey herons entailed a massive collapse of fish stocks in many waters and especially in pond farming. This took a toll on grayling and eel in natural waters, in particular. The lack of refuges for fish in straightened river courses aggravates the problem.

Genetic alienation through improper stocking measures

The fisheries legislation of the Länder provides, within the scope of preservation, for the stocking with suitable animals to offset recruitment deficits as well as to reintroduce fish species that used to be native.

Studies of genetics show that individual fish species demonstrate widely varying regional differences, in some cases only between catchment areas. In the case of some species, however, disparities also occur inside one region or even on a very small geographic scale (example: bullhead). In spite of a stocking practice that has been engaged in for many decades, regional differences are still clearly visible in some species. Take ~~common~~ trout, for example, that is probably the fish species that is stocked most frequently and also throughout Germany. Despite this long-standing stocking practice, almost every stock under examination still displays the characteristic genetic features of the respective catchment area. However, only few ~~common~~ trout stocks exist in Germany that do not display any influence exerted by stocking. Knowledge of the genetic differentiation of stocks is poor especially in the case of small fish species that are not exploited by fishing. There is a major need for research in this regard. Stocking with material of unclear origin should therefore be refrained from.

Especially in the case of salmonid~~ae~~, ranching has been occasionally promoted as a method for minimizing the influence of stocking ~~material~~ on the existing population. Ranching means that parent animals are ~~removed~~ from the stocking water, eggs are harvested from them and fertilized and ~~bred~~. Alevins or juvenile fish reared to a certain size are again released into this water body.

Breeding colony of cormorants

Roach injured by cormorant

However, in controlled breeding, the selection conditions differ from those in the wild. Through human interventions, specific genotypes may unintentionally be preferred that are favoured in rearing whereas other genotypes may have better chances of survival in the wild.

The experience gained in reintroduction programmes shows that different approaches may prove successful. The first question to be posed before the start of a reintroduction programme should be whether a residual stock of a species still exists in the river basin. The experience with the river Rhine clearly shows how the drastic improvement of the water quality in the 1980s and 90s enabled various fish species to rebuild an appreciable stock without any human interference. Nobody had any idea that these species still existed. This includes river and sea lamprey, for instance. Salmon, in contrast, had definitively disappeared from the river Rhine, thus rendering a natural reintroduction impossible. In this case, stocking is the only option to rebuild a stock again. However, stocking with material of alien origin should only be continued until an adequate, self-reproducing stock has been established. Juvenile fish of different origins are being used because the original Rhine salmon no longer exists. As soon as sufficient fish has returned, the spawning material of these animals can be used and the share of alien origins in the stock can be reduced.

The example of Lake Constance ~~salmon~~ trout showed that an effective replenishment of the stocks was only possible if spawning material harvested from parent animals that were reared in Lake Constance and migrated into the tributaries was used. Today, stocking measures are scaled back in favour of renaturation measures in the largest tributary of Lake Constance, the Alpine Rhine.

If fish of alien origin is used for stocking, there is a risk of infiltration of adapted and specialised genotypes, resulting in a loss of vitality of the stock through depletion of the local gene pool.

The use of non-native species is subject to approval or prohibited as it can involve incalculable risks. The problem of bastardisation of fauna manifests itself in a number of fish species that had already been introduced in Germany some decades ago, in some cases even in the penultimate century. Nevertheless, small fish species of unknown origin are offered to increase the species number and as an alleged contribution to species conservation. Stocking these animals harbours the risk of mixing with genetically still uninfluenced residual populations or ecologically unacceptable alien species could stablish themselves.

The risk of stocking with bioengineered fish is hard to estimate. So far there have been no plans or applications for the stocking of genetically modified fish. Most Fisheries Acts expressly prohibit this stocking.

Stocking should always be the last recourse to rebuild populations or for reintroduction. Yet, it should be noted that some stocks, especially migratory species, still do not encounter any living conditions that would allow a stable self-reproduction and have so far only been preserved with the aid of stocking. Stocking cannot be dispensed with at present. Prior to stocking measures, all options should be seized for stock recovery through biotope protection or through possibilities of natural migration from the catchment area. At the same time, efforts should be made to lay the foundations for a well-balanced, healthy and diverse fish stock on a permanent basis by restoring and improving the habitats.

Endangerment through neozoa

A large number of neozoa occurs in Germany. Annex 2 sets out the species of which larger stocks are known to exist in inland waters or of which larger stocks had at least temporarily been present in Germany. Species that are only regionally neozoa are also listed.

A general statement on the effects of aquatic neoza on aquatic genetic resources cannot be made because the already observed or also presumed effects can have effects at very different levels. The formerly deliberate introduction of neozoa that also encompasses carp and rainbow trout turned out to be an enrichment for our fishing industry. Today, these “former neozoa” that had been subject to breeding activities to a different degree are seen as part of our genetic resources. This aspect of deliberate introduction, breeding and use of originally non-native species applies to most farm animals and arable crops. They are mainly kept in ~~growing~~ areas specifically created for this purpose such as ponds, fields and pastures. It should ~~by all means~~ be examined whether other potential species of cultivated fish could be used in aquaculture. The intended and unintended release of alien species represents a possible hazard.

In many cases, the occurrence of neozoa and changes in habitats, e.g. eutrophication, river barriers, recently also oligotrophication and renaturation, coincide. A transformation of the biocenosis cannot only be ascribed to the occurrence of neozoa. Changes in the habitats certainly facilitate the establishment of some neozoa.

From the 1880s until the beginning of the last century, targeted releases were the main reason for the occurrence of aquatic neozoa. Statutory rules restricted these targeted releases in the past few decades.

Other reasons for the occurrence of aquatic neozoa lie in the construction of canals that link up previously isolated catchment areas as well as the introduction through ballast water and the periphyton in vessels. The latter can be considered a hazard in the marine field especially. It is assumed that 2.7 million individuals are introduced through ballast water into German waters on a daily basis of which ca. 20% are alien. A more intensive monitoring of fish stocks had certainly also provided a more precise picture of the neozoa that are actually present. Stocks of small fish species especially such as that of the stone moroko would mostly not be detected without intensive monitoring and hence would not be documented either.

The occurrence of neozoa can exert many different effects. Aquatic neozoa can compete with related species (and taxa below them) or species with similar habitat requirements. This can result in the displacement of the native species or a genetic intermixing with the native species. The mass occurrence of Chinese crab that had been introduced through ballast water and populates habitats of native species poses a serious problem. An example of genetic intermixing is the crossing of brook trout (Salvelinus fontinalis) with the native ~~lake~~ char (Salvelinus alpinus) that frequently led to an infiltration of brook trout into the naturally occurring stocks of lake char. Efforts are made to contain this process through stocking programmes with exclusively indigenous material. Only few neozoa could establish themselves in Lake Constance, for instance. Of these neozoa, only pike-perch (Sander lucioperca) has any economic importance. However, evidence of any profound changes in the fish fauna of our natural ecosystems through neozoa is lacking.

The introduction of disease agents poses a serious threat to native stocks. Our European crayfish (Astacus astacus) had been largely ousted by American crayfish that had been introduced into Central Europe in the 1860s for the first time. North American crayfish are carriers of crayfish plague (Aphanomyces astaci). This fungal disease occurs in North America and does not pose any problems for the crayfish there. However, this disease agent is a lethal hazard for European crayfish species. Hence, most stocks of European crayfish had been eradicated within a few years through the incidence of crayfish plague that spread in Central Europe from the 1880s onwards. A resettlement of hydrological networks where North American crayfish occurs with native crayfish is still impossible today due to crayfish plague.

Another disease agent that had been introduced in the 1980s is the nematode Anguillicola crassus that affects the swimbladder of eels. This parasite lives in the swim bladder of eels in Asia. It does not cause any problems for the eel species there. The swim bladder of European eel is seriously damaged by a stronger infestation, however. Virtually all eel stocks in Germany are likely to be infected now. The infection of the swim bladder in freshwater seems to have few or only minor adverse effects. Dutch studies show that problems may occur for spawning migration depending on the intensity of infestation. Whether the steep decline in glass eel populations in the estuaries of European rivers in the past few years is related to this cannot be directly proven but a connection cannot be ruled out.

Nonaquatic neophytes or neophytes that are not disease agents can also have an impact on aquatic genetic resources. Take, for example, Himalayan Balsam (Impatiens glandulifera). The mass occurrence of this species in the past few years along natural stream and river courses results in a severe erosion hazard for parts of the natural banks and shores in autumn and winter because the riparian zone is no longer protected by vegetation after the autumnal die-back of snapweed plants. There is a liability to erosion therefore and a lack of shelters or visual cover for native fish species.

It is known about neozoa that many years can pass by from the first occurrence to a greater distribution and/or establishments of a self-reproducing stock. It can therefore not be ruled out for the neozoa that may now only occur in negligibly small stocks that they could unexpectedly and suddenly spread in the near future and build up a larger stock at least locally or regionally. The appearance of new species always involves the risk of introduction of parasites or diseases. The occurrence of crayfish plague demonstrates that this can have a serious impact. Due to dynamic trade in ornamental fish and shipping, many different fish species reached Central Europe of which some species at least are potentially capable of natural reproduction in Central Europe.

Neozoa in open waters are practically uncontrollable now. As in the case of each fish species, it is almost impossible to remove neozoa from the water bodies again. In such cases only a stock management can exert a regulatory effect. The most effective option is to prevent the release of a species in the first place.

2.3.3 Importance, vulnerability and use of aquatic genetic resources in aquaculture

Fish husbandry in aquaculture is in keeping with a long-standing tradition in Germany. In the process, trout farming, mainly rainbow trout, and carp farming now plays a major role in economic terms. Aquaculture meanwhile accounts for 80 % of the total output of inland fisheries. In contrast to our domestic animal species, there is no monitoring in Germany and no measures to protect the genetic base of the species kept in aquaculture. Any threat to already established species and newly cultured species is hard to assess due to a lack of data. What is certain is that many of the old breeding lines have already been lost in carp at least. Especially with a view to the global growth prospects in aquaculture, rainbow trout, carp as well as the accompanying fish of pond farming and the newly cultured species necessitate more precise monitoring and assessment of the genetic base.

2.3.3.1 Importance of the genetic resources of salmonidae, especially of rainbow trout, for breeding

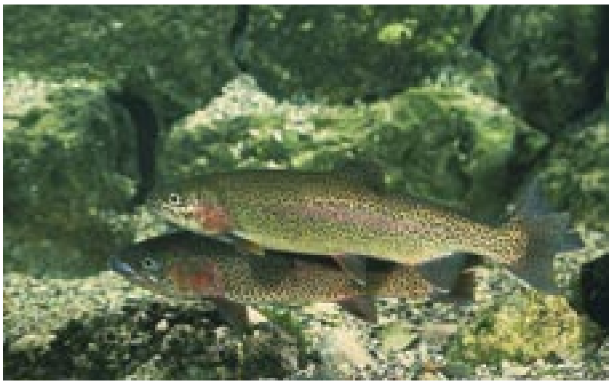
Salmonidae only became important as farmed fish in Europe at a relatively late stage. As early as 1765, the German Stephan Ludwig Jacobi successfully conducted the artificial insemination of native ~~common~~ trout (Salmo trutta fario). The insights gained by Jacobi fell into oblivion temporarily. In the mid-19 century, the method of artificial reproduction of salmonidae was rediscovered and put into practice. First, salmon and ~~common~~ trout were bred for stocking purposes. Rainbow trout (Oncorhynchus mykiss) from North America was introduced around 1880. The aquaculture of fish of the Salmonidae type in Central Europe quickly developed with this new species. Since then, rainbow trout in Central Europe has played the key role among all salmonidae produced by pond farming. Today, trout production accounts for a 48% share in the total output of German inland fisheries. Domestic production can therefore only cover 50 % of the requirements for table trout. The rest is mainly imported from Denmark, France and Italy.

In its ~~home region~~ on the North American West Coast, rainbow trout has a large range of distribution and therefore occurs in numerous local forms. Two types can basically be distinguished among the forms of this species, an anadromous migratory type that ~~climbs~~ from the ocean to the inland waters for reproduction, whose juvenile fish return to the ocean after a certain period of time, and a sedentary type that spends all its life in inland waters, i.e. rivers or lakes. Due to the large natural range and the prevailing different environmental conditions there, the spawning period of the species stretches from August to April.

Rainbow trout turned out to be more suited for pond farming and the production of fish for food than the native ~~common~~ trout. It coped far better with the typical pond conditions, i.e. more or less stagnant water that is not particularly clean and frequently warmer and the feeding regime. Furthermore, it has a better feed efficiency, faster growth as well as lower loss rates in rearing than the native trout. However, there are now also breeding lines of native ~~common~~ trout that can almost take on rainbow trout with regard to performance and tolerance of farming conditions.

The genetic potential of rainbow trout can only be assessed in a European context because a more intensive exchange of genetic material occurs in Europe.

~~Breeding~~ is also practised in the reproduction of rainbow trout in Germany. Yet, this is not sufficiently documented



Rainbow trout

Grayling

Brown trout

Brook trout

in every case. ~~Breeding lines~~ exist that stand out from the general standard. Apart from certain colour varieties that are mostly less interesting in economic terms (e.g. “golden trout”), distinctive feature worth noting are, in particular, the performance traits (growth, meat percentage etc.) and particular adaptations to local or regional environmental conditions such as a different spawning maturity.

Many ~~fish~~ farms in Germany largely specialise in the sub-productions “breeding and reproduction” or “fattening and processing of table trout” ~~in the aquaculture of rainbow trout~~. Reproduction takes centre stage in the hatcheries mentioned first. Here, brood fish are kept and juvenile fish are produced. Besides rainbow trout and ~~common~~ trout, other salmonid~~ae~~ species (table 5) are also used as fish for stocking for open waters as well as for ~~edible fish production~~. Chapter 2.3.2 explains the problems arising in salmonidae production as fish for stocking for open waters. Whereas experience has shown that the genetics and origin of spawners is a key criterion for stocking in open waters, they are neglected to some extent in aquaculture. The breeding lines of broodstock constitute the actual genetic resources for this branch of production. Given that they have either not been or only inadequately examined, their value and also

Table 5: Salmon~~-like fish~~ produced by aquaculture in Germany

Species	Origin	Importance for aquaculture
Rainbow trout *(Oncorhynchus mykiss)*	North America	Almost exclusively as food fish, locally also as fish for stocking for open waters
Brown trout *(Salmo trutta fario)*	Indigenous to Germany	Mainly as fish for stocking, seldom as food fish
Brook trout *(Salvelinus fontinalis)*	North America	Mainly as a genetic base for Elsässer Saibling
~~**Charr**~~ *(Salvelinus alpinus)*	Indigenous to Germany	Fish for stocking and genetic base of Elsässer Saibling
Grayling *(Thymallus thymallus)*	Indigenous to Germany	Locally as a fish for stocking to replenish stocks in flowing water bodies that are endangered by cormorants and for reintroduction
Various local types of Common Whitefisch *(Coregonus lavaretus)*	Indigenous to Germany	Stocking for the recovery of indigenous stocks and stocking in some valley reservoirs and mining lakes
Vendace *(Coregonus albula)*	Indigenous to Germany	Fish for stocking for stock rebuilding in some lakes and in some valley reservoirs and for stocking in mining lakes
Huchen *(Hucho hucho)*	Indigenous to Germany	Fish for stocking for stock rebuilding and locally also for reintroduction
Atlantic salmon *(Salmo salar)*	Indigenous to Germany	Fish for stocking for reintroduction
Diverse ~~crossings~~ of trout and char, especially the Elsässer Saibling *(Salvelinus fontinalis x Salvelinus alpinus)*		Food fish

their vulnerability, cannot be assessed as yet. It would be necessary to evaluate the actual breeding stock to this end.

In the “fattening and processing” branch, rainbow trout and other species as well as char hybrids, especially „Elsässer“ Char (S. fontinalis (f) x S. alpinus (m)), are produced primarily for marketing as food fish.

2.3.3.2 Importance of the genetic resources of carp for breeding

The domesticated ~~pond~~ carps in Central Europe differ considerably from wild carp in appearance and behaviour. Wild carp is completely covered with scales and has an oblong, torpedo-like form and is coloured blue and grey. The transition between head and back is elongated and ~~without~~ the typical and distinct rising neck of pond carps. Whereas the ratio between body length to body height in wild carp amounts to approx. 3.6 or 3.1 depending on the origin, it easily reaches levels of 2.5 or under in pond carps. Commercially farmed carp in Europe is generally coloured green and yellow and shows minor squamation. The virtually unscaled linear carp, mirror carp and even ~~naked~~ carp evolved in the course of time. Pleiotropic effects exist between squamation and performance ability. The order of performance ability (e.g. in growth, survival rate) generally decreases from scaly carp via mirror carp, linear carp to ~~naked~~ carp. However, scaly carp and mirror carp do not differ so much so that mirror carp prevailed in line with consumer habits.

The original home region of carp (Cyprinus carpio) lies in Asia Minor and in the Caspian Sea in all likelihood. Carp spread from there to the East and to the West. Solid evidence indicates that carp has existed in the catchment area of the Danube for eight to ten thousand years. Today’s subspecies Cyprinus carpio carpio descends from this western population. Carp spread to the East via Siberia and China to Japan. Today’s subspecies Cyprinus carpio haematopterus emerged from this spread to the East. The Vietnamese subspecies Cyprinus carpio viridiviolaceus constitutes a further eastern variant.

Carp is said to be the oldest domesticated commercially harvested fish species in the world ~~and rightly so~~. Its natural spread and settlement by humans cannot be clearly separated any longer. It has long been assumed that the carp was first domesticated in China because there has been evidence of carp farming in ponds for over 2500 years, thus longer than in Europe. Yet, this has probably been catches of fish fry reared in ponds. This did not result in a domestication.

The domestication of carp started in Europe from the 1st to the 4th century AD when the Romans transported carp from the Danube as ornamental fish or as exotic gourmet dish in their piscinae to Rome or to countries occupied by them. The installation of ponds with their more favourable temperature regime compared with natural waters made it possible to rear and reproduce carp in regions where no natural reproduction would normally occur. It is for precisely this reason that breeding progress in European pond carp has been so swift. A selection breeding under compulsion probably occurred because breeders only used the best and fast growing spawners for reproduction, basically exluding the others from passing on genetic information to the subsequent generation.

Harvest of carp

Wild carp from the Rhine

Mirror carp

The evolution of carp to a domestic animal only happened after carp breeding became more widespread in the Middle Ages. Targeted breeding and selection began from the 14th to the 16th century. Breeding with targeted selection peaked in the 17th to the 20th century. In the early 20th century, different carp breeds could already be described in Central Europe using physical features. These were assigned to the groups “humpback-shaped and short carp breed” (Aischgründer and Galizier) as well as “elongated carp with a more or less low back” (Böhmer, Franken, Lausitzer). Types that could be traced back to existing breeds were designated as strains, e.g. “Wittinger strain”, “Berneuchener strain” or “Göllschauer carp”.

Apart from a differentiation according to external features, the first performance tests of these types of carp were conducted in the first half of the 20th century.

The situation in carp breeding changed fundamentally after the Second World War. Prompted by the acute lack of stocking material, but also by improved means of transportation the stocks intermixed to a considerable degree and breeding almost came to a standstill.

In the old Länder, carp production is mainly concentrated in northern Bavaria. As a result of the vicinity, the still existing breeds and the numerous strains of individual fish farmers mixed in the past century. Breeding material was also exchanged with some East European countries, notably the Czech Republic, Hungary and Yugoslavia. Substantial quantities of reared carp had also formerly been obtained from Israel.

Carp pond farming had been largely self-sufficient in the ~~GDR~~ for over 40 years and carp for stocking was hardly ever imported. Therefore, local strains again emerged in many pond farms through inbreeding in the wake of the Second World War.

The genetic variability of German commercially farmed carp is still minor. Bavarian as well as Lausitzer carp can therefore still be genetically distinguished despite 40 years of separate breeding activities, but they are closely related. In genetic terms, they clearly differ from the morphologically wild-carp like stock that endemically occurs in the river Rhine and also belongs to the subspecies C. carpio carpio.

No serious efforts are currently being made in Bavaria to preserve or maintain pure strains whereas large pond farms in the Lausitz still see to it that their breeding material is kept in a specific way. However, a humpback-shaped carp called “Aischgründer carp” is marketed in the Bavarian Aischgrund for which protection of the designation of origin has been applied for according to Regulation (EEC) 2081/92. However, the carp marketed with this designation do not necessarily descend from the Aischgründer breed in genetic terms. This Aischgründer breed used to be native to the region. No activities are currently undertaken in Germany to document any still existing carp strains and there is no safeguarding concept for their preservation.

Alongside carp that is intended for human consumption, coloured carp has attained an economic importance in Germany today that should not be underrated. They are kept and reproduced as ornamental fish purely according to optical features. Apart from the golden varieties that still occur relatively frequently in Europe, there are red, orange, steel-coloured, jet-black, snow-white varieties as well as carp that is spotted in two or several colours (Nishikigoi or in brief Koi). Koi carps are now also increasingly being produced in pond farms in Germany and kept in garden ponds or special facilities.

Whitefish breeding

Catfish

Sturgeon

2.3.3.3 Importance of accompanying species and of other species kept in aquaculture

Accompanying fish of pond farming such as common sturgeon, pike, catfish, pike-perch and eel are to some degree economically important. As prime quality freshwater fish they frequently yield higher proceeds/kg than the main species. Technical facilities are currently being tested that are to allow fish breeding in an ecological manner, if possible. Species like European and African catfish, turbot and seabass are reared in freshwater or saline water. The feeding of eel is economically important. Its reproduction under breeding conditions has not yet established itself. The genetic base of these cultured fish requires further research and development activities to adequately assess the new resources and to be able to use them economically, as appropriate.

3 Legal and political framework conditions

The conservation and sustainable use of aquatic genetic resources is not a separate policy and legal area. It is largely governed by the rules of fisheries, environmental, nature conservation as well as consumer protection policies. In the limnic area, the aquatic genetic resources are particularly affected by the water management regimes.

3.1 International regulatory framework

The Convention on Biological Diversity (CBD) constitutes the key regime for the protection and sustainable use of genetic resources as part of biodiversity. It took effect in 1993 and has so far been ratified by 188 states, including Germany. Objectives of the Convention are the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of biodiversity. The contracting states committed themselves to embodying these objectives in the national legislation and policies with the aid of national plans and programmes.

The Agenda 21 adopted in 1992 is not a legal instrument, but is of vital political importance. In 40 chapters, mandates for action are issued for all key areas of environmental and development policy. The chapters 17 and 18 are crucial for the conservation and use of aquatic genetic resources. Chapter 17 addresses the protection of oceans with their living resources. Chapter 18 mainly deals with the protection of freshwater reserves, whilst also taking into account aquatic ecosystems. Agenda 21 supports the implementation of the 1982 United Nations Convention on the Law of the Sea.

The 1982 United Nations Convention on the Law of the Sea had also been ratified by Germany and took effect in 1994. It regulates the division of the oceans into economic zones that are up to 200 nautical miles wide. It ensures the sovereign rights to explore and exploit, conserve and manage the natural living and non-living resources within the national territory. At the same time, it contains the commitment to set catch quotas that allow a maximum sustainable yield.

As a result of the United Nations Convention on the Law of the Sea, the 1995 UN Agreement relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks took effect in 2001. This Agreement is to guarantee the long-term conservation and sustainable use of straddling and highly migratory fish stocks for instance by strengthening regional fisheries organizations and intensifying international cooperation on matters concerning these stocks.

A further political element is the FAO Code of Conduct for Responsible Fisheries of 1995. This Code of Conduct lays down the principles and international standards of conduct to ensure an effective conservation, management and development of living aquatic resources with due regard to the ecosystem and species diversity. In the process, attention is paid to the biological characteristics of the resources and their environment as well as to the interests of consumers and other users. The Code integrates the requirements set out in the above-mentioned and other key instruments and fosters their implementation.

The following international regimes are also of importance:

- the Bern Convention, 1979 (Convention on the Conservation of European Wildlife and Natural Habitats) and
- the Bonn Convention, 1984 (Convention on the Conservation of Migratory Species of Wild Animals) and the
- Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1976 (CITES, EU Wildlife Trade Regulation (EC) No. 338/97).

3.2 International regional agreements

The international regulatory framework at regional level refers to demarcated geographical areas. The agreements listed in the following are relevant for Germany, in particular.

The following multilateral agreements for the marine sector on the conservation and management of fish stocks under regional fisheries organizations should be pointed out, first and foremost:

- IBSFC, 1973 (Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts, repealed at the end of 2006 and replaced by a bilateral agreement between the EU and Russia);
- NAFO, 1978 (Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries);
- NEAFC, 1980 (Convention on Future Multilateral Cooperation in the Northeast Atlantic Fisheries);
- NASCO, 1983 (Convention for the Conservation of Salmon in the North Atlantic Ocean)

and the multilateral agreements governing the protection of the marine environment:

- OSPAR, 1992 (Convention for the protection of the marine environment of the North-East Atlantic);
- HELCOM, 1992 (Convention on the Protection of the Marine Environment of the Baltic Sea Area).

With regard to freshwater, international water conservation agreements have been concluded between the riparian states for cross-border European rivers and lakes especially. They strive, for example, for the curbing of the pollution load through industrial discharges or draw up joint management plans:

- IBKF, since 1893 (International Conference of Deputies for Fishery in Lake Constance)
- ICPR, since 1951 (International Commission for the Protection of the Rhine)
- International Commissions for the Protection of the river Mosel and Saar since 1962
- IKSE, since 1990 (International Commission for the Protection of the Elbe River)
- ICPDR, since 1994 (International Commission for the Protection of the river Danube)
- IKSO, since 1996 (International Commission on the Protection of the Oder)
- IGKB, since 1960 (International Commission for the Protection of Lake Constance).

3.3 EU regulatory framework

German fisheries policy is to a great extent incorporated into the Common Fisheries Policy of the EU (CFP). The European Council (Fisheries) adopted the Regulation (EC) No. 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the common fisheries policy on 20 December 2002, thus replacing the Basic Regulation on Fisheries that previously applied. The new Regulation now contains, inter alia, the authorisation to restrict the fishing effort to protect stocks. The Federal Government welcomes this part of the new Basic Regulation on Fisheries with a view to a sustainable and ecologically responsible fisheries. The Biodiversity Action Plan for Fisheries (2001) greatly matters for genetic resources in fisheries and aquaculture notably.

Further action plans concern the integration of environmental conservation requirements into the CFP and the curbing of illegal fisheries. A Community action plan of the EU to manage European eel is currently being drawn up.

The Financial Instrument for Fisheries Guidance (FIFG) (Regulation EC No. 2792/1999, amended by Regulation (EC) No. 2369/2003) was available to the Member States to implement the structural policy such as the development of fleet sizes, of processing and trade in fish and fishery products and the development of aquaculture projects. From 2007, the FIFG is replaced by the European Fisheries Fund (EFF) (Council Regulation (EC) No. 1198/2006 of 27 July 2006 on the European Fisheries Fund).

In addition, there are EU directives regarding environmental and nature conservation policy that can also make an indirect key contribution to protecting aquatic genetic resources. Take, for example, the Fauna-Flora-Habitat Directive (FFH Directive 92/43/EEC) of 1992 as well as the EC Wild Birds Directive (79/409/EEC) of 1979 on the basis of which an ecologically consistent European network of special protected areas designated “Natura 2000” will be established and the EC Water Framework Directive (2000/60/EC) of 2000.

The main target of the FFH Directive is to foster the preservation of biodiversity, with the economic, social, cultural and regional requirements also being taken into consideration though. To this end, terrestrial as well as aquatic areas are to be designated that serve the in-situ conservation of biodiversity.

The EC Water Framework Directive constitutes a Europewide valid regulatory framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. In the water categories of rivers, lakes as well as transitional waters, fish fauna is used, inter alia, as a monitoring indicator and element for the ~~assesssment~~ of the ecological status of the waters.

The EU budget has earmarked approx. 4 % for research and technology. Research support on the AGR can be applied for under the 7th framework programme for research.

3.4 National regulatory framework

Competencies of the Federal Government

Within the scope of concurrent legislative powers, the Federal Government has the legislative power for deep-sea and coastal fisheries (see Article 74 (1) no. 17 of the Basic Law). These are integrated into the common fisheries policy of the EU. The Federal Government is in charge of fisheries monitoring and control in the exclusive economic zone (EEC) outside of the 12 nautical mile zone and on the High Seas. EFF support is intended as an instrument to implement structural policy. The coordination and monitoring of support programmes conducted by the Länder also rests with the Federal Government. The Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) is in overall charge of fisheries policy.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) is in overall charge of issues related to water management and environmental and nature conservation. This encompasses, inter alia, the Federal Water Act and the Federal Nature Conservation Act. They are also designed to transpose international and EU commitments such as the EC Water Framework Directive, the EU Wildlife Trade Regulation and the FFH and the Wild Birds Directive provided the Federal Government’s competency for framework legislation allows this.

Länder competencies

The Länder have the exclusive legislative power for inland fisheries. Moreover, they implement the rules governing coastal and inland fisheries. Within the 12 nautical mile zone, the authorities competent under Länder law exercise the monitoring of fisheries activities to implement Community fishery legislation. Hence, regional conditions are also taken into account. The provisions of Section 5 of the Federal Nature Conservation Act do not affect the provisions of the Länder fishery legislation.

Priority areas are as follows:

- engaging in fishing activities (fisheries legislation, issuance of angling licences, description of forms of fishery legislation and the exercise of fishing rights),
- conservation of fish species and protection of fisheries (fish preservation duty, stocking requirements, closed periods for fishing, harvestable size limits, fishing-ban zones, protection of fish water, rules governing fish harvesting).

4 Current conservation and support schemes

4.1. Coastal and deep-sea fisheries

4.1.1 Measures and actors

The Common Fisheries Policy (CFP) endorses the protection, conservation and safeguarding of a sustainable use of living aquatic resources by integrating the precautionary and ecosystem approach, in particular, into fisheries management. Take for example the numerous regulations to limit the level of catches and restrictions on fishing gear that are subject to constant checks, the formulation and adoption of stock recovery plans as well as the measures taken to preserve sensitive habitats.

Concepts for a targeted conservation of genetic diversity in marine fish stocks are still in their infancy. In many cases it is still a question of laying the scientific groundwork for this.

The importance of biological diversity is acknowledged in many of the agreements mentioned in Chapter 3. Different national and international programmes are designed to implement these agreements. They increasingly make allowances for the protection of biodiversity. Under its Biodiversity Strategy (1998), the European Union produced a “Biodiversity Action Plan for Fisheries”. Its implementation with the integration of other environmental aspects influenced the common fisheries policy. The Action Plan defines the following targets:

- fostering the conservation and sustainable use of fish stocks,
- supporting the monitoring of catch levels and technical measures with regard to the conservation and sustainable use of fish stocks,
- reducing the impact of fisheries on non-target species as well as on coastal and marine ecosystems,
- avoiding aquaculture methods that jeopardise habitat preservation.

ICES (International Council for the Exploration of the Sea) is an institution that addresses research and issues related to the management and protection of fish stocks in European marine waters, inter alia. ICES has concepts drawn up by its working groups WGECO (Working Group on the Ecosystem Effects of Fisheries) und WGAGFM (Working Group for the Application of Genetics in Fisheries and Mariculture) on the basis of which concepts for a targeted conservation of genetic diversity can be devised. The consultative committee of ICES, primarily the Advisory Committee for Fishery Management (ACFM) and the Advisory Committee on Ecosystems (ACE), formulate a joint scientific recommendation on the basis of the reports submitted by various working groups. Pending the drafting of an adequate scientific groundwork for the conservation of the marine genetic diversity of usable fish stocks, ICES has outlined the following recommendations as a framework for the time being:

- Mortality due to fishing is to be curbed to preserve sufficiently large populations.
- Fish harvesting should be evenly spread over a large geographical area, if possible, and should encompass all populations to prevent local eradication and fragmentation.
- Reduction of the fishing effort should take priority over all other measures (e.g. improvement of selection).
- A case-by-base assessment of the risks involved in the loss of genetic diversity should at any rate be made.

4.1.2. Documentation of aquatic genetic resources in the marine sector

The Federal Agency for Agriculture and Food (BLE) (see table 1) gathers statistical data on landings and information on market-economy trends.

ICES makes annual recommendations to the EU that can be used to set catch quotas and draw up stock management plans. The Johann Heinrich von Thünen-Institute in Hamburg delivers the German contribution to this. The recommendations are made on the basis of studies of key

Research vessel „Solea"

commercially harvested stocks. The stock size, age and length distribution and geographic dissemination are registered in the process. The current status is assessed on the basis of the entire stock and the spawning stock. Stock developments can then be described and forecast under certain conditions in a comparison with the previous years' data.

On balance, however, there is a lack of scientifically usable data on fish species that are used to some extent, but not exploited in a targeted way (non-target species).

4.1.3. Assessment of the actual situation

The protection of marine resources (fish as well as invertebrates) requires constant monitoring. Only an incomplete description of marine genetic resources on the level of species diversity can currently be given and genetic parameters for the individual species and stocks have not been determined so far so that there is a need for information in this regard. The monitoring does not take elasmobranch species (shark or ray) and unexploited or under-fished species into account whose stock development has been affected by industrial fisheries, discards or changes in the ecosystem.

The catch levels and conditions stipulated on the basis of the ~~collcted~~ data are mostly only indirectly intended to protect genetic diversity. Hence, specific minimum sizes of fish stocks are to be maintained through specified catch quotas. Yet, there is not a simple connection between the preservation of a specific stock size and the protection of genetic diversity. Once a stock is heavily decimated, a loss of genetic diversity can already occur. If stock sizes rise again due to protection efforts, this will only result in a reproduction of already existing genotypes and not in an increase of genetic diversity.

There is a concrete need for action to preserve marine genetic resources in the laying of scientific groundwork and recording of genetic diversity. The population structures and genetic variability within the populations are known only for a few fish species. There is a considerable need for research to shed light on these structures. There are signs that indicate a change in the composition of the population structure through fishing. The measurable facts of changes in length frequency and age structure suggest a selection in favour of smaller and earlier maturing individuals because the large and older animals are being snatched away. Alongside the changes in the genetic potential within the populations, ecosystemic implications of these processes can also be observed. To what extent is a recovery of a genetically restricted population through over-exploitation possible? Here, issues regarding the genetic potential of the residual population and the interrelations between different species in the ecosystem should be researched and monitored.

Alongside the genetic changes through over-fishing, a genetic infiltration through foreign genes can be observed. Close attention should be paid to the influence of escapes of mariculture species from their farms such as salmon farms, for instance, on the wild stocks. The increased use of species in aquaculture will aggravate this problem.

It is necessary to close these knowledge gaps through a sound scientific and informative monitoring of species diversity and the genetic variability of species to record and monitor the entire status of the aquatic genetic resources of the ocean on a large geographical scale. Only in this way can protective measures for acutely or potentially endangered species and populations be devised if necessary and management plans be drawn up.

4.2 Lake, river and pole-and-line fishing

4.2.1 Contribution of the Federal Government/Länder acts to the conservation of aquatic genetic resources

The rules of water legislation can also be regarded as a set of measures to protect water bodies and water-dwelling genetic resources. The legal protection of aquatic genetic resources is based on three pillars:

- fisheries legislation of the Länder,
- Federal Government/Länder nature conservation law and
- Federal Government/Länder water legislation.

Some other legal areas (e.g. ecofriendliness, animal diseases) also have a bearing on the conservation of aquatic genetic resources, but are only of subordinate importance compared with the aforementioned legislation.

The rules on specific species protection for fish, lampreys, crustaceans and mussels can mainly be found in the Länder fisheries legislation that also contains provisions for the protection of aquatic habitats and the protection of other aquatic species ("fish food organisms"). The Länder fisheries acts and ordinances constitute the oldest and technically most differentiated form of legal protection of fish species. They demand to care for a species-rich fish stock that is adapted to the water bodies to ensure fish management and preservation. For many fish species, the setting of harvestable size limits and closed seasons ensures the possibility of natural reproduction. Rules governing fish harvesting prevent the overfishing of stocks. Nature conservation law contains some framework provisions on the specific protection of species that also come under fisheries legislation. However, it mainly deals with the protection of habitats and species that are not subject to fisheries legislation.

The implementation of the Fauna-Flora-Habitat Directive, FFH, 92/43/EEC of 21 May 1992 and as a result the designation of protected areas under NATURA 2000 are relevant for aquatic habitats in inland fisheries. The habitats of aquatic genetic resources are also included, inter alia, through the

Nature-oriented stream: Lauchert

targeted protection of habitats and the fauna inhabiting them. Management plans are to ensure the conservation of the habitats listed in Annex I, also aquatic, and of the species listed in Annex II, also fish species. These measures indirectly benefit aquatic genetic resources and thus the conservation mandate to be met by this technical programme.

If you look into the causes for the vulnerability of aquatic genetic resources, the technical and physico-chemical changes of water bodies come first by far, i.e. the interventions through water engineering for various reasons and the adverse effects caused by discharge of wastewater. Due to progress being made in sewage treatment and prevention, the weighting of these factors is now increasingly shifting towards technical interventions through development and maintenance programmes. Given that hydraulic engineering, sewage disposal and the use of water bodies are primarily governed by water legislation, the rules of water legislation among the different legal areas thus play the key role for the conservation of aquatic genetic resources.

The EC Water Framework Directive (2000/60/EC) was adopted on 23 October 2000 and integrates the various requirements for comprehensive protection of the aquatic environment. It comprises all Community waters, i.e. inland waters, groundwater as well as the transitional and coastal waters. It is intended to achieve a “good status” of water bodies at least within a 15 year period. To this end, the Directive was transposed into national law in 2003, with river catchments being designated. This requirement has been met in Federal legislation by the amendment to the Federal Water Act (WHG) in June 2002. The Länder are to conclude the legal transposal until 2004. A characterisation of river catchments is to follow this phase. For this purpose, an analysis of the features of each river catchment unit, a study of the impact of human activities on the status of surface waters as well as an economic analysis of water use according to the Annexes II and II to the Water Framework Directive are conducted and presented.

The monitoring programmes were established by the end of 2006. The management plans including the action plans are to be drawn up and published by the end of 2009. The action plans are to achieve their objectives until 2015 finally. Taking biological parameters as a quality component to assess surface waters into account (see also BMU brochure: The Water Framework Directive- Results of an appraisal in Germany in 2004) is new and thus of key importance for the conservation of aquatic genetic resources.

The Federal Water Act used to be geared to the use of water bodies as a matter of priority, with ecological aspects only receiving marginal attention. A process of greening of this basic regulatory framework has started with the 5th amendment in 1986 and is still ongoing. New instruments to preserve or rehabilitate semi-natural water bodies are gradually being included. The WFD was finally transposed into federal legislation by the recent 7th amendment in June 2002.

That the objective of the Federal Water Act now also focuses more strongly on the ecological aspect manifests itself in the first sentence in Section 1 (a) that was newly inserted in 1996: “Water bodies must be protected as part of the ecological balance and as habitats for flora and fauna”. This duty of protection also encompasses, for instance, the free passability of running water bodies for aquatic animals reliant on migrations, one of the key measures for the conservation

Angling a recreational activity

of aquatic genetic resources. The WFD is also of great importance in this context. It provides decisive guidelines for taking ecological connections meaningfully into account.

The Federal Water Act's previous priority to exploit natural aquatic resources for human benefit has since 1996 been subject to the reservation that "avoidable impairments of their ecological functions" should not occur. In view of all considerations and decisions in the implementation of water legislation, the conservation of aquatic habitats and their networking with the environment therefore carries special weight today.

In line with this modern goal, the provisions on waterway construction and on river maintenance have now also been adapted to ecological requirements. Section 31 of the Federal Water Act says "Bodies of water that are in a natural or semi-natural state should be maintained in this state and natural bodies of water that have been developed in a way that is not semi-natural should be returned to a semi-natural state as far as possible".

The provisions in Section 28 of the Federal Water Act on the maintenance of water bodies focus on their upkeep and development. The conservation of a proper runoff and of navigability, as appropriate, is no longer the sole objective.

A new part (Sections 25 a to 25 d) was inserted in the Federal Water Act to transpose the WFD. Section 25 a (1) describes the fundamental management objectives for surface waters, i.e. to prevent adverse changes to the ecological and chemical status or to restore a good ecological and chemical status. Section 25 c addresses the deadlines for reaching the management goals specified in the Länder water legislation.

These new regulations do not only necessitate a monitoring of the ecological and chemical status of hydrological networks, but also the drawing up of water management and development plans that comprise the protection and conservation of aquatic genetic resources. Here, the fisheries administration and other competent bodies must table the necessary requirements for assessing the water status, monitoring of fish stocks as well as with regard to the inclusion of suitable measures in the plans.

The coordination of the management of river basin districts will in future be regulated by the Länder water legislation. It is imperative in the process to regulate the cooperation with the competent bodies of neighbouring states to agree on cross-border management plans and implement them in a coordinated manner. Given that the requirement for management according to river basin districts stems from Community law, the management plans, for the first time, provide a basis for a water management in line with natural boundaries and not administrative demarcations.
As a result of earlier amendments to the Federal Water Act, the Länder water legislation has already been increasingly geared to a focus on ecological requirements. All in all, water legislation has shifted to a considerable degree to the conservation and restoration of sound ecological conditions in the past few years, with further additions towards this target already being specified. This has led to a great improvement in habitat protection for aquatic life that has attained a high level in the meantime. The management according to sustainability criteria that will in future be related to entire hydrographical networks will serve the protection of aquatic genetic resources, in particular. This represents a major positive development in the field of water legislation.

4.2.2 Migratory fish and reintroduction programmes

Migratory fish and reintroduction programmes first of all require the free passability of running water bodies again. Apart from this, the other habitat factors must be improved to such an extent that fish again encounter suitable living and spawning conditions. The reintroduction programmes for salmon and sturgeon, above all, are attractive to the general public. Both fish species are seen as guarantors of clean water. However, the programmes also promote the stocks of fish species that are far less known. The following fish species are deemed key diadromous migratory fish in Germany:

- Sea lamprey Petromyzon marinus
- European river lamprey Lampetra fluviatilis
- Sturgeon Acipenser sturio
- Atlantic sturgeon Acipenser oxyrinchus
- Atlantic salmon Salmo salar
- Sea trout Salmo trutta trutta
- Allis shad Alosa alosa
- Twaite shad Alosa fallax
- Houting Coregonus oxyrhynchus
- Common whitefish Coregonus lavaretus
- European smelt Osmerus eperlanus
- Flounder Platichthys flesus
- European eel Anguilla anguilla

The original incidences of salmon and sturgeon in Germany have been deemed extinct since the last third of the 20th century at the latest. The populations are irretrievably lost in genetic terms. A reintroduction programme can only achieve that the ecological niche that has arisen is restocked with genetic material that closely resembles that of the original population. Juvenile salmon has been released for reintroduction into small streams and rivers draining into the North Sea since 1978.

The stocking material used comes from eggs that had been imported from Sweden, the British isles, Ireland or France. Experience has shown that it is important for the different individual initiatives to coordinate stocking. Mixing different origins in reproduction should be refrained from. Stocking material is now also harvested from returning adult fish that are caught and reproduced.

According to the latest research results, the Atlantic sturgeon Acipenser oxyrinchus that today only occurs in North America had inhabited the hydrographic basin of the Baltic Sea for around 1000 years and not the sturgeon Acipenser sturio to which the Atlantic sturgeon is closely related. It is intended to reintroduce this species in the Baltic Sea region.

Whereas other species such as ~~salmon~~ trout, nase and large bottom whitefish sustained steep declines in their stocks, they had not vanished completely at any time. Efforts for the recovery of local residual populations and to promote the spread in formerly settled areas have started in the last third of the 20th century.

The passability of waters and habitat improvement suffice for stock recovery in some cases. Stocking measures are also conducted to some extent. The stocking material generally comes from fish from the region from which eggs and semen have been ~~harvested~~.

Many of these programmes are conducted by local angler associations and frequently coordinated and scientifically monitored across country borders, too, in river basin districts or river sections. The Länder support these programmes in their legislation, financially and in fisheries research and management. Alongside the official programmes, normal preservation measures that are coordinated with the fishing authorities after the renaturalisation of water bodies also result in the successful reintroduction or recovery of species.

In 1950, all riparian countries and states in the river basin of the Rhine pooled forces for joint efforts to improve the water quality and installed the International Commission for the Protection of the Rhine against Pollution (ICPR). The water legislation adopted by the ICPR member states in the ensuing months and years and the practical steps in the follow-up, notably the construction of efficient sewage treatment plants, gradually resulted in the return of numerous micro-organisms. However, a considerable deficit in fish species persisted. To accelerate the recovery of the ecosystem of the entire water body, the Rhine riparian states announced the

Fishpass and ~~control~~ station at Buisdorf/ Sieg

“Rhine Action Programme” in 1987, “Salmon 2000” in short. It was aimed at “improving the ecological conditions in the Rhine in such a way until 2000 that species such as salmon that used to be there would be able to return”. The measures to this effect have for some years been named “migratory fish programme” to document that not only salmon, but also other species are included in the efforts and that no time limit should be specified. Hence, river lampreys and sea lampreys that do not swim so well could also reestablish themselves to a large degree. These actions in favour of migratory fish are part of the ICPR working programme „Rhine 2020“.

Within the Rhine system, the first juvenile salmon were released in the area of the North Rhine-Westphalian Sieg in 1988. Already in the 1993/94 spawning season, the first evidence of a successful natural reproduction of salmon could be obtained. In 2007 about 500 salmon ascended to the Sieg. Relevant activities are being conducted, bit by bit, in other places (table 6).

To ~~implement~~ the migratory fish programme in Baden-Württemberg, a fish pass (an artificial passage for fish which enables them to surmount an obstruction such as a weir or dam or natural falls) was put into service at the barrage Iffezheim in 2000, another fish pass was also installed at the barrage Gambsheim in 2004/2005. With regard to the tributaries as well, great efforts are being undertaken to remove existing obstacles to migration. Control catches at the Iffezheim fish pass show that the measures are beginning to show effects and that the number of ascending salmon is rising. As a result of this and an improved water quality, some species such as salmon, sea lamprey, river lamprey, twaite shad and ~~salmon~~ trout that had been deemed extinct or almost extinct there can again be observed in larger numbers in the past few years.

In the North Rhine-Westphalian catchment area of the river Weser, salmon has been restocked at the tributaries since 1988. Adult salmon returning from the ocean has only been detected in isolated cases in the Weser catchment area to date. In addition, efforts are underway to restore the free passability of running water bodies so that ascending salmon can reach spawning areas in the area of the upper Fulda, Werra and Eder again. The “Working Group for Pollution Control in the Weser” that had been formed by the competent Länder agencies of Thuringia, Hesse, North Rhine-Westphalia, Lower Saxony and Bremen coordinates the programme.

In Northern Germany, the “Working party on the protection of fish species and water pollution prevention in Northern Germany” (AFGN) joined together whose work has been integrated into the programmes for the Elbe river catchment areas (“Elbe salmon 2000”), of the Weser (“Migratory fish programme of the Working Party on Pollution Control in the Weser river”) and the Ems.

Salmon ~~spawner~~

Table 6: Salmon stocking in the Rhine system 1999-2003 (Source: ICPR, Landesamt für Natur, Umwelt und Verbraucherschutz NRW)

North Rhine-Westphalia	Sieg Wupper Dhünn Rur Ruhr
Rhineland- Palatinate	Sieg Ahr Saynbach Mosel/ Kyll, Prümm Lahn/ Mühlbach
Hesse	Lahn/ Dill,Weil Wisper Main / Kinzig
Bavaria	Main
Baden-Württemberg	Saalbach Pfinz Alb Murg Rench Kinzig
Luxembourg	Sauer
France	Restrhein (remaining Rhine) Ill
Switzerland	Rhein

Salmon eggs

Different angler associations stock ~~salmon~~ trout in a number of direct tributories to the North Sea and Baltic Sea or in dependent waters of the Elbe, Weser and Ems. Since 2000, the Land of Mecklenburg-Western Pomerania has been funding stocking measures with salmon trout in different water bodies of the Land from the revenue of the sale of angling permits.

Since 1990, the Elbe riparian states have been cooperating in the International Commission on the Protection of the Elbe (IKSE). The activity of this body has made a key contribution to improving the water quality in the Elbe and its tributaries. Furthermore, efforts are being launched to improve the passability in the upper reaches of the Elbe and in its tributories to thus enable fish migrations again. The programme “Elbe salmon 2000” has its main initiative in Saxony. In 1995, the first salmon fry imported from Sweden was released into the Elbe tributaries Sebnitz and Polenz (table 7). Between 1995 and 2006 the river Elbe was stocked with 6,5 million fry and parr, from which 4,0 million were stocked in Germany. As a result of this stocking campaign, the first mature salmon for spawning returned to Saxony in the Elbe in the autumn of 1998. The restoration of the access to the former main spawning area in Saxony, the catchment area of the Mulde, would be key to the success of the salmon programme.

Large-scale stocking measures concerning salmon fry, smolts and ~~salmon~~ trout fry have been conducted in Brandenburg

Alevin

Parr

in the river system of the Stepenitz since 1999. The first returners were recorded in 2002. The success of the breeding activities could be proved by the detection of spawning redds with eggs at the eyed stage. The programme “Elbe salmon 2000” has been continued with the stocking of salmon trout fry in the Ucker and of smolts in the Schwarze Elster. The fish stocking has been accompanied by stock-conserving

Salmon caught in the Elbe

measures such as the dismantling of transverse structures, weir conversion or the building of fishways. Further measures regarding rivers in Saxony-Anhalt and perhaps in Thuringia could follow. The tributaries located in the Czech Republic have now also been integrated in the salmon programme.

The stock of lake trout (Salmo trutta lacustris) in Lake Constance decreased steeply in the 1960s and 1970s. Within the scope of international cooperation, the stock had been stabilised as an initial measure through stocking, establishing parent animal strains in different Lake Constance tributaries and by conserving the stocks in the lake itself. In the follow-up, the key spawning grounds have been made accessible again. For this purpose, weirs have been converted to rough ramps (e.g. Argen river) and operational fish ways or diversion canals (Alpine Rhine, Rotach) have been built. In addition, the management of fisheries in the lake had been adapted. The effect has been clearly visible for some years. The lake trout yield in the lake has stabilised to a great extent and the number of ascending spawners has increased substantially in the tributaries, too, over the past few years.

Apart from the above-mentioned species, other species, too, that rely on extensive migrations during their life cycle such as nase (Chondrostoma nasus) and barbel (Barbus barbus) are being supported in Baden-Württemberg, for instance. This is done both indirectly by restoration of the free passability of running water bodies and directly. Hence, programmes to reintroduce nase that had vanished from the water bodies or water segments concerned through initial stocking over many years are currently underway in Baden-Württemberg in several flowing water bodies.

Table 7: Salmon stocking programme in the Elbe catchment area

Germany/ Lowe Saxony	Luhe/Ilmenau Oste Ilmenau/Luhe Seeve Schwinge
Germany/ Brandenburg	Stepenitz and Tributaries Pulsnitz (schwarze Elster)
Germany/ Sachsen	Kirnitzsch Lachsbach and Polen/Sebnitz Wesenitz Müglitz Chemnitz (Mulde)
Czech Republic	Kamenice (Kamnitz) Ploucnice (Polzenbach) Egernebenflüsse

(Source: NASCO Implementation Plan EU-Germany)

Reintroduction of native crustaceans

Stone crayfish (Austropotamobius torrentium) as well as European crayfish (Astacus astacus) have been reintroduced in all German Länder. The basic prerequisite for this is that no North American crustaceans occur in the water bodies in question because there would otherwise be a danger of the outbreak of crayfish plague.

4.2.3 Sustainable fisheries management of natural water bodies and stocking

The principle of the sustainable use of fisheries resources is accorded top priority in the Länder legislation on fisheries. In order to reach the associated goal of a long-term protection of a semi-natural species diversity in vital fish stocks, suitable management measures and uses are defined and summarised under the terms of “sound fisheries”

Control catch of Crayfish

or "good professional practice". In the very own interest of fisheries, fishery legislation is not only confined to fishing, but also, on an equal footing, comprises the duty to preserve the entire aquatic ecosystem. Therefore, not merely the maximization of the catch is important in the exercise of fishing rights in natural water bodies, but equally the orientation to the guiding rules of aquatic ecology.

In contrast to other types of nature use such as conventional arable farming, for instance, that is associated with a pro-

Crayfish

found impact on the structure and chemism of the soil as well as the establishment of monocultures, fisheries in internal waters still mainly represents a harvesting of natural growth today that is largely suited to the special natural conditions of water bodies and does not fundamentally change them.

Fish has been harvested for millennia by fisheries that reproduce as a result of the natural biological productivity of water bodies. In today's man-made environment, the importance of fishing goes beyond the use for human nutrition. Stagnant as well as flowing waters have been shaped by diverse influences of civilisation. The supply of nutrients via the atmosphere, via precipitation or from surrounding areas as well as structural damage can result in a shift of the species spectrum and dominance relations in the water-specific fish fauna.

Whereas eurytopic generalists tend to reproduce more, species with a pronounced structural bond or high sensitivity to water quality changes especially increasingly come under pressure. This entails an increased competitive pressure on specialists that tend to occur more rarely anyway. In such cases, a targeted harvesting of competitors that tend to occur in masses as part of fisheries management could stabilise endangered species and populations. At the same time, nutrients bound in fish are being removed. This can ease the strain on the water regimen and also result in a stabilisation of sensitive populations via this action path.

The nutrient accumulation in water bodies also results in a shift of dominance relations at other trophic levels. Once a certain limit is overstepped, lakes with clear water that are rich in plants are transformed into water bodies dominated by phytoplankton that are characterised by monotonous and structurally poor habitats and widely varying living conditions for fish. Particularly specialised and sensitive species are harmed by this development. Taking countermeasures in a pro-active manner is required to return water bodies to a semi-natural status providing diverse habitats for different species.

The exploitation of fisheries resources can contribute to this as part of a targeted water quality management through the direct harvesting of zooplanktivorous mass fish species or their indirect depletion by fostering strong predator fish stocks.

As a sum total, these fisheries measures promote the conservation or restoration of structurally diverse habitats, thus improving the living conditions of species specifically adapted to them.

Anthropogenically induced water impairments do not only impact on the dominance relations in the water-specific fish species community, however, but also indirectly pose a threat to fish species. Particular mention should be made of the longitudinal and transverse structures in flowing water bodies for the purpose of hydropower production. This destroys spawning habitats and substrates, inter alia, and prevents the spawning migrations of fish. Most migratory fish species are therefore deemed at great risk.

Fisheries has been striving for decades to offset the dwindling of fish stocks and collapses of populations through stocking. Take, for example, eel that is both reliant on fish passes to climb to eutrophic internal waters and on options of outmigration to the ocean. The pollution, damming and barriers in rivers caused by industrialisation in the past century specifically have led to a steady decline in eel migration into our internal waters. To minimise yield losses, fishermen have released eel fry into the wild for some time now at their own expense. Without this stocking, eel would today be severely reduced or extinct in a major part of its natural range in the European inland.

Other species, too, benefit from stocking measures that are carried out as part of fisheries water management to compensate for reproduction losses. A typical example of this are chubs that settle in deep, cool and oligotrophic lakes in the Alps (association of sub- and allospecies large bottom whitefish) as well in the Northern German lowland (mainly vendace) as a characteristic species. The changes in the aquatic biology associated with nutrient accumulation result in reproductive failures in these species. This deficiency is being offset by targeted stocking in a number of lakes. However, species in flowing waters, too, such as ~~common~~ trout or grayling are rebuilt and preserved through stocking in view of deteriorating conditions of reproduction.

However, fish stocking does not always entail an absolute improvement of the situation of aquatic genetic resources, but can also have adverse implications if improperly conducted.

4.2.4 Documentation of aquatic genetic resources in natural water ecosystems

Fish register of the Länder and the database AGRDEU of the IBV (Information and Coordination Centre for Biological Diversity)

The historic as well as current settlement of German inland waters with lampreys and fish has been presented by the Länder in the form of fish species registers or fish atlases. These nationwide surveys covering all Länder do not only focus on distribution maps, but also describe trends in the stock development and mention general and specific causes of danger for individual species. The collection of data is not uniform in the individual Länder. The methods range from monitoring series of electro-fishing data over many years or interviews of professional fishermen to compilations from one-off commissioned works. In some cases, fish is classified into categories of risk (red lists) or geographical information is gathered. There is no uniform nationwide monitoring system due to the heterogeneous surveying situation.

As the first nationwide survey, the results of the fish species mapping of the Länder as well as of the red list of Germany in its current version have been compiled by the Information and Coordination Centre for Biological Diversity (IBV), stating the relevant sources, and can be accessed on the Internet at the website: http://www.genres.de/agrdeu. The database AGRDEU which aims to be a national inventory on marine, inland and aquaculture species, compiles for the inland waters the taxonomic data, descriptions of the species and way of living, photos and, in some cases, population descriptions of the native and naturalized fish species and of some mussels and crustaceans. The hazard rating of the red list (nationwide) and of the individual registers (concerning specific Länder) can also be researched. At present, the part on inland waters designate 86 species of lampreys and fish species or forms (populations) of which 4 species have been deemed missing or extinct according to the red list (see Annex 1).

As shown by the current success in the reintroduction of common sturgeon and salmon, this assessment represents a snapshot. Moreover, a clear-cut demarcation between populations and species often poses problems and is subject to continuous revisions such as, for instance, the group of allospecies of large bottom whitefish or common trout, lake trout and salmon trout. In addition, a number of species listed in Annex II have only recently either through stocking or dissemination via artificial migratory routes entered German internal waters (e.g. mottled black sea goby, stone moroko, sunfish, inter alia). The development of neozoa also needs to be monitored. The database has not yet been developed as a monitoring instrument. Moreover, geographical information is lacking to also cover aspects of ecosystemic diversity. Initial attempts to map the intra-specific diversity have been made, but need to be stepped up.

Red list of the Federal Agency for Nature Conservation (BfN)

The red list of endangered fish in Germany is based on the specialist expertise of numerous fishery experts and the data from the fish registers of the Länder. The BfN analyses the data from the registers and compiles a list on this basis at a ten-year interval with hazard ratings for all native fish species. Naturalized species are left out of consideration.

Documentations within the framework of the EC WFD (Water Framework Directive)

All water bodies are to be restored to a “sound ecological status” at least until 2015. For this purpose, reference conditions were formulated according to the WFD requirements. These are used to assess the biological quality of rivers and streams. In Germany, the Working Group of the Federal States on Water Problems (LAWA) suggests the criteria for the reference status. The Working Group of the Federal States on Water Problems was set up in 1956 as an association of the Länder ministries responsible for water management and water legislation and provides the Conference of Environmental Ministers (UMK) and the Conference of Deputy Ministers (ACK) with advice on current questions. When implementing the EC WFD, it acts across Länder borders as well as internationally with regard to river basin districts.

What is new about this is that alongside hydromorphological and physical conditions, biological parameters are also to be taken into account when stipulating benchmarks. Phytoplancton, macrophytes, phytobenthos, macrozoobenthos and the fish fauna are to be used to assess the status of surface waters. The monitoring to be carried out will also allow important conclusions to be drawn for the conservation status of the aquatic genetic resources addressed in this technical programme.

Only time will tell, however, how far-reaching the monitoring will be. Confining it to specific indicator organisms in the fish fauna is conceivable, also for reasons of practical implementation. In the case of lakes, a selection is given due to the size, in the case of flowing waters on the basis of the catchment area size, in the case of survey monitoring at least one sample point every 2,500 km², in the case of operational monitoring the water bodies at risk. As part of the monitoring duty under Art. 11 of the FFH Directive, species surveys will be carried out in future.

4.2.5 Assessment of the actual situation

Wild fish populations are to be preserved in situ on a priority basis, i.e. in their natural environment. This renders an assessment of the habitat situation and an assessment of the species or population itself necessary. The required measures to be taken will then be derived from the results of the assessment.

Habitat

- The development of the water quality is rated positively all in all. The water pollution has declined considerably, thus clearly improving the living conditions of aquatic life. This development should be continued. However, the residue problem of the sediments should not be ignored. Hence, for instance, the Rhine eel is contaminated with dioxin in some cases which comes from the sediments.

- Fish is deemed to be the most severely endangered group of vertebrates in Germany. The structural impoverishment of running waters is a key problem. Taking Schleswig-Holstein as an example, it can be convincingly demonstrated that 95 % of the flowing water bodies have been modified by hydraulic engineering. The situation in the other Länder can be judged analogously.

- Habitats and spawning areas either disappear or have already vanished. There is a need for renaturation measures that would allow a stable reproduction of stocks again. Required stocking measures should be conceived in such a way that they support the recovery of natural stocks without modifying the genetic base, i.e. stocking, if possible, only with water-specific fauna that had been reproduced under ex-situ conditions. The current stocking practices should be reviewed under the above-mentioned criteria.

- Turbines, transverse structures and draining installations represent an unsolved problem. This applies to power plants above all. Measures will continue to be necessary to secure the passability of waters for fish. With regard to power plants, we must work towards ensuring the minimum water quantities necessary for fish fauna. In addition, the fish mortality in the turbines must be lowered further.

- The maintenance measures that do not require official approval also cause some problems in hydraulic engineering.

- Maintenance measures concerning water bodies, flood control and shipping frequently cause problems. These rights undermine to some extent the protective measures under the FFH Directive, for example. Thus, stringent environmental conservation measures, e.g. the drastic restriction of engaging in fishing activities become ineffective. There are considerable discrepancies here between the interests of river maintenance, environmental protection and fisheries. Fish fauna suffers because of these conflicting demands.

- The increase in the stocks of cormorants and other fish-eating birds poses a serious threat to fish stocks in some cases in open waters.

- The management of artificial lakes should generally be analysed and discussed in terms of the importance of the aquatic genetic resources. The Arendsee, a lake on a caved in salt dome, is an example of systematic breeding over many years with its own nursery house of coregonids. This should perhaps also be evaluated under the aspect of aquaculture. The renaturation and management of mining lakes should be continued on a scientific basis. A medium-term view could also be helpful: an inland like comparable in size to the Starnberger See arises from the backfilling of the open-cast mine of the “Hambacher Loch (hole)” in North Rhine-Westphalia. This open-cast mine is not the only one and the filling of some lakes is currently underway.

Species and populations

- Many migratory fish programmes have already been implemented or are being planned. A further monitoring is required. The stocks are generally not yet stable and self-reproducing. The process will have to be monitored over many decades presumably to achieve stable stocks that would perhaps allow a management of fisheries.

- An individual monitoring of species, their conservation status and usability seems necessary. If the stock conservation cannot be ensured, it should be examined whether other conservation measures apart from stocking measures such as complete ex-situ husbandry or cryopreservation are also necessary.

- The monitoring and documentation of fish and lampreys is not yet seen as satisfactory in some Länder. Already existing documentations or documentation in progress should be expanded so that transnational protective measures can also be initiated on their basis. It should be examined to what extent the documentation to be drawn up within the scope of the WFD can be used for expanding the database AGRDEU and thus for the purposes of the technical programme.

- The monitoring and documentation of the stocks of crustaceans and mussels are not conducted in all Länder because they are not subject to fisheries legislation everywhere. Here, a data~~base is frequently~~ lacking that ~~is~~ needed to make more far-reaching statements.

- Crayfish plague is a major problem in crustaceans. The domestic species of crustaceans can in many cases only be kept in demarcated waters. Reintroduction and recovery programmes concerning crustaceans, mussels and accompanying fish should be more closely scrutinized. A reintroduction of native crustaceans is only appropriate in places where no North American crustacean species occur. The experience from the current programmes has shown that a selection of the genetic base of introduced species is key to the re-establishment of the species.

- Several species of neozoa are present. They cause major damage in some cases (e.g. Chinese crab, crayfish plague). Given that existing neozoa cannot be removed from the water bodies or only with great effort, the best protection would consist in preventing the intrusion of (other) neozoa in the first place. An expansion of monitoring is also required in this regard. By means of an early knowledge of the occurrence of neozoa measures can be initiated to stop a further spread.

- Intergovernmental agreements on the protection of individual flowing water bodies are not yet expressly aimed at the conservation and sustainable use of aquatic genetic resources. This should be striven for in the future to reinforce synergy effects through international or European cooperation.

4.3 Aquaculture

4.3.1 Measures and actors

The intensive breeding activities in the past, notably in the case of carp, largely came to a standstill after the Second World War. The few activities undertaken in the ~~GDR~~ in the case of carp and rainbow trout waned after reunification. In contrast to Germany, breeding programmes are still conducted abroad, in the neighbouring countries in the East, in particular.

In Germany, a first overview of the existing breeding strains of carp and rainbow trout and some species accociated to these in aquaculture exists and is available via the database AGRDEU. Although the first steps are done, more work is necessary to assess the status of the genetic resources and to evaluate the steps for their conservation. The genetic base of the newly cultured species is only insufficiently taken into account. The actual “fish breeding” in Germany mainly deals with the optimisation of husbandry and feeding systems. A further aspect is the marketing of fish under specific geographical indications such as “Aischgründer Karpfen” or “Schwarzwaldforelle”. In these cases, too, the origins are not tied to specific breeding lines. Actors such as breeding associations in the case of farm animals do not exist.

4.3.2 Assessment of the actual situation

A direct need for action must be derived from the lack of information about the conservation status of aquatic genetic resources in aquaculture. The first overview of the existing resources of salmonids and cyprinids and some accompanying species in aquaculture should lead to an estimation if and which conservation measures must be taken.
Some reference points for activities to be undertaken are mentioned in the following:

- It is assumed for the specific case of carp that there are still pure lines in the pond farms producing spawners.

- The documentation of the breeding lines of carp, trout and accompanying species in aquaculture aims to assess the existing potential of the resources. The survey should be enlarged of the other species in aquaculture.
- In the case of rainbow trout, large quantities of eggs are being imported. Apart from the production of edible fish, the production of fish for stocking plays a major economic role. The genetic base of salmonidae is still fragmentary. There is an urgent need for research in this regard.

- The opportunities of an international cooperation should be explored.

Trout farm in Baden-Wuerttemberg

- A use of large seaweeds in aquaculture is also conceivable. Some projects on this topic are currently running, but none on the economic use of large seaweeds. Microalgae are used for industrial purposes in Germany. The subsequent treatment of algae in the technical programme should be examined.

Cultural landscape shaped by carp ponds

5 Aims of the technical programme

These are the targets of the technical programme for the conservation and sustainable use of aquatic genetic resources:

- Preserving the diversity of aquatic genetic resources in the long-term in a scientifically substantiated and cost-efficient manner in situ and ex situ, tapping them and making them usable through suitable measures such as evaluation, characterisation and documentation and intensifying their use for economic purposes, notably in aquaculture;

- Fostering the reintroduction of fish species that used to inhabit specific waters;

- Making a contribution to the conservation and rehabilitation of aquatic ecosystems;

- Supporting all activities for the conservation and sustainable use of aquatic genetic resources;

- Establishing more transparency in the allocated responsibilities and competencies of the Federal Government, Länder and municipalities as well as among the persons, organisations and institutions working in this field;

- Using and promoting synergies that may arise from increased competition at national, supranational, regional and international levels.

6 Future measures for conservation and sustainable use

For the subareas “coastal and deep-sea fisheries”, “lake, river and pole-and-line fishing” as well as “aquaculture”, the conservation and sustainable use of aquatic genetic resources necessitates measures with different priorities.

6.1 Future measures for the conservation and sustainable use of aquatic genetic resources (AGR) in coastal and deep-fisheries

The genetic resources of the oceans can only be used and preserved within the scope of international cooperation. The ICES is carrying out an assessment of the status of commercial harvested fish species every year. The data required for this purpose are being supplied by research programmes coordinated by the individual contracting states. These programmes do not exist for species that are not or hardly used by fisheries even if they are also recorded by surveys and their biological data are being collected on such occasions.

With the common fisheries policy, the European Union laid a foundation that is designed to ensure the sustainable use of marine genetic resources. In addition, it drew up its own action plan on the conservation or restoration of biodiversity that contains an action plan on the conservation of biodiversity in fisheries (see chapter 4.1.1). This action plan is implemented by integrating its goals into the fisheries management under the common fisheries policy. This encompasses, inter alia:

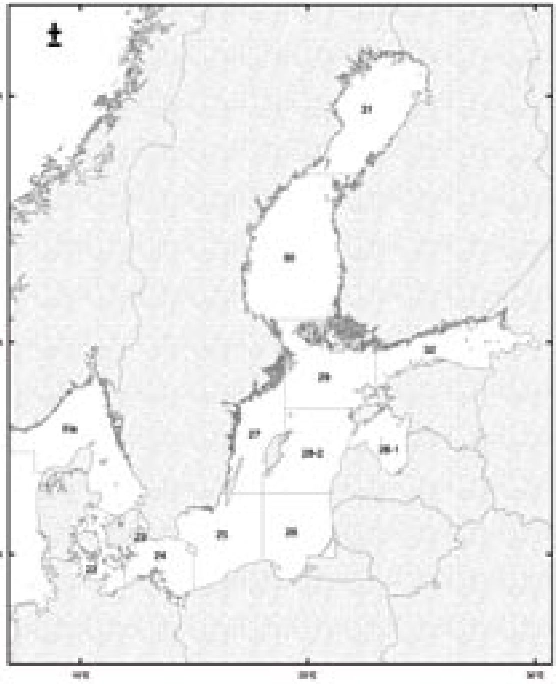
- setting catch limits for exploited fish stocks at a reasonable level;
- reducing the fishing effort;
- stipulating the required mesh openings in fishing gear;
- designating fishing-ban zones;
- improving the size selectivity in fishing gear with the aim of curbing discards of juvenile fish;
- improving the species selectivity of fishing gear;
- establishing temporal and/or spatial closures of specific areas to create better conditions for the survival of juvenile fish, spawners or even subpopulations and thus preserve the genetic diversity;
- setting new or amended minimum landing sizes for fish and shellfish, as required.

The EU action plan also considers the impact of fisheries on non-commercially used organisms and habitats such as, for example, the occurrence of mechanical damage to marine organisms, the occurrence of damage to seabeds as well as disruptions in marine food webs and the impairments of sensitive habitats. Possible adverse effects are to be countered by different measures:

- the introduction and promotion of selective fishing gear to reduce or avoid by-catches of non-target species;
- the introduction and fostering of fishing techniques that have a minor physical impact on the environment;
- if required, the introduction of time-limited and geographically limited closures, including the establishment of fishing-ban zones to improve the protection of species and habitats;
- if required, the introduction of restrictions on the extent of by-catch and unintended catches, notably of species mentioned on the red list.

The targeted measures can be expected to protect genetic resources from the most serious adverse effects of fisheries.

Via the regional advisory bodies establishing themselves under the CFP, scientists as well as fishermen and other stakeholders will be in future be more involved in EU decision-making with the aim of raising transparency and acceptance for measures of fisheries policy.



ICES areas in the Baltic Sea

ICES areas in Western Europe

Efforts are also being made at an international level to counter the negative impact of marine pollution on genetic resources caused by the input of pollutants. Programmes have been developed within the framework of OSPAR and HELCOM that are to provide protection in this field in the future as well. Monitoring programmes exist under these conventions that give a good idea of the status of marine habitats.

The marine species diversity is currently not covered by an interterritorial specific monitoring. Hence, a complete mapping of the incidence of species on a global scale is lacking. Under the above-mentioned stock monitoring of commercially harvested fish species, data on the occurrence of other fish species (so-called by-catch and non-target species) are also being collected. Due to the different way of life of fish species and the different design and mode of operation of fishing gear, it is generally difficult to make any substantiated statements on the species diversity including any quantitative aspects because a specific fishing gear only provides a selection of all species that are actually present.

In order to record the species spectrum in its entirety, additional monitoring programmes would be required that would entail a substantial increase in personnel and equipment. The current staffing levels of the Johann Heinrich von Thünen-Institute - Federal Research Institute for Rural Areas, Forestry and Fisheries do not allow the launch of additional monitoring programmes.

Very little information is available about the genetic structure of individual species. Either none or only very patchy information is available about most fish species. Merely some heavily exploited species such as cod have recently been examined. It is therefore imperative to close these informational gaps through own research programmes so that departmental research can provide sound advice in this field. Continuous monitoring is necessary in the case of heavily exploited species with decimated stocks such as cod to detect hazards for genetic diversity at an early stage and to be able to initiate countermeasures.

The Johann Heinrich von Thünen-Institute – Federal Research Institute for Rural Areas, Forestry and Fisheries is generally able to conduct this research because it already runs molecular genetic tests now on a limited scale. To expand this cost-intensive research, however, additional funds and additional qualified staff are needed.

Need for action:

- The current monitoring programmes are not adequate. The existing monitoring programmes for commercially harvested species should be expanded to non-target species to be able to better assess these stocks as well.
- A concrete need for research exists in the recording of population structures and intra-species genetic variability. The hazards to genetic diversity must be identified early on, especially in the case of heavily exploited species. Alongside potential genetic erosions, genetic changes such as a change in the age and size at spawning maturity as a possible consequence of selective fishing should also be considered.
- Research should clear up in scientific terms the influence of escapes of mariculture species from their farms on the genetic base of wild stocks.
- The red list of endangered species should be revised and undergo a revision at specific intervals.
- Measures to protect the ecosystem should be endorsed. In the process, activities to improve the water quality, notably through the reduction of substance inputs, as well as the conservation or improvement of habitats should be taken into account. Disturbances such as damage to seabeds through fishing gear and the impact of offshore wind farms should be assessed.
- With a view to the working programme on protected areas adopted by the 7th Conference of the Parties to the Convention on Biological Diversity, that includes marine protected areas, the scientific basis for marine protected areas in the North Sea and Baltic Sea must be laid.
- Options of an expanded sustainable use of AGR through mariculture or fisheries should be examined and evaluated.

Coast guard ship

Fish sales counter

6.2 Future measures for the conservation and sustainable use of aquatic genetic resources (AGR) in lake, river and pole-and-line fishing

After water pollution had peaked in the 1960s and 70s, measures were initiated to improve the water quality and thus indirectly improve the living conditions of the aquatic genetic resources. Many positive examples such as the renewed spread of species in the Rhine show that the right direction has been taken.

The statutory requirements of the Water Framework Directive provide for a comprehensive monitoring of certain fish stocks in the future that are deemed specific to the types of water bodies defined there. This monitoring can be expected to supply detailed information about the status of fish stocks.

Besides monitoring programmes, the use of fish (pole-and-line fishing and/or commercial fishing) also provides long-term information about the fish stock.

Fishpass at the Pfortmühle in Hameln

The recovery of a self-reproducing stock of a species that has almost vanished is only promising if the living conditions in the water can be restored to such an extent that the species can reproduce successfully. In most cases a stock recovers by itself if the external environment is improved. It should be examined in special cases whether measures for a stock recovery must be taken.

The many programmes on reintroduction must be coordinated more closely. In some cases they only operate on the basis of the private initiative of interested associations and in single cases they are not scientifically monitored. This monitoring is imperative. Hence, successful reintroduction programmes, inter alia, may be jeopardised by the use of unsuitable stocking material in the same catchment area or reintroduction programmes may fail in the medium term due to a lack of funding.

Need for action:

- Measures that aim at a nature oriented state and at an improved passability of water bodies should be expedited and supported. The protection of habitats is the best guarantee of stock conservation and should thus be intensively fostered. Use by fishing is not inconsistent with this.
- With regard of the conservation of aquatic genetic resources (AGR), the current monitoring programmes must be examined whether they are sufficient or if additions are necessary (e.g. at population level). If required, the monitoring and data management must be expanded with a view to the specific requirements of the AGR.
- The documentation of the data must be standardised to allow and further synergetic effects between the actors.
- A finalisation of the documentation on all organisms within the scope of the Länder fisheries legislation, especially crustaceans and mussels, should be striven for.
- Geographically and genetically related populations should be used for reintroduction measures.
- All measures of reintroduction (e.g. for salmon, sturgeons and other fish species) must be coordinated at national and international level. Therefore databases should be established.
- The exchange of information with international organisations (e.g. EIFAC= European Inland Fisheries Advisory Commission, NASCO = North Atlantic Salmon Conservation Organisation) must be coordinated and ensured.
- For the documentation of AGR (down to the population level) and the support of reintroduction programmes research effort is necessary.
- From the perspective of the precautionary approach, measures should be planned for the conservation of the AGR. It should be examined whether protected areas should be designated that hold available a genetic reserve of endangered species or whether additional measures (ex-situ-conservation) are required and feasible from a technical point of view.
- National and international strategies to prevent the introduction of neozoa and for the management of already established neozoa must be developed and supported.

Dead wood in the Lauchert

6.3 Future measures for the conservation and sustainable use of aquatic genetic resources in aquaculture

Economically speaking, aquaculture is the key sector of German inland fisheries with 80% of the total output. The two species rainbow trout (Oncorhynchus mykiss) and carp (Cyprinus carpio) account for the largest share. The proportion of accompanying fish and of new species kept in aquaculture is still minor. In the following, the measures taken for the three principal branches of German aquaculture are analysed separately.

6.3.1 Measures taken in trout farming

Given that there is an intensive exchange in trout production at European level, national measures can cover only some aspects at most. Cooperation at international (European) level in this field should therefore be aimed at.

Over 95 % of the salmonidae produced in Germany are trout. Apart from rainbow trout, char, ~~common~~ trout and lake trout are produced above all. A lot of ~~breeding~~ work has been done in this branch of production in Germany over the past 50 years. Many fish farmers have their own ~~breeding~~ lines that show characteristic features with regard to the spawning period, growth and body shape, for instance, that distinguish them from other spawning fish strains in some cases at least. A first documentation of these breeding lines exists and should be used for defining necessary conservation and precautionary measures for the conservation of these AGR. This first documentation comprises, for instance, the ~~breeding establishment~~, the type of fish, origin and age of the strain, number of spawners and the type of breeding activities undertaken. Apart from this, the purpose of parent stock husbandry for the production of edible fish or fish for stocking is to be documented. A genetic characterisation is partly available.

Analoguous projects are already underway abroad. In 2004, the establishment of a register of the existing breeding strains was launched by a project in Poland. These are also genetically characterised at the same time. In the early 1990s, projects to establish a register of spawning fish strains of rainbow trout had been launched in Norway and the USA on a voluntary basis.

A key aspect for the conservation of breeding strains is their use and genetic improvement in fish farms. Only if this is cost-efficient will fish farms have a chance of preserving a breeding strain in the long run, whether for edible fish production in the farm and/or roe and juvenile fish production for other facilities.

It could make sense in individual cases to build up a genebank (cryopreservation, as appropriate). These genebanks could be used to preserve a part of the genetic variability at least.

A further focus of trout ~~pond~~ farming is the production of stocking material for open waters. In the process, ~~common~~ trout and lake trout, char, grayling and salmon are mainly reproduced. Care should be taken here to ensure that the regional origin of the strains is guaranteed and also documented. For example, only ~~common~~ trout from the Danube area and not Atlantic origins should be stocked in the Danube catchment area. Alongside the regional origin, attention should also be paid to a stocking with genetically pure lines by stocking lakes with char, for instance, and not with hybrids of different char species.

Need for action:

- Measures intended to preserve existing breeding strains in ~~breeding~~ farms or research establishments should be supported.
- The breeding activities undertaken on strains for edible fish production should be fostered and intensified.
- A nationwide documentation of existing breeding strains should be aimed at.
- The genetic characterisation of these breeding strains should be fostered.
- The cooperation of breeding activities at federal level and internationally should be promoted, with synergetic effects being used.
- It should be examined whether a genebank (for sperm) could help to preserve the existing genetic material.

Carp filet

6.3.2. Measures taken in carp ~~pond~~ farming

In the old Länder, carp production largely focuses on northern Bavaria. The old carp breeds or strains in Bavarian carp pond farming mixed and frequently disappeared through the purchase of carp for stocking and trade relations with East European countries, especially with the Czech Republic but also with Hungary and Yugoslavia. There has hardly been any exchange of carp breeding material with eastern Germany over forty years.

Carp pond farming used to be largely self-sufficient in the ~~GDR~~ and had almost been unaffected by imports of carps for stocking. Therefore, local breeds have again been raised in many pond farms after the Second World War through inbreeding. In spite of that, the genetic variability within the German commercially farmed carp is insignificant. The Bavarian (Seckendorff, Scheuermann, Hertlein, Wiesinger and Fiedler) as well as the Lausitz carp provenances (Kreba, Glinzig, Petkamsberg, Kauppa) are genetically closely related in spite of separate breeding activities over forty years. Morphologically wild carp-like stocks in the Rhine and Danube differ considerably from pond carps.

Currently no serious efforts are undertaken in Bavaria to preserve or maintain pure breeds, whereas large pond farms in the Lausitz still pay attention to the special husbandry of their breeding material. However, in connection with the protection of the indication of geographical origin under Regulation (EEC) 2081/92, most Aischgründer pond farmers, for instance, consider the humpback shape of carp as a key characteristic for customers, the hotel and restaurant industry and the wholesale trade. According to a study conducted by the technical college of Weihenstephan, 23% of the pond farmers take the view that the humpback shape of the Aischgründer carp should be improved.

The respective local origins (pure lines or breeds) should be preserved separately. It is advisable to recruit and supplement the spawner stocks according to the hitherto employed criteria of selection from the offspring. The typical physical appearance of these origins should be selected in the process with a view to the distinctness and uniformity of the body shape, squamation and colour. The breeding targets of regional origins should be documented and centrally compiled.

The hitherto known wild carps in the Rhine and Danube should be subject to further genotypical and phenotypical research, description and documentation. Once their identity as wild carp has been substantiated, a national programme of protection should be drawn up.

All defined and documented carp origins should be subject to a genotypical characterisation. Genotypical examinations should also be conducted on samples taken from the conventional carp production in Germany and compared with those of defined origins. Surveys and documentations should be supported insofar as possible. A first documentation of carp lines including a genotypical characterization of selected lines is now available. Should the Expert Committee discover that the defined origins differ considerably from the remaining population in genotypical terms, it will decide whether the husbandry of these origins should be fostered. Origins from abroad can also be included in the studies and documentations.

International cooperation plays a major role for the conservation of the genetic resources of carp. In our Eastern and Southern European neighbouring states, carp pond farming carries far greater weight. The groundwork has over the past few years been laid in the big research centres of these countries to keep and reproduce a larger number of carp breeds separately that clearly differ from each other in genetic terms. In some cases, the way has already been paved for conducting performance tests and hybridization under stringent scientific supervision. The following examples should be pointed out:

- At the fisheries experimental station of the Polish Academy of Sciences in Gołysz (Institute of Ichthyobiology and Aquaculture - Polish Academy of Sciences Gołysz 43-520 Chybie), two experimental ponds had been built specifically for conducting performance tests. Over 20 Polish, Israeli, French, Hungarian, Yugoslavian and German carp origins are held available for relevant tests.

- The Research Institute of Fish Culture and Hydrobiology in Vodnany Zatisi 728/II, 38925 Vodňany, Czech Republic, addresses questions of fish genetics and the breeding of carp. To this end, genetically distant origins of spawning carp are also being made available.
- Carp breeding at the Hungarian Research Institute for Fisheries, Aquaculture and Irrigation (H-5540 Szarvas, Anna-liget 8., H-5541 Szarvas, P O.Box 47, Hungary) has traditionally been carried out at a high standard.
- In Vietnam, a large number of morphologically and genetically widely varying strains and subspecies of Cyprinus carpio occurs that has only recently been described within the scope of research programmes conducted by the University of Hanoi (Faculty of Biology, Hanoi Pedagogic University N. 1 Nha E6, P. 201 Khu Than Cong, Hanoi, Vietnam) (Tran Dinh Trong, 1995).

It is therefore advisable for the conservation of the genetic resources of this fish species to establish contacts with these establishments to be able to have recourse, if required, to the gene resources kept there for the purpose of hybridisation.

If carp breeds with excellent properties result from the comprehensive work of performance tests and hybridisation experiments at the foreign institutes, these stocks should be tested for their performance under the conditions of German carp pond farming at a fisheries research centre of one of the German Länder under controlled conditions to compare it with German carp fry used for commercial purposes.

The measures for the conservation of accompanying fish should be along the same lines as those for carp. Genetic characterisations and documentations take precedence, first of all.

Need for action:

- The origins (pure breeds) of pond carp and wild carp stocks should be described and documented.
- Measures for the conservation of existing breeds in pond farms and their use should be supported.
- Genetic studies should evaluate whether the origins and wild carp stocks differ considerably from the remaining carp population.
- Under the aspect of the precautionary approach, a nationwide documentation of the existing breeding strains should be aimed at.
- Cooperation at federal and international level should be fostered, with synergetic effects being used.
- It should be examined whether the measures are adequate for ensuring the preservation of aquatic genetic resources. It should perhaps be tested whether genetic resources must be compiled in genebanks.

6.3.3 Measures concerning other aquaculture species

Following the global trend, German aquaculture is also undergoing a strong development. Some species such as eel, catfish and sturgeon are already being successfully produced, and the culturing of other species is at an experimental stage. Methods of an eco-friendly and resource-conserving fish farming to produce fish for stocking and fish for food are being developed with the aim of achieving a sustainable aquaculture.

Need for action:

- A documentation of the organisms used in aquaculture and their genetic base should be aimed at.
- Activities to foster the breeding development and conservation of breeding strains should be promoted.
- Further development and introduction of methods for an eco-friendly and resource-conserving aquaculture of fish for food and stocking.

7 Organisation and implementation

7.1 Expert Committee on Aquatic Genetic Resources

The national technical programme for the conservation and sustainable use of aquatic genetic resources (Fachprogramm AGR) forms an integral, but technically separate part of the national programme on genetic resources for food, agriculture and forestry. An expert committee (Fachausschuss AGR) has been set up to achieve the targets referred to in chapter 5 of the technical programme and to promote the organisation and implementation of the measures to be taken to this end. The expert committee performs the following functions:

- providing advice on technical issues in connection with the implementation of the programme;
- analysis and assessment of measures for the conservation of aquatic genetic resources;
- formulate new proposals for the action to be taken or to improve existing measures and update the technical programme;
- coordinate measures with relevant actors, notably with the Federal Government, Länder, scientific community and practice;
- receipt and discussion of reports on the implementation and results of this programme;
- exchange of information and experience.

In addition, it can comment on all technical issues of the conservation and sustainable use of aquatic genetic resources and make recommendations for scientific opinions and statements.

Carp pond in the Lausitz

High seas trawler

16 members have been appointed to the expert committee, most of them have already been involved in drawing up the technical programme as members of the panel of experts. The members competently represent the specialised disciplines of coastal and deep-sea fisheries, lake and river fisheries as well as aquaculture, including the economic, cultural and ecological aspects, and organisationally represent Federal Government and Länder authorities, trade associations and organisations and the scientific and business communities. The expert committee receives support from a secretariat that is located at the IBV (Information and Coordination Centre for Biological Diversity) of the BLE (Federal Agency for Agriculture and Food).

The Expert Committee should also provide advice to the Advisory Board on Biodiversity and Genetic Resources established at the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The Advisory Board performs the task of providing advice to the BMELV on general and fundamental issues of the conservation and sustainable use of genetic resources for food, agriculture, forestry and fisheries as part of biodiversity as well as with regard to corresponding measures at national, EU and international levels. The chairman of the expert committee on aquatic genetic resources is allowed to attend the meetings of the BMELV advisory board.

Please see the homepage of the expert committee www.genres.de/agr/fachausschuss or contact the IBV secretariat at the BLE for information about the committee and its work.

7.2 Selected institutions, bodies, actors and their responsibilities

The comprehensive task of the conservation and sustainable use of aquatic genetic resources is implemented by a number of relevant actors (authorities, institutions and bodies) whose activity areas are outlined in the following. Please see Annex 3 for a detailed list of the actors.

7.2.1 Federal Government

Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)

The BMELV is in overall charge of fisheries and the conservation and sustainable use of genetic resources for food, agriculture, forestry and fisheries within the Federal Government. This responsibility also covers the AGR as part of the genetic resources. Representing the Federal Government, the BMELV shapes the German fisheries policy within the scope of the common fisheries policy of the EU. In doing so, the BMELV is competent for deep-sea fishing and has framework competencies in coastal and inland fisheries, aquaculture as well as animal welfare. To carry out fisheries measures, the BMELV administers the EFF (European Fisheries Fund). In addition, the BMELV also administers federal funds to promote fisheries structures. Support programmes for biological diversity can also be used for the AGR.

In the implementation of commitments arising from the CBD and the overall concept for the conservation and sustainable use of genetic resources for food, agriculture and forestry, the BMELV commissioned the drawing up of this technical programme.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

The BMU is in charge of the environmental and nature conservation policy of the Federal Government. This also includes water pollution prevention. The tasks of water protection policy in Germany comprise the maintenance or restoration of the ecological balance of water bodies, the safeguarding of the supply of drinking water and industrial water in terms of quality and quantity, whilst ensuring all other uses of water serving public welfare in the long run. Accordingly, the water protection policy formulates requirements for the use of waters that are to be achieved with only a minor impact on the type-specific aquatic biocoenoses. The implementation of the EC Water Framework Directive also deals with these tasks. In the process, the aquatic fauna is used for the first time to as-

Trout stream

sess the ecological water status and thus the natural habitats of the AGR. The BMU is, inter alia, responsible for designating protection zones under the Natura 2000 guidelines. It is also the competent ministry in overall charge of CBD issues.

Federal Ministry of Education and Research (BMBF)

The BMBF funding of research also encompasses the fields of oceanic research and sustainable development. Within this framework, projects that serve the conservation and sustainable use of AGR can also be promoted. Hence, a programme for the promotion of marine aquaculture has been launched. Practically-oriented research such as the development of monitoring instruments for rivers and lakes, that are to be used in the implementation of the EC WFD, also received support. As part of the research into global change, support programmes for biodiversity have also been initiated.

7.2.2 Supreme Länder authorities in charge of fisheries

The responsibility for inland and coastal fisheries rests with the Länder. They exercise sovereignty over this field through their fishery legislation. Legally established measures such as preservation of fish and the determination of closing periods for fishing and the issuing of fishing rights traditionally serve sustainable fisheries and the protection of the aquatic genetic resources. The Länder are in charge of monitoring professional and recreational fishing as well as the implementation of different EU and national agreements concerning fisheries into Länder legislation. The Länder have fisheries administration and management as well as research institutions of their own .
The Länder officials in charge of fisheries appointed the body of experts for the drawing up of the technical programme and accompany its drafting and implementation.

7.2.3 Bodies within the remit of the Federal Ministry of Food, Agriculture and Consumer Protection

Johann Heinrich von Thünen-Institute (vTI) - Federal Research Institute for Rural Areas, Forestry and Fisheries

The sphere of activity of the Johann Heinrich von Thünen-Institute comprises in its three instiutes with the main focus on fisheries all research activities required to achieve the policy objectives of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) in the fisheries sector and with regard to its products.

A priority area of the research tasks lies in the biological monitoring of the marine commercially harvested stocks, the changes in their stocks and seasonal locational changes in terms of the exploitation of fisheries resources and the given changes in environmental conditions. The results of this work provide guidance for the Federal Government's fisheries policy, notably in the negotiations under the international fisheries conventions (quota arrangements etc.) and for bilateral agreements. The studies of genetic diversity, pollution and the presence of diseases affecting marine animals are intended to protect aquatic biotopes and monitor and preserve biodiversity. Fishing gear studies are conducted under the aspects of energy savings, conservation of stocks and environmental stewardship.

The research centre also advises the Ministry on matters of the protection and use of Antarctic animal populations and marine mammals and birds under the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Whaling Commission (IWC). Furthermore, the ecological impact of aquaculture is being analysed and animal welfare issues regarding aquatic organisms are addressed. The achievement of a sustained high fishing yield with a minimisation of the undesirable impact on nature and the environment and a minimisation of the technical effort can be regarded as the pre-eminent target of all of these efforts. The section on fisheries economics examines the macro-economic importance of fisheries and the impact of measures of fisheries policy, monitors the national and international markets and market structures and conducts cost-earnings studies for enterprises of cutter deep-sea and coastal fisheries to provide policy advice.

Federal Agency for Agriculture and Food (BLE)

The BLE is, inter alia, competent for the implementation of the common organisation of the markets in fishery and aquaculture products. It conducts market assessments and reporting, supply and demand analyses and addresses foreign trade issues of the fisheries sector. The BLE performs tasks in fisheries monitoring and control and deploys three vessels engaged in fisheries inspection for this purpose. Apart from this, BLE runs three research vessels that are chartered by the vTI to monitor and reseach on the fish stocks and of fishing gear. A key task is the management of the national catch quotas and the granting of fishing permits.

Information and Coordination Centre for Biological Diversity of the BLE (IBV)

The tasks of the Information and Coordination Centre for Biological Diversity comprise the central documentation, information, counselling and coordination in the field of the genetic resources for food, agriculture, forestry and fisheries. To this end, the IBV has developed and maintains, inter alia, the Information System on Genetic Resources GENRES and the central documentation of aquatic genetic resources in Germany, the database AGRDEU. The IBV also provides the secretariat for the Advisory Board on Biodiversity and Genetic Resources at the BMELV.

Friedrich Loeffler Institute, Federal Research Institute for Animal Health

The Friedrich Loeffler Institute, Federal Research Institute for Animal Health, is an independent higher federal authority within the purview of the Federal Ministry of Food, Agriculture and Consumer Protection. It conducts research in the field of infectious animal diseases and related scientific fields, discharges the duties assigned to it by the Animal Disease Act and Genetic Engineering Act, publishes research results and fosters the national and international cooperation with leading scientists and establishments. The agents of infectious diseases in fish are also being examined in this context.

7.2.4 Bodies within the remit of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Federal Environmental Agency (UBA)

As a superior federal authority within the purview of the BMU, the UBA is responsible for ensuring the protection of the environment and humans against harmful environmental influences. These tasks comprise the protection of the AGR if their natural habitats are affected. The UBA tasks encompass, inter alia, the coordination of the implementation of the EC WFD and the representation of the Federal Government in the implementation and further development of diverse marine conservation agreements such as OSPAR or HELCOM as well as the award and technical monitoring of research projects to this effect.

Federal Agency for Nature Conservation (BfN)

As a superior federal authority within the purview of the BMU, the BfN is responsible for advising the Ministry on all matters related to national and international nature conservation and maintenance of the landscape. It promotes nature conservation projects and monitors research projects. A work priority of the BfN is the designation of protected areas in the oceans and inland under Natura 2000. The AGR are also indirectly included in the scope of protection through the protection of habitats. Besides, the BfN is responsible for drawing up the red list of endangered flora and fauna.

7.2.5 Fisheries institutes and establishments run by the Laender

The Land-own fisheries research centres are directly involved in the development and implementation of measures for the protection and sustainable use of the AGR. Their fisheries research is oriented on practical requirements and demands. Another key mandate is providing advice to the Ministries and public authorities and their representation in national and international bodies of experts. Apart from this, they are in charge of providing advice to professional fishermen, water stewards and fish farmers and competent for their training and further training.

7.2.6 University institutes and institutes addressing topics related to fisheries

Various institutes with different sponsorship deal with topics related to fisheries. Frequently, they are also involved in national and international activities that serve research into and protection of the AGR and their natural habitats.

7.2.7 Associations of German fisheries

German professional and recreational fishers are organised in a large number of associations and clubs. The German Fisheries Association unites the professional and recreational fishermen from deep-sea, coastal and inland fisheries and aquaculture as an umbrella organisation. Fishermen and anglers conduct the actual preservation and management of water bodies. In doing so, they contribute their traditional experience and a lot of commitment on an honorary basis. The professional and recreational fishermen are key actors in the implementation of this technical programme.

7.2.8 Environmental conservation groups

Numerous environmental conservation groups foster the conservation of AGR and their habitats at regional and supraregional level. Greenpeace conducts campaigns against the over-exploitation of the oceans and the protection of whales. The WWF supports concrete research projects and carries out campaigns on the thematic areas of rivers and river meadows and coasts. The BUND (Friends of the Earth Germany) actively fights against river barriers and hence for the protection of the habitats of the AGR.

7.3 Implementation of the technical programme

The Federal Government and the Länder as well as the actors mentioned in 7.2. on a voluntary basis are supporters of this technical programme. The BMELV, in overall charge of this technical programme within the Federal Government, and the Länder have the responsibility for coordinating the implementation within their jurisdictions. They receive support from the expert committee on aquatic genetic resources in the process.

The Federal Government and the Länder support the programme by including individual measures into existing programmes or by establishing their own programmes. Improving the flow of information and communication among the actors is key to the transparence, coherence and efficiency of the measures. Beyond the activities currently undertaken, the IBV is developing suitable instruments to this end. The programme is analysed and updated, as appropriate, from time to time and involving all key actors.

8 Annexes

Annex 1 Lamprey and fish species or forms (breeds) in German inland waters (according to information from AGRDEU on the basis of the Red List Germany and the fish species registers kept by the Länder; use = types of use in natural inland waters)

German name (English name in brackets)	Scientific name	Use
Aal – European eel	*Anguilla anguilla*	CS
Aland – Ide	*Leuciscus idus*	C
Alse, Maifisch – Allis shad	*Alosa alosa*	U
Amerikanischer Hundsfisch – Eastern mudminnow	*Umbra pygmaea*	U
Äsche – Grayling	*Thymallus thymallus*	CS
Atlantischer Lachs – Atlantic salmon	*Salmo salar*	S*
Atlantischer Stör – Atlantic sturgeon	*Acipenser sturio*	S*
Bachforelle – ~~Sea~~ trout	*Salmo trutta fario*	CS
Bachneunauge – European brook lamprey	*Lampetra planeri*	U
Bachsaibling – Brook trout	*Salvelinus fontinalis*	CS
Bachschmerle – Stone loach	*Barbatula barbatula* *Noemacheilus barbatulus*	U
Barbe – Barbel	*Barbus barbus*	CS
Binnenstint – European smelt	*Osmerus eperlanus spirinchus*	U
Bitterling – Bitterling	*Rhodeus sericeus* *Rhodeus sericeus amarus*	S*
Blaubandbärbling – Stone moroko	*Pseudorasbora parva*	CS
Blei, Brachsen, Brassen – Common Bream	*Abramis brama*	C
Buntflossenkoppe, Ostgroppe – Alpine Bullhead	*Cottus poecilopus*	U
Döbel, Aitel – European Chub	*Leuciscus cephalus*	C
Donau-Neunauge – Ukrainian brook lamprey	*Eudontomyzon mariae*	U
Dreistachliger Stichling – Three-spined stickleback	*Gasterosteus aculeatus aculeatus* *Gasterosteus aculeatus* *Gasterosteus tachurus* *Gasterosteus semiarmatus* *Gasterosteus leiurus*	U
Elritze – Eurasian minnow	*Phoxinus phoxinus*	S*
Europäischer Hundsfisch – Mudminnow	*Umbra krameri*	U
Finte – Twaite shad	*Alosa fallax*	U

German name (English name in brackets)	Scientific name	Use
Flunder – Flounder	*Platichthys flesus* *Pleuronectes flesus*	U
Flussbarsch European perch	*Perca fluviatilis*	C
Flussneunauge – European River Lamprey	*Lampetra fluviatilis*	U
Frauennerfling – Pearlfish	*Rutilus pigus virgo* *Rutilus virgo*	U
Gangfisch – Houting	*Coregonus macrophthalamus* *Coregonus lavaretus macrophthalamus*	CS
Giebel – Prussian carp	*Carassius auratus gibelio*	C
Goldfisch – Goldfish	*Carassius auratus auratus*	A
Graskarpfen – Grass Carp	*Ctenopharyngodon idella* *Ctenopharyngodon idellus*	C
Groppe, Koppe, Mühlkoppe – Bullhead	*Cottus gobio*	S*
Große Maräne, Große Schwebrenke -Common whitefish	*Coregonus lavaretus* *Coregonus lavaretus lavaretus*	CS
Gründling – Gudgeon	*Gobio gobio gobio* *Gobio gobio*	CS*
Güster – White bream	*Abramis bjoerkna* *Blicca bjoerkna*	C
Hasel – Common dace	*Leuciscus leuciscus*	C
Hecht – Northern pike	*Esox lucius*	CS
Huchen – Huchen	*Hucho hucho*	CS
Karausche – Crucian carp	*Carassius carassius*	C
Karpfen – Carp	*Cyprinus carpio carpio*	CS
Kaulbarsch – Ruffe	*Gymnocephalus cernuus* *Gymnocephalus cernua*	C
Kleine Bodenrenke, Kilch – Humpback whitefish	*Coregonus pidschian*	U
Kleine Maräne – Vendace	*Coregonus albula*	CS
Laube, Ukelei – Bleak	*Alburnus alburnus*	C
Mairenke – Danube Bleak	*Chalcalburnus chalcoides*	C
Marmorierte Grundel – Tubenose goby)	*Proterorhinus marmoratus*	U
Marmorkarpfen – Bighead carp	*Aristichthys nobilis* *Hypophthalmichthys nobilis*	C
Meerforelle – Sea trout	*Salmo trutta trutta* *Salmo trutta*	S

German name (English name in brackets)	Scientific name	Use
Meerneunauge – Sea lamprey	*Petromyzon marinus*	U
Moderlieschen – Belica	*Leucaspius delineatus*	S*
Nase – Sneep	*Chondrostoma nasus*	CS
Nordseeschnäpel – Houting	*Coregonus oxyrinchus* *Coregonus lavaretus oxyrhynchus*	S
Ostseeschnäpel – Large bottom whitefish	*Coregonus lavaretus baltica*	CS
Peledmaräne – Peled	*Coregonus peled*	C
Perlfisch – Pearlfish	*Rutilus meidingeri* *Rutilus frisii meidingeri*	S*
Quappe, Trüsche, Rutte – Burbot	*Lota lota*	CS
Rapfen, Schied – Asp	*Aspius aspius*	CS*
Regenbogenforelle – Rainbow Trout	*Oncorhynchus mykiss*	CS
Rotauge, Plötze – Roach	*Rutilus rutilus*	CS
Rotfeder – Rudd	*Scardinius erythrophthalmus*	C
Russischer Stör – Russian Sturgeon	*Acipenser gueldenstaedti*	A
Schlammpeitzger – Weatherfish	*Misgurnus fossilis*	U
Schleie – Tench	*Tinca tinca*	CS
Schneider – Spirlin	*Alburnoides bipunctatus*	U
Schrätzer – Schraetzer	*Gymnocephalus schraetzer*	U
Schwarzer Zwergwels – Black bullhead	*Ameirus melas* *Ictalurus melas*	C
Seeforelle – Lake trout	*Salmo trutta lacustris*	CS
Seesaibling – ~~Charr~~	*Salvelinus alpinus*	CS
Sibirischer Stör – Siberian sturgeon	*Acipenser baerii baerii* *Acipenser baerii*	A
Silberkarpfen – Silver Carp	*Hypophthalmichthys molitrix*	C
Sonnenbarsch – Pumpkinseed	*Lepomis gibbosus*	C
Steinbeißer – Spined loach	*Cobitis taenia taenia* *Cobitis taenia*	U
Sterlet – Sterlet	*Acipenser ruthenus*	S*
Stint – European smelt	*Osmerus eperlanus*	C
Streber – Danube streber	*Zingel streber*	U
Strömer – Varione	*Leuciscus souffia agassizii*	U
Waller, Wels – Wels catfish	*Silurus glanis*	CS

German name (English name in brackets)	Scientific name	Use
Weißflossiger Gründling – White-finned gudgeon	*Gobio albipinnatus*	U
Zährte, Rußnase – Vimba	*Vimba vimba*	CS*
Zander – Pike-perch	*Stizostedion lucioperca* *Sander lucioperca*	CS
Ziege;Sichling – Ziege	*Pelecus cultratus*	U
Zingel – Zingel	*Zingel zingel*	U
Zobel –White-eye bream	*Abramis sapa*	C
Zope – Zope	*Abramis ballerus*	C
Zwergstichling, 9-stachliger Stichling – Nine-spined stickleback	*Pungitius pungitius pungitius* *Pungitius pungitius*	U
Zwergwels Katzenwels – Brown bullhead	*Ameirus nebulosus* *Ictalurus nebulosus*	C

CS = catch and stocking, C = only catch, U = no use, S = stocking, S* = stocking mainly
or only for reasons of species conservation, A = only for use in aquaculture and pond farming

Annex 2 List of some already established neozoa (fish, crustaceans, mussels) in Germany

German name of the neozoa in Germany (English name in brackets)	Latin name	Brief assessment
Regenbogenforelle (Rainbow trout)	*Oncorhynchus mykiss*	Competition to ~~common~~ trout, only in natural reproduction
Bachsaibling (Brook trout)	*Salvelinus fontinalis*	Competition to ~~common~~ trout, above all danger of genetic mixing with char Salvelinus alpinus
Blaubandbärbling (Stone moroko)	*Pseudorasbora parva*	In case of mass occurrence competition to indigenous cyprinids such as moderlieschen (Belica) for instance, temporary mass occurrence in some waters, disappears again afterwards
Marmorierte Grundel (Tubenose goby)	*Proteorhinus marmoratus*	
Sonnenbarsch (Pumpkinseed)	*Lepomis gibbosus*	Through strong territorial behaviour displacing of native species in the shallow water of lakes
Zwergwelse (Catfish)	*Ameiurus nebulosus, A. melas*	
Graskarpfen (Grass carp)	*Ctenopharyngodon idella*	In case of dense stocking massive reduction of submersed macrophytes and thus decline in key spawning and juvenile fish habitats of native fish species, stocks that still exist today are based on stockings in the 70s and 80s; no natural reproduction in Central Europe
Silberkarpfen (Silver carp)	*Hypophthalmichthys molitrix*	
Marmorkarpfen (Bighead carp)	*Aristichthys nobilis (Hypophthalmichthys nobilis)*	
Störe/Störhybriden (Sturgeon/sturgeon hybrids)	*versch. Arten/Hybriden*	Released from aquarium husbandry or escaped from aquaculture, only isolated occurrence, no natural reproduction at present, hardly any danger potential
Galizischer Sumpfkrebs (Galician crayfish)	*Astacus leptodactylus*	Competition to crawfish
Wollhandkrabbe (Chinese mitten crab)	*Eriocheir sinensis*	Mass occurrence in all North Sea tributaries
Kamberkrebs (American river crayfish)	*Orconectes limosus*	
Signalkrebs (Signal Crayfish)	*Pazifastacus leniusculus*	
Roter Amerikanischer Sumpfkrebs (Red swamp crayfish)	*Procambarus clarkii*	
Kalikokrebs (Kaliko Crayfish)	*Orconectes immunis*	
Süßwassergarnele (Freshwater shrimp)	*Atyaephyra desmaresti*	

German name of the neozoa in Germany (English name in brackets)	Latin name	Brief assessment
Dreikantmuschel (Zebra mussel)	*Dreissena polymorpha*	First introduced into Lake Constance in the early 1970s, rapidly massive occurrence, today widespread, many aquatic birds feed on it, currently steep decline in the stock
Körbchenmuscheln (Common basket shell)	*Corbicula sp.*	So far no implications for the Rhine fauna noticeable
Regional neozoa		
Kaulbarsch (Ruffe)	*Gymnocephalus cernuus*	In Lake Constance since 1987, massive spread within a few years, one of the most frequent species in the riparian area of many water bodies, the stocks seems to be decreasing again substantially at present, food competitor to perch, fierce predator of chub eggs on bank verges
Zobel (White-eye bream)	*Abramis sapa*	Cyprinids from the Danube region, larger numbers for the first time detected in the Rhine region in 2000, possible competition to native Cyprinids
Huchen (Huchen)	*Hucho hucho*	Outside of the Danube region, possible competition to native ~~common~~ trout
Getigerter Flohkrebs ~~(Sideswimmer)~~	*Gammarus tigrinus*	Dissemination in the rivers Werra, Weser and Rhine, salt tolerant, fish food organism

Annex 3
List of addresses

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Annex 4
List of abbreviations

ACE	Advisory Committee on Ecosystems of ICES
ACFM	Advisory Committee on Fisheries Management of ICES
ACK	Amtschefkonferenz *(Conference of Deputy Ministers)*
AFGN	Arbeitsgemeinschaft für Fischarten- und Gewässerschutz in Norddeutschland *(Working Party on fish species and water pollution prevention in northern Germany)*
AGR	Aquatische Genetische Ressourcen *(aquatic genetic resources)*
AGRDEU	Online Dokumentation zu Aquatischen Genetischen Ressourcen in Deutschland *(online documentation on aquatic genetic resources in Germany)*
ARGE	Arbeitsgemeinschaft (Working Party)
AWZ	Ausschließliche Wirtschaftszone *(exclusive economic zone)*
BfN	Bundesamt für Naturschutz *(Federal Agency for Nature Conservation)*
BLE	Bundesanstalt für Landwirtschaft und Ernährung *(Federal Agency for Agriculture and Food)*
BMBF	Bundesministerium für Bildung und Forschung *(Federal Ministry of Education and Research)*
BML	Bundesministerium für Ernährung, Landwirtschaft und Forsten *(Federal Ministry of Food, Agriculture and Forestry, former name of BMELV)*
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit *(Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)*
BMELV	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz *(Federal Ministry of Food, Agriculture and Consumer Protection)*
BNatSchG	Bundesnaturschutzgesetz *(Federal Nature Conservation Act)*
BUND	Bund für Umwelt und Naturschutz *(nature conservation association)*
CBD	Convention on Biological Diversity
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DAV	Deutscher Anglerverband e. V. *(German Federation of Anglers)*
DFV	Deutscher Fischerei-Verband e. V. – Union der Berufs- und Sportfischer *(German Fisheries Association)*
EC	European Community
EFF	European Fisheries Fund
EIFAC	European Inland Fisheries Advisory Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFH	Fauna-Flora-Habitat Directive
FIFG	Financial Instrument for Fisheries Guidance
FIZ	Fisch-Informationszentrum e. V. (FIZ) *(Fish Information Centre)*
FLI	Friedrich-Loeffler-Institute, Federal Research Institute for Animal Health
GENRES	Informationssystem Genetische Ressourcen *(Information System on Genetic Resources)*
GFP	Common Fisheries Policy of the European Union

HELCOM	Helsinki Comission – Baltic Marine Environment Protection Commissio
IBSFC	International Baltic Sea Fisheries Commission
IBKF	Internationale Bevollmächtigtenkonferenz für die Bodenseefischerei *(International Conference of Deputies for Fishery in Lake Constance)*
IBV	Informations- und Koordinationszentrum für Biologische Vielfalt *(Information and Coordination Centre for Biological Diversity)*
ICES	International Council for the Exploration of the Sea
ICPDR	International Commission for the Protection of the Danube River
ICPR	International Commission for the Protection of the Rhine
IGKB	Internationale Gewässerschutz-Kommission für den Bodensee *(International Commission for the Protection of Lake Constance)*
IKSE	Internationale Kommission zum Schutz der Elbe *(International Commission on the Protection of the Elbe)*
IKSO	Internationale Kommission zum Schutz der Oder *(International Commission on the Protection of the Oder)*
IUCN	International Union for the Conservation of Nature and Natural Resources-World Conservation Union
IWC	International Whaling Commission
LAVES	Niedersächsisches Landesamt für Verbraucherschutz und Lebensmittelsicherheit *(Land Office for Consumer Protection and Food Safety of Lower Saxony)*
LAWA	Länderarbeitsgemeinschaft Wasser *(Working Group of the Federal States on water problems)*
NABU	Naturschutzbund Deutschland *(Nature Conservation Association)*
NAFO	Northwest Atlantic Fisheries Organization
NASCO	North Atlantic Salmon Conservation Organisation
NEAFC	North-East Atlantic Fisheries Commission
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
TAC	Total allowable catches
UBA	Umweltbundesamt *(Federal Environmental Agency)*
UMK	Umweltministerkonferenz *(Conference of Environmental Ministers)*
UN	United Nations
VDBI	Verband der Deutschen Binnenfischerei e. V. *(German Inland Fisheries Association)*
VDSF	Verband Deutscher Sportfischer e.V. *(German Sport Fishermen Association)*
vTI	Johann Heinrich von Thünen-Institute Federal Research Institute for Rural Areas, Forestry and Fisheries
WGAGFM	Working Group for the Application of Genetics in Fisheries and Mariculture ~~des~~ ICES
WGECO	Working Group on the Ecosystem Effects of Fisheries ~~des~~ ICES
WHG	Wasserhaushaltsgesetz des Bundes *(Federal Water Act, WHG)*
WFD	Water Framework Directive
WWF	World Wide Fund for Nature

Notes

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