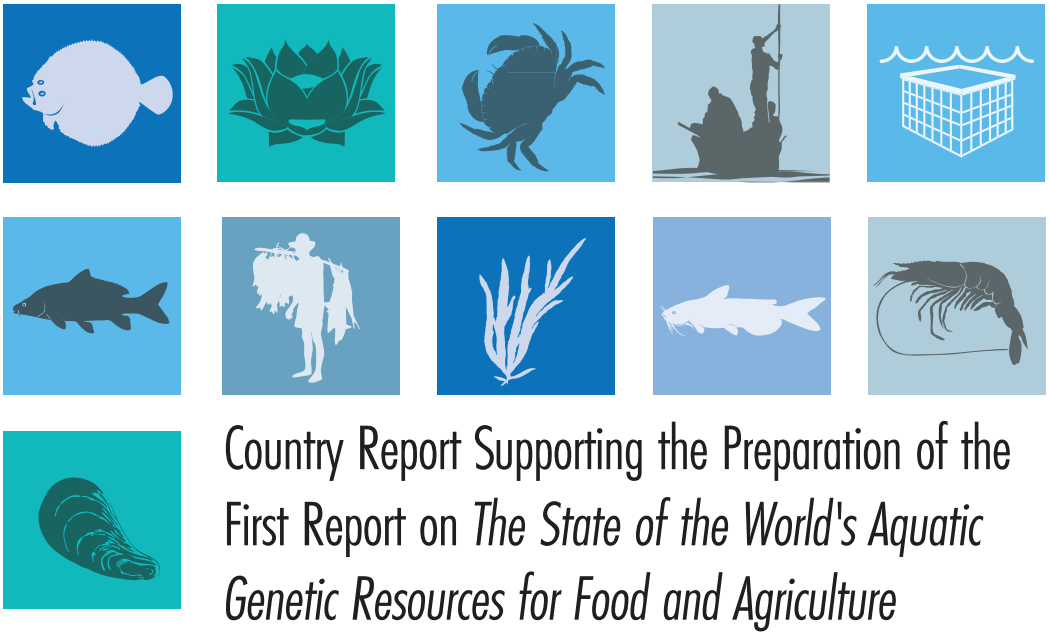
Food and Agriculture Organization of the United Nations

COUNTRY REPORTS

Czech Republic



Country Report Supporting the Preparation of the First Report on *The State of the World's Aquatic Genetic Resources for Food and Agriculture*

Food and Agriculture Organization of the United Nations

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Questionnaire for the Preparation of Country Reports for *the First State of the World's Aquatic Genetic Resources for Food and Agriculture*

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

INSTRUCTIONS FOR COMPLETING THE DYNAMIC GUIDELINES

How do I complete the dynamic guidelines?

1. You will require Adobe Reader to open the dynamic guidelines. Adobe Reader can be downloaded free of charge from: http://get.adobe.com/uk/reader/otherversions/. Use Adobe Reader Version 10 or higher.
2. Open the dynamic guidelines and save it (save as a pdf) on your hard drive.
3. Please rename it <name of your country>.pdf.
4. You may forward the dynamic guidelines to stakeholders you would like to involve or inform by e-mail. You may also print and/or save the dynamic guidelines.
5. It is advisable to prepare textual responses (including any formatting such as bullet points) first in a separate document and then to copy and paste them into the form. Please use font Arial 10. Acronyms and abbreviations should be avoided if possible. If included, they must be introduced (i.e. written out in full) the first time they are used. Note that the text boxes are expandable. Once text has been entered, the box will automatically enlarge to make its content fully visible when you click outside its border. To delete a row you have added, click on the "X" on the far right of the table
6. When you have finished completing the dynamic guidelines, click the “Submit form” button at the end of the form and send the completed dynamic guidelines to Devin.Bartely@fao.org; Matthias.Halwart@fao.org; and ruth.garciagomez@fao.org.
7. This should automatically attach the document to an email that you can then send. Otherwise, please attach the completed dynamic guidelines manually to an e-mail and send it to Devin.Bartely@fao.org; Matthias.Halwart@fao.org; and ruth.garciagomez@fao.org.
8. A letter confirming official endorsement by relevant authorities should also be attached to the email.
9. You will receive a confirmation that the submission was successful.

Where can I get further assistance?
If you have any questions regarding the dynamic guidelines, please contact
Devin.Bartely@fao.org; Matthias.Halwart@fao.org; ruth.garciagomez@fao.org

Several websites provide useful information on aquatic species that can be consulted for proper species names and for information on aquatic genetic resources: AlgaeBase, Aquamaps, Barcode of Life, Census of Marine Life, FishBase, Frozen Ark, GenBank, Global Biodiversity Information Facility, International Union for Conservation of Nature, National Institutes of Health Database on Genomes and Bioinformatics, Ornamental Fish International, SealifeBase, Sea Around Us, and World Register of Marine Species.

How, by whom and by when must the completed dynamic guidelines be submitted?
Once officially endorsed by the relevant authorities, the completed dynamic guidelines should be submitted (click the “Submit form” button on the header banner) by the National Focal Point. **Completed dynamic guidelines should be sent by December 31st 2015.**

www.algaebase.org
www.aquamaps.org
www.barcodeoflife.org
www.coml.org
www.fishbase.org
www.frozenark.org
www.genbank.org
www.gbif.org
www.iucn.org
http://discover.nci.nih.gov/
www.ornamental-fish-int.org
www.sealifebase.org
www.seaaroundus.org
www.marinespecies.org

I. INTRODUCTION

At its Thirteenth Regular Session, the Commission noted that the preparation of a country-driven *State of the World's Aquatic Genetic Resources for Food and Agriculture* would provide countries with opportunities for assessing the status of their aquatic genetic resources for food and agriculture and enhancing the contributions of aquatic genetic resources to food security and rural development. Additionally the process of producing Country Reports will assist countries in determining their needs and priorities for the conservation and sustainable use of aquatic genetic resources for food and agriculture, and will help raise awareness among policy-makers.

II. COUNTRY REPORTS

As with the other sectors, *The State of the World's Aquatic Genetic Resources for Food and Agriculture (SoWAqGR)* will be compiled from Country Reports. It is recognized that guidance is necessary in order to assist countries in completing those reports under a common framework. The Country Reports will become official government documents submitted to FAO.

The following questionnaire is the suggested format for the preparation and submission of Country Reports. The questionnaire has been prepared by FAO to assist in the preparation of Country Reports contributing to the SoWAqGR Report. It has been designed to assist countries to undertake a strategic assessment of their aquatic genetic resources for food and agriculture.

The scope of the first State of the World's Aquatic Genetic Resources for Food and Agriculture, and therefore the emphasis in the Country Reports, is farmed aquatic species and their wild relatives within national jurisdiction.

Country Reports should:

- become powerful tools for improving the conservation, sustainable use and development of aquatic genetic resources for food and agriculture, at national and regional levels;
- identify threats to aquatic genetic resources, gaps in information about aquatic genetic resources and needs for the strengthening of national capacity to manage aquatic genetic resources effectively;
- inform the development of national policies, legislation, research and development, education, training and extension concerning the conservation, sustainable use and development of aquatic genetic resources for food and agriculture;
- contribute to raising public awareness about the importance of aquatic genetic resources for food and agriculture;
- complement other national reporting activities on the conservation, sustainable use and development of aquatic genetic resources.

Timeline and process

In line with the overall process, as established by the Commission, the Director-General of FAO sent a Circular State Letter on 19 April 2012 to countries requesting them to identify National Focal Points for the preparation of Country Reports by 31 December, 2015.

The following steps are recommended in preparing the Country Report, using a participatory approach:

- Each participating country should appoint a National Focal Point for the coordination of the preparation of the Country Report who will also act as focal point to FAO. National Focal Points should be communicated to the Secretary, Commission on Genetic Resources for Food and Agriculture (cgrfa@fao.org) immediatly.
- Countries are encouraged to establish a national committee to oversee the preparation of the Country Report. The national committee should consist of as many representative stakeholders as practical (representing government, industry, research and civil society).
- The national committee should meet frequently to review progress and consult widely with key stakeholders.

- The National Focal Point should coordinate the preparation of the first draft of the Country Report, which should be reviewed by the national committee. The National Focal Point should facilitate a consultative process for broader stakeholder review.
- Following the stakeholder review, the National Focal Point should coordinate the finalization of the Country Report, submit it to the government for official endorsement and transmit it to FAO in one of the Organization's official languages (Arabic, Chinese, English, French, Russian and Spanish) by 31 December 2015.
- The Country Report will be an official government report.
- If countries are unable to submit final Country Reports by the set deadline, preliminary reports of findings should be provided to FAO to contribute to the identification of global priorities for inclusion in the SoWAqGR Report.

QUESTIONNAIRE FOR PREPARATION OF COUNTRY REPORTS FOR *THE STATE OF THE WORLD'S AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

Country report supporting the preparation of

The State of the World's Aquatic Genetic Resources for Food and Agriculture

Country	Czech Republic
Prepared By	Prof. Martin Flajšhans, Dr. Michal Kratochvíl, Assoc. Prof. Tomáš Randák et al.
Date	Dec 31, 2015

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I. EXECUTIVE SUMMARY

The Country Report should contain an executive summary of 2-3 pages highlighting the main findings of the analysis and providing an overview of key issues, constraints and existing capacity to address the issues and challenges. The executive summary should indicate trends and driving forces and present an overview of the proposed strategic directions for future actions aimed at the national, regional and global levels.

Please include the Executive Summary here.

In general, aquatic genetic resources in the Czech Republic are well managed in both domains of the fisheries sector, in freshwater aquaculture as well as in recreational fisheries (angling).

In freshwater aquaculture, many Czech fish farms operate own hatcheries for the larvae production of commercial fish species. Fish larvae production is used for subsequent steps of pond fish culture or sale to customers from Central European countries. This production system utilises pond cultured broodstock which are spawned once per year during the natural spawning period. It means that hatcheries of Czech fish farms are used seasonally, mostly without stimulation of out-of-season spawning. Czech hatcheries produce high quality fish gametes with high fertilization rates (85-100 %) and high quality larvae with hatching rate around 65 – 90 %. The hatcheries are accordingly distributed in the country and cover almost 100 % of the total requirement for fish larvae stocking. Some of the salmonid fish farmers also purchase eyed eggs from abroad. Only negligible part of fish (mainly zander and European catfish) larvae is obtained by semi-artificial methods of reproduction.

In recreational fisheries (angling), local units of angling unions (local angling clubs) operate smaller hatcheries to produce larvae and juveniles of different game fish species such as trout, grayling, burbot and other riverine fish for angling grounds stocking. The hatcheries are used for the final phase of fish reproduction only. This involves temperature preparation of broodstock before reproduction and, if appropriate for the respective species, its hormonal treatment, then stripping of eggs and sperm, egg fertilization and incubation and hatching. Broodstock culture and management are performed under outdoor conditions of ponds and angling grounds. This production system utilises pond cultured or wild broodstock which are spawned once per year during the natural spawning period. It means that hatcheries are used seasonally without stimulation of out-of-season spawning. Total production of fish for restocking is more than 1 500 tonnes per year. Up to thirty fish species including endangered ones are released to the fishing grounds each year.

In the national scale, fish genetic resources are enlisted and specified within the National Programme on Conservation of Farm Animal Genetic Resources, and they are conserved with a goal to keep old, less productive breeds as a part of national heritage and as a source of genes for contemporary breeding. Altogether 10 Czech and Moravian fish farms, angling unions´ hatcheries and a national park fish hatchery maintain in total 36 live gene banks of common carp, tench, rainbow trout and European catfish (with 11, 8, 3 and 2 breeds, respectively), 2 pure populations of brown trout (Salmo trutta) and pure species of great maraena (Coregonus lavaretus), peled (C. peled), sterlet and beluga (Huso huso). All fish genetic resources have undergone genetic analyses to assess their genetic purity, variability and genetic distances of breeds within each species. Mean annual state subsidies to the fish farms comprise 46.55% of farm´s direct costs for maintenance of live gene banks. Bank of cryopreserved sperm maintains at present 6 833 insemination doses of fish genetic resources.

Aquatic genetic resources play an indispensable role in sustainable development of fisheries and water management of pond ecosystems in the Czech Republic. The aquatic genetic resources contribute to the development of agrotourism, especially by public attractiveness of harvesting the largest ponds, frequent use of nature trails, walking and cycling paths along dams of ponds, or school excursions to fish farms and namely fish hatcheries. Cultural importance of the aquatic genetic resources has been always reflected in folktales and folksongs, in typical traditional regional gastronomy and in artistic works already since the medieval times.

Future direction of conservation of aquatic genetic resources could be seen in maintaining and strengthening the well-established national programme of genetic resources of farmed aquatic species both in situ and ex situ, while improving habitat conditions for wild aquatic species and limiting the main deleterious phenomena (water pollution, migration barriers, fish predators, etc.) and/or antagonistic effects of various juridical directives (bird areas vs. fish, hydropower plants vs. fish assemblages a.o.). Role of ex situ conservation approaches such as banks of cryopreserved gametes and germ cells or DNA/tissue banks could be reinforced both nationally and internationally while distinguishing indefeasible stores essential for potential reconstruction of a genetic resource on one hand, from redundant resources set aside for international exchange for scientific and/or commercial purposes on the other hand.

II. INTRODUCTION

The main objective of the Introduction is to present an overview that will allow a person who is unfamiliar with the country to appreciate the context for the Country Report. The Introduction should present a broad overview and present background information from your country on farmed aquatic species, their wild relatives and culture based fisheries. Detailed information should be provided in the main body of the Country Report. Countries may wish to consider developing their Introductions after completing the main body of their Country Reports.

Please write the overview here

Czech Republic is an inland country on the watershed of Elbe, Danube and Oder river systems. Few small natural lakes are all in nature preserves and they are not used for fishery at all. Artificial lakes of total area over 3 113 ha comprise water bodies originating after recultivation of coal-, lignite-, slate- or sand mines, and they are of rising interest for recreational fisheries. On rivers, 118 dam reservoirs have been built with a total water area of 14 200 ha. Commercial fisheries in open waters do not, de facto, exist in the country due to legal reasons (Adámek et al., 2012).

The entire fisheries sector in the Czech Republic is represented by two domains – freshwater aquaculture and recreational fisheries (angling) on both salmonid and non-salmonid waters, including management of fishing grounds for angling. Market-size fish are produced to major extent (96%) by means of pond aquaculture, to much lower extent in special facilities (3%, aquaculture systems mostly for salmonid fish production) and to the least extent by catching in river dam lakes using nets and/or electrofishing (less than 1%). Czech fish farming in ponds has more than 500 years long history. In the country, there are more than 24 000 man-made ponds of total area 52 000 ha. Approximately, 42,000 ha of ponds are primarily used for fish production. Of their total number, 88% of ponds with fish culture are managed by fish producers who are members of the Czech Fish Farmers´ Association; 7% of ponds with fish culture are managed by other registered fish breeders and 5% are managed by different small subjects with extensive production. Ponds, that were originally built for fish production, became an integral part of Czech countryside over centuries and, apart from their main role in pond aquaculture, they represent several other functions in the landscape, such as accumulation and retention of water and therefore ensuring protection from drought and flood, providing habitats for other plant and animal organisms, and recreation, besides other things.

During the last decade, annual production of marketable fish in the Czech Republic was stabilised at the level of about 20 000 tons of market size fish. Common carp (Cyprinus carpio) aims over 85 % with more than 17 000 tons of market carp produced annually, only in pond aquaculture and its rearing cycle from larvae to market size (1.3-3 kg) takes 3-4 growing seasons. High quality of the production is warranted by official trademarks and gained on use of natural food in ponds with high content of animal proteins (zooplankton, benthos) and on supplemental feeding with cereals to enhance the energetic component if feeding ration. Grass carp (Ctenopharyngodon idella), silver carp (Hypophtalmichthys molitrix) and bighead carp (Hypophtalmichthys nobilis) make 4-5 % of total annual production of market fish. They are produced only in pond aquaculture and their rearing cycles from larvae to market size (2-4 kg) take 3-4 growing seasons. Tench, Tinca tinca aims less than 1 % of the total production. It is produced in pond aquaculture only, with rearing cycle from larvae to market size (200-400 g) taking usually 3 years. Predators (pike, Esox lucius, pikeperch, Sander lucioperca; European catfish, Silurus glanis; perch, Perca fluviatilis) are taken as supplemental species with productive limits in typical carp pond aquaculture that can be hardly overcome. They aim about 1 % of total production. Pond aquaculture production of whitefish (Coregonus spp.), once an important group for market fish production, dropped greatly due to extensive losses caused by predation of cormorants, among other reasons.

Contribution of intensively cultured salmonids to the total Czech fish production is considerably lower compared to pond fish production. Over 700 tonnes of market size rainbow trout (Oncorhynchus mykiss) and brook trout (Salvelinus fontinalis) are produced annually, ranging within 3 % to 5 % of the total production. They are produced using artificial pelleted feeds, with rearing cycles from larvae to market size (200-400 g) taking 1-2 years. Increasing costs of production together with strong competition of imported rainbow trout from EU countries and Turkey are the reasons for decreased production volume. On the other hand the production of brown trout, Salmo trutta and European grayling, Thymallus thymallus for restocking of angling grounds is quite significant. Salmonids are intensively raised mostly in raceways, canals and earthen ponds in highland regions. However the number of suitable sites for salmonid farming using flow-through technologies is strongly limited due to the requirements on outflow water quality.

Recycling cold and warm water aquaculture systems are used only for the production of fish species such as: eel, Anguilla anguilla; pikeperch; rainbow trout; catfish; whitefish; sturgeons (mainly sterlet, Acipenser ruthenus and Siberian sturgeon, A. baerii) and ornamental fish species. Today, just four large fish farms use recirculation aquaculture systems for the production of marketable or stock fish with annual production 150 tonnes. This sector of Czech aquaculture is relatively new and its further development is envisaged during the next decade. Pikeperch and perch appear to be new promising species for intensive aquaculture.

The total annual volume of marketable fish produced refers to real requests of both the national and export markets which are balanced in 1 : 1 ratio. Productive fishery provides employment altogether to 1 500 full-time staff what is especially important in rural areas with limited job opportunities.

Angling is a hobby of altogether 320 000 anglers registered in 585 local angling clubs of either the Czech Anglers´ Union in Prague or of the Moravian Anglers´ Union in Brno. The unions currently belong to the biggest associations in the Czech Republic. In total 42 000 hectares of fishing grounds in the Czech Republic are managed by the anglers unions. Almost 4 000 tonnes of various fish species are caught by angling in Czech fishing grounds each year. This amount comprises approximately 3 200 tonnes of carp, 23 tonnes of tench, 170 tonnes of bream, 80 tonnes of grass carp, 130 tonnes of pike, 110 tonnes of zander, 80 tonnes of catfish, 20 tonnes of eels, 45 tonnes of rainbow trout and 14 tonnes of brown trout. The Czech Anglers´ Union is a member of the International Angling Organization (CIPS) and of the International Casting Sport Federation (ICSF).

Czech Republic manages own national programme of subsidies to conservation of fish genetic resources within the National Programme on Conservation of Farm Animal Genetic Resources, with a goal to keep old, less productive breeds as a part of national heritage and as a source of genes for contemporary breeding. The financial aid to maintain freshwater fish genetic resources for aquacultures – nucleic shoal was successfully notified to the European Commission in September 2013 and its approval lasts until the end of 2022.

Vocational and complete secondary education in fisheries, aquaculture, water management and aquatic ecology is provided in two fisheries secondary schools. University education of fisheries can be gained at three universities which also perform scientific research in fisheries and in related fields and organize professional training courses and seminars.
In conclusion, fisheries in the Czech Republic is well established considering both the fish production and recreational fishing, performed under established legal principles and with broad system of professional-, university graduate- and doctoral education. Despite of external retarding pressures, the productive fish farming keeps its position of a stabilized, competitive and professionally highly developed field, producing high quality fish which are essential for healthy nutrition of human.

References:
Adámek, Z., Linhart, O., Kratochvíl, M., Flajšhans, M., Randák, T., Policar, T., Masojídek, J., Kozák, P., 2012. Aquaculture the Czech Republic in 2012: Modern European prosperous sector based on thousand-year history of pond culture. Aquaculture Europe 37 (2): 5-14.
Czech Anglers´Union, 2015. Data from website www.rybsvaz.cz
Czech Fish Farmers´ Association, 2015. Data from website www.cz-ryby.cz
Ministry of Agriculture of the Czech Republic, 2014: Situation and outlook report. Fish. Ministry of Agriculture, Prague, www.eagri.cz
Moravian Anglers´Union, 2015. Data from website www.mrsbrno.cz

III. MAIN BODY OF THE COUNTRY REPORT

Aquaculture, culture-based fisheries and capture fisheries, have differing importance among countries. The structure of chapters in each Country Report will reflect those differences. Countries which do not have a well-developed aquaculture sector but where wild relatives of farmed aquatic species are located, should report on these resources. Countries should decide how to prioritize the coverage of their Country Reports depending on their aquatic genetic resources.

Chapter 1: The Use and Exchange of Aquatic Genetic Resources of Farmed Aquatic Species and their Wild Relatives within National Jurisdiction

The main objective of Chapter 1 is to provide annotated inventories of aquatic genetic resources (AqGR) of farmed aquatic species and their wild relatives.

Farmed aquatic species

1. Over the last 10 years, has production been: ***Please mark appropriate box.***

- ○ Increasing
- ◉ Stable
- ○ Decreasing
- ○ Stopped
- ○ Still in Research and Development
- ○ Fluctuating
- ○ Not known

2. What is the expected trend over the next 10 years? ***Please mark appropriate box.***

- (●) Increasing
- ( ) Stable
- ( ) Decreasing
- ( ) Stopped
- ( ) Still in Research and Development
- ( ) Fluctuating
- ( ) Not known

3. Is the identification and naming of farmed species, subspecies, hybrids, crossbreeds, strains, triploids, other distinct types accurate and up- to-date? ***Please mark appropriate box.***

- ( ) Yes
- ( ) No
- (●) Mostly Yes
- ( ) Mostly No

Please include any explanation or additional information here.

Naming of farmed species and subspecies, as well as of species for recreational fishing (angling), follows the valid scientific nomenclature . Identification and naming of crossbreds and strains follows regulations of the Animal Breeding Act No. 154/2000 of the Code of Laws of the Czech Republic in wording of next amendments. Names of fish strains used are registered in the Central Register according to the above act.

4. To what extent are genetic data for farmed aquatic organisms

a) Available? ***Please mark appropriate box.***

- ( ) Not at all
- ( ) To a minor extent
- (●) To some extent
- ( ) To a great extent

b) Used in management? ***Please mark appropriate box.***

- ( ) Not at all
- ( ) To a minor extent
- (●) To some extent
- ( ) To a great extent

Please add any explanation here.

Ad a) Within the scope of the Animal Breeding Act No. 154/2000 of the Code of Laws of the Czech Republic in wording of next amendments, genetic data for identification of species, subspecies, populations of farmed aquatic organisms are collected and analysed by a reference laboratory to assess their genetic purity (integrity), genetic variability and genetic distances of breeds within each species. They are externally available only if published in scientific journal papers or topical books. Genetic data of other aquatic genetic resources are collected and processed by the respective research organisations/universities upon research projects and are externally available only if published in scientific journal papers.

Methods of testing, structure and collection frequency of quantitative genetic data of farmed aquatic genetic resources are defined in the implementary regulations of the Animal Breeding Act No. 154/2000 of the Code of Laws of the Czech Republic in wording of next amendments and comprise performance and heredity testing of pure strains and/or performance testing of F1 crossbreds. Summary reports are released annually by the stakeholders´ association (Czech Fish Farmers´ Association of the Czech Republic) for its members. Data on performance traits of the respective strains or F1 crossbreds are externally available only if published in scientific journal papers or topical books.

Ad b) Data on genetic integrity and variability of populations are used in annual evaluation and management of progress of the conservation programme of fish genetic resources within the National Programme on Conservation of Farm Animal Genetic Resources. Information on genetic distances of breeds within each species are used to choose a proper strategy (selection / hybridization) in fish breeding programme within the Czech Fish Farmers´ Association, which is the authorized breeders´ association for breeding work in fish in terms of the Animal Breeding Act. No. 154/2000 of the Code of Laws, in wording of next amendments.

5. To what extent are the aquatic organisms farmed in your country sourced as wild seed or from wild brood stock*?*

Please mark appropriate box.

- (●) Not at all
- ( ) To a minor extent
- ( ) To some extent
- ( ) To a great extent

Please add any explanation here.

Farmed aquatic organisms (fish) are mostly reproduced artificially in hatcheries, to a minor extent they are reproduced semi-artificially in spawning ponds. They are not collected from the wild at all.

6. What proportions (%) of breeding programmes and efforts for the genetic improvement of farmed aquatic species in your country are being managed by the public sector (government research, universities etc.), the private sector, and public-private partnerships?

- Percent managed by public sector. **Please Enter Percentage Here** 80
- Percent managed by private sector**.** **Please Enter Percentage Here** 10
- Percent managed by private /public partnership. **Please Enter Percentage Here** 10

Total 100

Please add any explanation here.

Similarly to other farm animals in the Czech Republic, commercially important (farmed) fishes are subject to the act No. 154/2000 of the Code of Laws in wording of next amendments. Observance of this legislation is supervised by the Czech Breeding Inspectorate.
According to this act, all persons farming the broodstock of particular breeds, strains or pure populations, developing new breeds or hybrid strains and/or testing purebreds or hybrids must be authorized by the Ministry of Agriculture of the Czech Republic for breeding work, must be registered in Central Registry of brood fish and broodstock farmers and, if such person does the fish performance testing itself, must provide the resulting data to the Czech Fish Farmers´ Association (CFFA), which is the authorized breeders´ association for breeding work in fish in terms of the above act on one hand, and associates all major stakeholders in the field. The CFFA manages and concerts all breeding programme activities through its special advisory body, the Fish Breeding Advisory Board of the CFFA:
To a major extent, breeding programme and efforts for genetic improvement of farmed fish are developed by the public sector (university, under national funding sources) and pilot-tested in own facilities or on fish farms. Only few SMEs (fish farms) develop their own breeding programme for common carp and/or rainbow trout.
Performance testing of purebreds/F1 crossbreds follows unified methodology subject to the act No. 154/2000 of the Code of Laws and it is performed on fish farms (private sector) or in cooperation of the fish farms with university or research organization (public/private partnership). The latter also concerns research pilot projects within the Operational Programme Fisheries of the EU.

7. To what extent do genetically improved aquatic organisms, including hybrids, crossbreeds, strains, triploids and other distinct types contribute to national aquaculture production in terms of volume ?

Please mark appropriate box.

- ( ) Not at all
- ( ) To a minor extent
- ( ) To some extent
- (●) To a great extent

8. Please list most significant examples where genetic improvement contributed to increased production and indicate whether they were developed by public, private or public/private partnerships.

Add Row

Species	Type of genetic improvement *mark all that apply*	Developed By *mark all that apply*	
Cyprinus carpio	☒ Traditional selective breeding	☒ Private Sector ☒ Public Sector ☒ Private/Public partnership	X
	☐ Hybrids	☐ Private Sector ☐ Public Sector ☐ Private/Public partnership	
	☐ Triploids and other polyploids	☐ Private Sector ☐ Public Sector ☐ Private/Public partnership	
	☐ Mono-sex production	☐ Private Sector ☐ Public Sector ☐ Private/Public partnership	
	☒ Other	☒ Private Sector ☒ Public Sector ☒ Private/Public partnership	

9. Please fill in table 1.1

Table 1.1 Aquatic genetic resources (AqGR) of farmed aquatic species in your country

Add Row

Farmed species	Genetic type	Availability of genetic data	Trends in production	Future trends in production	Genetic improvement	Future genetic improvement	Comments	
List species (scientific names), strains and varieties as scientific names (put in brackets the most widely used national common name or names) and indicate whether native or introduced	*Indicate all genetic types that apply to the species*	Are genetic data available for farmed populations? If yes, give summary details in comments	Over the last 10 years, production has been ***(mark one)***	Expected trend over the next 10 years is that production will ***(mark one)***	Which genetic technologies are currently being used on the species ***(mark all that apply)***	***mark all that apply***	For example important traits improved, how data are used in management or name of breed, source of information, etc.	
◉ Native ○ Introduced Cyprinus carpio							Important traits improved comprise growth traits, fry survival rate and disease resistance (e.g. to dropsy, KHV). Selective breeding employing directional selection has been most used to establish individual strains, in some of them already since 1880´s. There are altogether 20 registered purebred strains of common carp in the Czech Republic. 11 of them are enlisted among fish genetic resources: South Bohemian Mirror Carp; Pohořelice Mirror Carp; Synthetic Strains C434 and C435; Telč Mirror Carp; Milevsko Mirror Carp; Třeboň Scaly Carp; South Bohemian Scaly Carp	X

	☐ Wild Type ☒ Selective bred type ☐ Hybrids ☒ Cross breeds ☒ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☒ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☒ Marker assisted selection ☒ Other (specify in comment)	C73; Zďár Mirror Carp and Žďár Scaly Carp; Mariánské Lázně Scaly Carp. See Flajšhans, M., Linhart, O., Šlechtová, V., Šlechta, V., 1999: Genetic resources of commercially important fish species in the Czech Republic: Present state and future strategy. Special edition Genetics in Aquaculture VI, Aquaculture 173: 471 - 483.Strains are characterized by diagnostic allozyme markers and recently also molecular markers, by phenotype of scaliness, breed standards and performance traits. See e.g. Kohlmann, K., Kersten, P., Flajšhans, M., 2005. Microsatellite based genetic variability and differentiation of domesticated, wild and feral common carp (Cyprinus carpio L.) populations. Aquaculture 247, 1-4, 253 - 266. For marketable fish production, crossbreeding is mostly used for heterosis effect of growth and resistance traits in F1 hybrids. Several strains are purebred for market fish production also. The species is used for restocking of fishing grounds.

◉ Native ○ Introduced Tinca tinca	☐ Wild Type ☒ Selective bred type ☐ Hybrids ☒ Cross breeds ☒ Strains ☐ Varieties ☒ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ◉ Decreasing ○ Stopped ○ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	☒ Selective breeding ☒ Hybridization ☒ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☒ Other (specify in comment)	☒ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☒ Marker assisted selection ☐ Other (specify in comment)	In Czech pond aquaculture, there are altogether 7 autochthonous tench strains enlisted among fish genetic resources (Velké Meziříčí, Hluboká, Tábor, Mariánské Lázně, Vodňany, Leather ´92, Blue), plus other 5 newly bred and/or imported strains (Golden, Alampic, Hungarian, Rumanian, Königswartha). Genetic characterization of farmed tench populations was given by Kohlmann, K., Kersten, P., Panicz, R., Memis, D., Flajšhans, M., 2010. Genetic variability and differentiation of wild and cultured tench populations inferred from microsatellite loci. Reviews in Fish Biology and Fisheries 20: 279-288. Production of triploids and/or gynogens was pilot tested but not yet widely used. However, tench production in the country dropped about 50% during the last decade. Used also for restocking of fishing grounds.	X

○ Native ◉ Introduced Oncorhynchus mykiss	☐ Wild Type ☒ Selective bred type ☐ Hybrids ☐ Cross breeds ☒ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☒ Selective breeding ☐ Hybridization ☒ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☒ Polyploidy (chromosome set manipulation) ☒ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Three strains have been selectively bred in the country. They are enlisted among fish genetic resources (PdM; PdD66 Kamloops; PdD75). For historical summary see Flajšhans, M., Ráb, P., Kálal, L., 1993: Genetics of salmonids in Czechoslovakia: Current status of knowledge. In: NATO-ASI Genetic Conservation of Salmonid Fishes, (J. Cloud and G. H. Thorgaard, Eds.), Plenum Publishing Corporation, New York: 231 - 242. Used for restocking of fishing grounds. All-female monosex populations and/or triploids are not produced in the Czech Republic, except for research and pilot testing, but imported by fish farmers mostly as eyed eggs from abroad.	X
◉ Native ○ Introduced Silurus glanis	☒ Wild Type ☒ Selective bred type ☐ Hybrids ☐ Cross breeds ☒ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Two strains are enlisted among fish genetic resources (Vodňany and Hodonín). In addition, Albino strains is bred as well. See Flajšhans, M., Linhart, O., Šlechtová, V., Šlechta, V., 1999: Genetic resources of commercially important fish species in the Czech Republic: Present state and future strategy. Special edition Genetics in Aquaculture VI, Aquaculture 173: 471 - 483 or Linhart O, Štěch L, Švarc J, Rodina M, Audebert J P, Grecu J, Billard R., 2002.The culture of the European catfish, Silurus glanis, in the Czech Republic and in France. Aquatic Living Resources 15, 2: 139–144.	X

							Used for restocking of fishing grounds.	
◉ Native ○ Introduced Salmo trutta	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ◉ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Two original populations (Šumava and Teplá) are enlisted among fish genetic resources. The species is used for restocking of fishing grounds. For genetic data of wild and farmed brown trout see Kohout, J.; Jaskova, I.; Papousek, I.; et al. 2012. Effects of stocking on the genetic structure of brown trout, Salmo trutta, in Central Europe inferred from mitochondrial and nuclear DNA markers.FISHERIES MANAGEMENT AND ECOLOGY 19, 3: 252-263.	X
◉ Native ○ Introduced Acipenser ruthenus	☒ Wild Type ☒ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☒ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Sterlet is autochthonous to Danube River basin. Pure species is enlisted among fish genetic resources and kept in live gene bank. Genetic data are being collected but not published so far. Hybrids (mostly with Huso huso or A. baerii) are used for beginning farm production.	X

◉ Native ○ Introduced Huso huso	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Beluga is autochthonous to Danube River basin. Pure species is enlisted among fish genetic resources and kept in live gene bank. Genetic data are being collected but not published so far. Hybrids (mostly with A. ruthenus) are used for beginning farm production.	X
○ Native ◉ Introduced Coregonus spp	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ◉ Decreasing ○ Stopped ○ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	☐ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Two species have been introduced, C. lavaretus in 1880´s and C. peled in 1970´s. Purposeful interspecific hybridization since 1970´s to produce F1 hybrids with improved performance of market fish, along with accidental hybridization and/or use of filial hybrids for further breeding led to loss of performance traits. In pond aquaculture, coregonids are exposed to intensive predation of cormorants. Pure populations of both species are enlisted among fish genetic resources and kept in live gene bank. For genetic data see Slechtova, V; Valenta M., 1988. Genetic traits characterizing the great maraena (Coregonus lavaretus maraena), peled (Coregonus peled) and their hybrids. ZIVOCISNA VYROBA 33, 10: 865-875.	X

○ Native ◉ Introduced Ctenopharyngodon idellus	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	○ Yes ○ No ◉ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used for polyculture in pond carp farming, without specific approach for genetic improvement.	X
○ Native ◉ Introduced Hypophthalmichthys molitrix	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used for polyculture in pond carp farming, without specific approach for genetic improvement. For genetic data see Slechtova, V; Valenta, M; Doan, DH; et al., 1990. Morphological and biochemicogenetic analysis of the silver carp and big head and their hybrids reared in Czechoslovakia. ZIVOCISNA VYROBA Volume: 35 Issue: 10 Pages: 859-868	X

○ Native ◉ Introduced Hypophthalmichthys nobilis	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used for polyculture in pond carp farming, without specific approach for genetic improvement. For genetic data see Slechtova, V; Valenta, M; Doan, DH; et al., 1990. Morphological and biochemicogenetic analysis of the silver carp and big head and their hybrids reared in Czechoslovakia. ZIVOCISNA VYROBA Volume: 35 Issue: 10 Pages: 859-868	X
◉ Native ○ Introduced Esox lucius	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	○ Yes ○ No ◉ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used for polyculture in pond carp farming, without specific approach for genetic improvement. Used for restocking of fishing grounds.	X

◉ Native ○ Introduced Sander lucioperca	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	○ Yes ○ No ◉ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☒ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used in pond fish farming, on the beginning of controlled domestication. The species is used for restocking of fishing grounds. A promising candidate for intensive aquaculture. Aquaculture research targeted to genetic improvement.	X
◉ Native ○ Introduced Perca fluviatilis	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	○ Yes ○ No ◉ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☒ Polyploidy (chromosome set manipulation) ☒ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Species used in pond fish farming, in the beginning of controlled domestication. A promising candidate for intensive aquaculture. Aquaculture research (triploids, female monosex populations) targeted to genetic improvement.	X

○ Native ◉ Introduced Acipenser baerii	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☒ Monosex ☒ Marker assisted selection ☐ Other (specify in comment)	Genetic data are being collected but not published so far. Hybrids (mostly with A. ruthenus, A. gueldenstaedtii) are used for beginning farm production.	X
○ Native ◉ Introduced Acipenser gueldenstaedtii	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☒ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Genetic data are being collected but not published so far. Hybrids (mostly with A. baerii) are used for beginning farm production.	X

○ Native ◉ Introduced Acipenser stellatus	☒ Wild Type ☐ Selective bred type ☐ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ◉ Not known	☐ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☐ Polyploidy (chromosome set manipulation) ☒ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Genetic data are being collected but not published so far.	X
○ Native ◉ Introduced Salvelinus fontinalis	☒ Wild Type ☐ Selective bred type ☒ Hybrids ☐ Cross breeds ☐ Strains ☐ Varieties ☐ Polyploids	○ Yes ○ No ◉ Not Known	○ Increasing ◉ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	◉ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Stopped ○ Not known	☐ Selective breeding ☒ Hybridization ☐ Polyploidy (chromosome set manipulation) ☐ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	☒ Selective breeding ☐ Hybridization ☒ Polyploidy (chromosome set manipulation) ☒ Monosex ☐ Marker assisted selection ☐ Other (specify in comment)	Brook trout has been introduced in 1880´s and it is used for trout production in aquaculture and for restocking of salmonid waters.	X

10. Which aquatic species in your country are thought to have potential for domestication and future use in aquaculture?

Add Row

Species ***Type and select a species***	Is the species native to your country?	Comments ***For example main sources of information***	
Perca fluviatilis	(•) Yes ( ) No ( ) Not Known	Its status in Czech pond aquaculture during the last three decades changed from neglected coarse fish to sought-after aquaculture commodity. Its domestication and intensive fish culture is in progress. See e.g. Mélard, C., Kestemont, P., Grignard, J.C., 1996. Intensive culture of juvenile and adult Eurasian perch (P. fluviatilis): effect of major biotic and abiotic factors on growth. Journal of Applied Ichthyology12, 3-4: 175–180 or Overton, J. L., Toner, D., Policar, T., Kucharczyk, D., accepted. Commercial production: Factors for success and limitations in European percid fish culture. In: Kestemont, P. and Dabrowski, K. (eds.): Biology and Culture of Percid Fishes – Principles and Practices, Series 4, Blackwell Sciences, 30 pp.	X
Sander lucioperca	(•) Yes ( ) No ( ) Not Known	Although used as a supplemental (predatory) species in pond polyculture for centuries, its true domestication is on the beginning, including artificial propagation, closed rearing cycle, farming technologies. Pikeperch is a promising species for intensive aquaculture. See e.g. Fontaine P (2009) Development of European inland fish culture and domestication of new species. Cah Agric 18(2–3):144–147 or Overton, J. L., Toner, D., Policar, T., Kucharczyk, D., accepted. Commercial production: Factors for success and limitations in European percid fish culture. In: Kestemont, P. and Dabrowski, K. (eds.): Biology and Culture of Percid Fishes – Principles and Practices, Series 4, Blackwell Sciences, 30 pp.	X

11. Please list the aquatic genetic resources of farmed aquatic species your country has transferred or exchanged with other countries over the past 10 years.

Add Row

Species	Genetic alteration of exchanged material **Mark all that apply**	Details of transfer or exchange	Type of genetic material exchanged **Mark all that apply**	Country or countries involved with exchange **Hold CTRL button to select more than one country**	Comments ***Please add main purpose or objective of the exchange and main sources of information***	
Cyprinus carpio	☐ No deliberate genetic alteration ☐ Traditional selective breeding ☒ Hybrids ☐ Triploids and other polyploids ☐ Mono-sex production ☐ Other	☐ Import ☒ Export	☐ DNA ☐ Genes ☐ Gametes ☐ Tissues ☐ Embryos ☒ Living specimens ☐ Other	Japan Jordan Kazakhstan Kenya Kiribati Kuwait Kyrgyzstan Lao People's Democra Latvia Lebanon Lesotho Liberia Libya Lithuania Luxembourg Madagascar Malawi Malaysia Maldives Mali Malta Marshall Islands Mauritania Mauritius Mexico Micronesia (Federate	The Faculty of Fisheries and Protection of Waters, University of South Bohemia in České Budějovice delivered two common carp F1 hybrids for performance testing in facilities of Universidad Autonoma Metropolitana Unidad Xochimilco, Mexico, D. F. in cooperation with local Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación - Comisión Nacional de Acuacultura y Pesca in 2007.	X
Acipenser naccarii	☒ No deliberate genetic alteration ☐ Traditional selective breeding ☐ Hybrids ☐ Triploids and other polyploids ☐ Mono-sex production ☐ Other	☒ Import ☐ Export	☐ DNA ☐ Genes ☐ Gametes ☐ Tissues ☐ Embryos ☒ Living specimens ☐ Other	Gabon Gambia Georgia Germany Ghana Greece Grenada Guatemala Guinea Guinea-Bissau Guyana Haiti Hungary Iceland India Indonesia Iran (Islamic Republic Iraq Ireland Israel Italy Jamaica	The Faculty of Fisheries and Protection of Waters, University of South Bohemia in České Budějovice imported live young brood fish from Mr. G. Giovannini (Azienda Agricola VIP, Orzinuovi, Brescia, Italy) in 2013 for research and in order to extend the acipenserid live gene bank also accessible by the World Sturgeon Conservation Society´s European research network.	X

Acipenser transmontanus	☒ No deliberate genetic alteration ☐ Traditional selective breeding ☐ Hybrids ☐ Triploids and other polyploids ☐ Mono-sex production ☐ Other	☒ Import ☐ Export	☐ DNA ☐ Genes ☐ Gametes ☐ Tissues ☐ Embryos ☒ Living specimens ☐ Other	Gambia Georgia Germany Ghana Greece Grenada Guatemala Guinea Guinea-Bissau Guyana Haiti Hungary Iceland India Indonesia Iran (Islamic Republic Iraq Ireland Israel Italy Jamaica	The Faculty of Fisheries and Protection of Waters, University of South Bohemia in České Budějovice imported live brood fish from Mr. G. Giovannini (Azienda Agricola VIP, Orzinuovi, Brescia, Italy) in 2013 for research and in order to extend the acipenserid live gene bank also accessible by the World Sturgeon Conservation Society´s European research network.	X
Acipenseridae	☒ No deliberate genetic alteration ☐ Traditional selective breeding ☐ Hybrids ☐ Triploids and other polyploids ☐ Mono-sex production ☐ Other	☒ Import ☐ Export	☐ DNA ☐ Genes ☐ Gametes ☐ Tissues ☐ Embryos ☒ Living specimens ☐ Other	Belarus Belgium Belize Benin Bhutan Bolivia (Plurinational S Bosnia and Herzegovi Brazil Brunei Darussalam Bulgaria Burkina Faso Burundi Cabo Verde Cambodia Cameroon Canada Central African Repub	The Faculty of Fisheries and Protection of Waters, University of South Bohemia in České Budějovice imported live eyed eggs of shortnose sturgeon, Acipenser brevirostrum, a CITES I species, from Acadian Surgeon and Caviar Inc. (Saint John, Canada) in 2009 exclusively for research purposes.	X
Oncorhynchus mykiss	☐ No deliberate genetic alteration ☐ Traditional selective breeding ☐ Hybrids ☒ Triploids and other polyploids ☒ Mono-sex production ☐ Other	☒ Import ☐ Export	☐ DNA ☐ Genes ☐ Gametes ☐ Tissues ☒ Embryos ☐ Living specimens ☐ Other	Central African Repub Chad Chile China Colombia Comoros Cook Islands Costa Rica Côte d'Ivoire Croatia Cuba Cyprus Czech Republic Republic of Korea Democratic Republic Denmark Djibouti	Several trout farms purchase embryos (eyed eggs) of female monosex stocks and rarely also of triploids for ongrowing and market production.	X

Wild relatives of farmed aquatic species

12. Please list any wild relatives of aquatic species present in your country that are farmed in another country (but not in your country) and indicate their uses.

Add Row

This question refers to aquatic genetic resources that are present in the wild in your country and that are being farmed elsewhere (but not farmed in your country), indicating any uses these resources may have in your country.

Species	Use *(mark all that apply)*	Comments	
Abramis spp	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☐ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Scardinius erythrophthalmus	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☐ Research and develpment ☐ Other (specify in comments)		X
Scardinius erythrophthalmus	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X

Barbus barbus	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Carassius carassius	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Aspius aspius	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☒ Biological control ☐ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds and for biological control of planktonivorous fish in drinkwater reservoirs.	X
Leuciscus spp	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	Species of this genus (Leuciscus cephalus and L. idus) are used for restocking of fishing grounds.	X

Vimba vimba	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Anguilla anguilla	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Lota lota	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X
Hucho hucho	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☐ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X

Astacus astacus	☐ Capture fisheries ☐ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☒ Other (specify in comments)	Noble crayfish is a critically endangered and protected species in the Czech Republic. Research may be done only upon permit. Any manipulation (capture, culture) without appropriate permission is banned.	X
Astacus leptodactylus	☐ Capture fisheries ☐ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☒ Other (specify in comments)	Narrow-clawed crayfish is an endangered and protected species in the Czech Republic despite the fact that it is non-native . Research may be done only upon permit. Any manipulation (capture, culture) without appropriate permission is banned.	X
Pacifastacus leniusculus	☐ Capture fisheries ☐ Recreational fishery ☐ Aquaria ☐ Biological control ☒ Research and develpment ☒ Other (specify in comments)	See Patoka, J., Kalous, L., & Kopecký, O. (2014). Risk assessment of the crayfish pet trade based on data from the Czech Republic. Biological Invasions, 16(12), 2489-2494.) Signal crayfish was introduced in 1980 to the Czech Republic (from Sweden). It influences its European counterparts by competition but especially spread the causative agent pathogen of crayfish plague (an oomycete Aphanomyces astaci), causing mass mortalities to crayfish not originating from North America. May be very abundant in production carp ponds. It can harm in aquaculture as well as in natural waterbodies. (Souty-Grosset, C., Holdich, D. M., Noël, P. Y., Reynolds, J. D., & Haffner, P. (2006). Atlas of crayfish in Europe. Muséum national d'Histoire naturelle.).	X
Procambarus clarkii	☐ Capture fisheries ☐ Recreational fishery ☒ Aquaria ☐ Biological control ☐ Research and develpment ☐ Other (specify in comments)	Red swamp crayfish is the most important crayfish species involved in aquaculture worldwide. China is the major producer. Together with the marbled crayfish (P. fallax f. virginalis), they are the most usual crayfish pets available in the Czech hobby market (Patoka et al., 2014). New stocks are often imported from Indonesia (Patoka, J., Kalous, L., & Kopecký, O. (2015). Imports of ornamental crayfish: the first decade from the Czech Republic's perspective. Knowledge and Management of Aquatic Ecosystems, (416), 04.) Species still present in aquaria only but escapes or releases with negative impacts on invaded ecosystems are expected.	X

Thymallus thymallus	☐ Capture fisheries ☒ Recreational fishery ☐ Aquaria ☐ Biological control ☐ Research and develpment ☐ Other (specify in comments)	The species is used for restocking of fishing grounds.	X

13. Please list the aquatic genetic resources of wild relatives of farmed aquatic species your country has transferred or exchanged with other countries over the past 10 years.

Add Row

This question refers to wild aquatic genetic resources collected from the wild, not from farming facilities as in question 11.

Species	Details of transfer or exchange ***mark all that apply***	Type of genetic material exchanged	Country **Hold CTRL button to select more than one country**	Comments ***main sources of information, if the transfer was legal or not***	
Salmo salar	☒ Import ☐ Export	☐ Tissues ☐ Gametes ☐ DNA ☐ Genes ☒ Embryos ☐ Living specimens ☐ Other	Egypt El Salvador Equatorial Guinea Eritrea Estonia Ethiopia European Union (Member Faroe Islands (Associate M Fiji Finland France Gabon Gambia Georgia Germany Ghana	Reintroduction. The transfers are legal.	X

14. Please fill in table 1.2

Table 1.2 Aquatic genetic resources of wild relatives of farmed aquatic species in your country.

Add Row

Target species, stocks or other management units	Characteristics of species	Capture fisheries	Management measures	Availability of genetic data	Use of genetic data in management	Trends in catches	Future trends in catches	Ecosystem(s) where the fishery is located	Changes in ranges and habitats	Reasons for change in abundance of species	
For each row, list the species as scientific names (put in brackets the most widely used national common For each species, include the named stocks and name of other management units if known)	Is the species ***(mark as appropriate):***	Is this species targeted by capture fisheries?	Are there any management measures in place?	Are genetic data available for the fishery?	Are genetic data used in management?	Over the last 10 years, catches have been:	Expected trend over the next 10 years.	Indicate the ecosystem where the fishery is located (***mark all that apply)***	The habitat or range is	What are likely reasons for changes? (***mark all that apply)***	
Astacus astacus	☐ Straddling ☐ Transboundary ☐ Introduced ☒ Native	○ Yes ◉ No ○ Not Known	◉ Yes ○ No ○ Not Known	◉ Yes ○ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	☐ Intertital ☐ Coastal in EEZ ☐ High seas ☒ Lake ☒ Reservoir ☒ River ☐ Swamp ☐ Other **(specify)**	○ Increasing ○ Stable ◉ Decreasing ○ Not known	☒ Habitat ☒ Climate ☒ Invasive species ☐ Pollution ☐ Rehabilitation of habitat ☐ Others ☐ Not known	X

Target species, stocks or other management units	Characteristics of species	Capture fisheries	Management measures	Availability of genetic data	Use of genetic data in management	Trends in catches	Future trends in catches	Ecosystem(s) where the fishery is located	Changes in ranges and habitats	Reasons for change in abundance of species	
Astacus leptodactylus	☐ Straddling ☐ Transboundary ☒ Introduced ☐ Native	○ Yes ◉ No ○ Not Known	◉ Yes ○ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	☐ Intertital ☐ Coastal in EEZ ☐ High seas ☐ Lake ☒ Reservoir ☐ River ☐ Swamp ☐ Other **(specify)**	○ Increasing ◉ Stable ○ Decreasing ○ Not known	☐ Habitat ☐ Climate ☒ Invasive species ☐ Pollution ☐ Rehabilitation of habitat ☐ Others ☐ Not known	X
Pacifastacus leniusculus	☐ Straddling ☐ Transboundary ☒ Introduced ☐ Native	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	☐ Intertital ☐ Coastal in EEZ ☐ High seas ☒ Lake ☒ Reservoir ☒ River ☐ Swamp ☐ Other **(specify)**	○ Increasing ◉ Stable ○ Decreasing ○ Not known	☐ Habitat ☒ Climate ☒ Invasive species ☐ Pollution ☐ Rehabilitation of habitat ☐ Others ☐ Not known	X

Target species, stocks or other management units	Characteristics of species	Capture fisheries	Management measures	Availability of genetic data	Use of genetic data in management	Trends in catches	Future trends in catches	Ecosystem(s) where the fishery is located	Changes in ranges and habitats	Reasons for change in abundance of species	
Procambarus clarkii	☐ Straddling ☐ Transboundary ☒ Introduced ☐ Native	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Yes ◉ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	○ Increasing ○ Stable ○ Fluctuating ○ Decreasing ○ Depleted ◉ Not known	☐ Intertital ☐ Coastal in EEZ ☐ High seas ☐ Lake ☐ Reservoir ☐ River ☐ Swamp ☒ Other **(specify)** aquarium trade	○ Increasing ○ Stable ○ Decreasing ◉ Not known	☐ Habitat ☒ Climate ☒ Invasive species ☒ Pollution ☐ Rehabilitation of habitat ☐ Others ☐ Not known	X
Salmo trutta	☐ Straddling ☐ Transboundary ☐ Introduced ☒ Native	◉ Yes ○ No ○ Not Known	◉ Yes ○ No ○ Not Known	◉ Yes ○ No ○ Not Known	◉ Yes ○ No ○ Not Known	○ Increasing ○ Stable ○ Fluctuating ◉ Decreasing ○ Depleted ○ Not known	○ Increasing ○ Stable ○ Fluctuating ◉ Decreasing ○ Depleted ○ Not known	☐ Intertital ☐ Coastal in EEZ ☐ High seas ☐ Lake ☐ Reservoir ☒ River ☐ Swamp ☐ Other **(specify)**	○ Increasing ○ Stable ◉ Decreasing ○ Not known	☒ Habitat ☒ Climate ☐ Invasive species ☒ Pollution ☐ Rehabilitation of habitat ☒ Others ☐ Not known	X

Chapter 2: Drivers and Trends in Aquaculture: Consequences for Aquatic Genetic Resources within National Jurisdiction

The main objective of Chapter 2 is to review the main drivers and trends that are shaping aquaculture and their consequences for aquatic genetic resources.

15. Please indicate the ways the aquatic genetic resources (AqGR) of **farmed aquatic species** have been impacted by the following drivers. Please give examples of positive and negative impacts for specific drivers.

This question refers to drivers impacting farmed aquatic genetic resources, not about impacts on the entire aquaculture sector. Drivers should be seen from a national perspective.

Driver impacting aquaculture	Effect on AqGR ***Mark appropriate box***	Comments ***List examples or other relevant information***
Human population increase	◯ Strongly positive ◯ Positive ◯ Negative ◯ Strongly negative ◉ No effect ◯ Unknown	There are not enough data yet for evidence-based analysis, moreover, there is no significant increase of inhabitants in the Czech Republic.
Increased wealth and demand for fish	◯ Strongly positive ◯ Positive ◯ Negative ◯ Strongly negative ◉ No effect ◯ Unknown	Although somewhat increased wealth was recorded for inhabitants of the Czech Republic, annual consumption of all fish (including seafood) has not changed for many years and is rather stagnant (1.5 kg per capita per year).
Governance (ability of government, industry and the public to work together in managing resources)	◯ Strongly positive ◉ Positive ◯ Negative ◯ Strongly negative ◯ No effect ◯ Unknown	Management of aquatic genetic resources is on a good level, public awareness is raising to some extent and it is reflected in agrotouristic activities.
Climate change	◯ Strongly positive ◯ Positive ◉ Negative ◯ Strongly negative ◯ No effect ◯ Unknown	There are not satisfactory data sets for evidence-based analysis yet, however, occasional flood events or draughts repeating with higher frequency in the last two decades may negatively affect AqGR, particularly production of juveniles.
Competition for resources, especially freshwater	◯ Strongly positive ◯ Positive ◯ Negative ◯ Strongly negative ◯ No effect ◉ Unknown	There are not concrete data for evidence-based analysis. Can be expected increasing competition for freshwater resources, which can strongly affect aquaculture.

Driver impacting aquaculture	Effect on AqGR ***Mark appropriate box***	Comments ***List examples or other relevant information***
Changes in values and ethics of consumers	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ◉ No effect ○ Unknown	
Other ***Add other drivers as necessary*** Add Row / Remove Row	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ○ No effect ○ Unknown	

16. Please indicate the ways the aquatic genetic resources of **wild relatives of farmed aquatic species** in nature have been impacted by the following drivers. Please give examples of positive and negative impacts for specific drivers.

This question refers to drivers impacting wild aquatic genetic resources of farmed species, not about impacts on the entire aquaculture sector. Drivers should be seen from a national perspective.

Driver impacting aquaculture	Effect on AqGR ***Mark appropriate box***	Comments ***List examples or other relevant information***
Human population increase	◯ Strongly positive ◯ Positive ◯ Negative ◯ Strongly negative ◉ No effect ◯ Unknown	Here are not enough data yet for evidence-based analysis.
Increased wealth and demand for fish	◯ Strongly positive ◯ Positive ◯ Negative ◯ Strongly negative ◉ No effect ◯ Unknown	The fish species in this group are consumed only by anglers.
Governance (ability of government, industry and the public to work together in managing resources)	◯ Strongly positive ◉ Positive ◯ Negative ◯ Strongly negative ◯ No effect ◯ Unknown	We should say "slightly positive" if we want to evaluate the overall effects, because there are numbers of positive as well as negative impacts of governance in terms of management of aquatic genetic resources. On one hand, highly professional fish farming organisations exist with modern know-how and capacities. Also, the fish districts are managed at a high level that enables to maintain the traditional composition of fish populations, mainly in ponds. Moreover, supportive financial and compensation schemes were developed by the state authorities in cooperation with the aquaculture and fisheries. For many years, national as well as European financial schemes exist and enable needed investments in aquaculture infrastructure and facilities, restoration of ponds, revitalisation of rivers and streams. On the other hand, there is a lack of coherence between the legislation protecting some of the wild living species (cormorant, beaver and otter) and the overall interests of fish farmers. Certain problems seem to be embedded even in the European Directives (chiefly Bird and Habitat directives) that are not flexible enough in case a certain species gets overpopulated very quickly (e.g. cormorant) and more regulation is thus needed at the European level. At the national level, there is a special act dealing with compensation of damages caused by selected protected species (in relation to aquaculture there is otter included,). However, all the established compensation and legal schemes do not seem to be sufficient in terms of prevention of damages caused by the predators as well as covering the losses.

Driver impacting aquaculture	Effect on AqGR ***Mark appropriate box***	Comments ***List examples or other relevant information***
Climate change	○ Strongly positive ○ Positive ◉ Negative ○ Strongly negative ○ No effect ○ Unknown	There are not concrete data for evidence-based analysis. Can be expected increasing competition for freshwater resources, which can strongly affect survival of wild relatives of farmed aquaculture species.
Competition for resources, especially freshwater	○ Strongly positive ○ Positive ◉ Negative ○ Strongly negative ○ No effect ○ Unknown	Can be expected increasing competition for freshwater resources, which can strongly affect aquaculture. Flood control measures and the promotion of small hydropower plants negatively affect wild fish stocks, particularly salmonids.
Changes in values and ethics of consumers	○ Strongly positive ◉ Positive ○ Negative ○ Strongly negative ○ No effect ○ Unknown	Fishermen (anglers) increasingly in terms of easier catch and for consumption purposes prefer stocked salmonids (rainbow trout, brook trout) against wild native salmonids. This "put and take stocking system" helps to protect wild native salmonids.
Other ***Add other drivers as necessary*** Add Row / Remove Row	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ○ No effect ○ Unknown	

17. What countermeasures might be taken to reduce adverse impacts on the aquatic genetic resources that sustain current aquaculture and/or provide for its future development?

Describe countermeasures

- To enhance the investments aimed at revitalisation and restoration of ponds, aquaculture facilities and modern technologies.
- To develop the fish production systems in the controlled environment, including recirculation systems of breeding of salmonids and other species with respecting the environmental standards.
- To enhance the overall competitiveness of aquaculture production entities through the diversification of their activities.
- To support investments into applied research, education and public awareness.
- To support the clearance of river systems in many places so that natural migration of fish populations is enabled and enhanced.
- To work further on the harmonisation of legislation and development of compensation schemes so that persisting different priorities and views of protection of certain wild species (mainly cormorant, beaver and otter) and the interests of fish farmers and producers are resolved.
- To enhance the mutual communication among all relevant stakeholders in the area of aquaculture management (state and regional authorities, aquaculture industry and NGOs).
- Reducing administrative burden and the impact of bureaucracy - enhancing of sustainability and competitiveness of SMEs, since majority of AqGR in the Czech Republic are just owned by SMEs.
- Enable more frequent and efficient veterinary surveillance of fish imports due to high risk of transmission of fish diseases (e.g. VHS, IHN, KHV, CEV) to susceptible species (common carp, salmonids) belonging to AqGR.
- Change of inappropriate way of agricultural farming (e.g. corn planting on steep slopes) in order to prevent increased soil erosion from catchment basin and subsequent siltation of ponds.
- Appropriate desiltation of ponds in order to increase volume/surface of fish ponds is also essential. Further, decreasing of uncontrolled nutrient and organic matter load from sewage systems and agriculture is also a good measure how to improve conditions for fish rearing. All of these countermeasures mentioned are necessary for a purpose of AqGR protection.

Biotechnologies

18. To what extent have the following biotechnologies been used in your country for the genetic improvement of farmed aquatic organisms.

Biotechnology	Extent of use	Comments ***main sources of information, important species for which the biotechnology is applied***
Selective breeding	○ Not at all ○ To a minor extent ○ To some extent ◉ To a great extent	Selective breeding has been the main tool to establish pure strains of common carp Cyprinus carpio, tench Tinca tinca, rainbow trout Oncorhynchus mykiss. See Flajšhans, M., Linhart, O., Šlechtová, V., Šlechta, V., 1999: Genetic resources of commercially important fish species in the Czech Republic: Present state and future strategy. Special edition Genetics in Aquaculture VI, Aquaculture 173: 471 - 483; Flajšhans, M., Ráb, P., Kálal, L., 1993: Genetics of salmonids in Czechoslovakia : Current status of knowledge. In: NATO-ASI Genetic Conservation of Salmonid Fishes, Moscow (Idaho) and Pullmann (Washington), USA, June 24 - July 5, 1991, (J. Cloud and G. H. Thorgaard, Eds.), Plenum Publishing Corporation, New York: 231 - 242 or Kocour, M., Gela, D., Šlechtová, V., Kopecká, J., Šlechta, V., Rodina, M., Flajšhans, M., 2008. Carp Breeds of the Czech Republic. In: Bogeruk, A.K. (Ed.), Catalogue of Carp Breeds (Cyprinus carpio L.) of the Countries of the Central and Eastern Europe, Ministry of Agriculture of the Russian Federation, Moscow. pp 13-46.
Hybridization	○ Not at all ○ To a minor extent ○ To some extent ◉ To a great extent	Breeding programme of common carp is mostly based on crossbreeding as it brings quick improvement of growth performance (heterosis effect) in F1 generation. Crossbreeding of breeds developed from both C. carpio and C. rubrofuscus (former C.c. haematopterus) improved survival rate of fry, cold and disease resistance (Flajšhans and Hulata, 2006; Piačková et al., 2013). See Flajšhans M. and Hulata G. , 2006. Common carp – Cyprinus carpio. In: "Genetic effects of domestication, culture and breeding of fish and shellfish, and their impacts on wild populations." D. Crosetti, S. Lapègue, I. Olesen, T. Svaasand (eds). GENIMPACT project: Evaluation of genetic impact of aquaculture activities on native populations. A European network. WP1 workshop "Genetics of domestication, breeding and enhancement of performance of fish and shellfish", Viterbo, Italy, 12-17th June, 2006, 7 pp. http://genimpact.imr.no/; Piačková, V., Flajšhans, M., Pokorová, D., Reschová, S., Gela, D., Čížek, A., Veselý, T., 2013. Sensitivity of common carp, Cyprinus carpio L., strains and crossbreeds reared in the Czech Republic to infection by cyprinid herpesvirus 3 (CyHV-3; KHV). Journal of Fish Diseases 36: 75-80. Intentional and accidental interspecific hybridization of coregonids (C. lavaretus, C. peled) since 1970´s led to decreased performance and, together with strong

		predation of cormorants on coregonids in ponds, contributed to decrease of coregonid production in the country. In sturgeon aquaculture, interspecific hybridization is studied with the aim to shorten the maturation interval and improve growth rate of F1 hybrids.
Polyploidy (chromosome set manipulation)	○ Not at all ◉ To a minor extent ○ To some extent ○ To a great extent	Production potential of induced triploids has been pilot-tested on tench Tinca tinca (see Piferrer, F., Beaumont, A., Falguière, J.-C., Flajšhans, M., Haffray, P., Colombo, L., 2009. Polyploid Fish and Shellfish: Production, Biology and Applications to Aquaculture for Performance Improvement and Genetic Containment. Aquaculture 293, 3-4: 125-156 and Flajšhans, M., Gela, D., Kocour, M., Buchtová, H., Rodina, M., Pšenička, M., Kašpar, V., Piačková, V., Sudová, E., Linhart, O., 2010. A review on the potential of triploid tench for aquaculture. Reviews in Fish Biology and Fisheries 20: 317-329), on European catfish Silurus glanis (see Linhart, O., Haffray, P., Ozouf-Costaz, C., Flajšhans, M., Vandeputte, M., 2001. Comparison of methods for hatchery-scale triploidization of European catfish (Silurus glanis L.). J. Appl. Ichthyol., 17: 247-255) and within public/private partnership (pilot projects of OP Fisheries, EU) also on rainbow trout Oncorhynchus mykiss and brook trout Salvelinus fontinalis.
Monosex production	○ Not at all ◉ To a minor extent ○ To some extent ○ To a great extent	For market fish production, female monosex stocks of rainbow trout Oncorhynchus mykiss are imported in eye-bud stage.
Marker assisted selection	◉ Not at all ○ To a minor extent ○ To some extent ○ To a great extent	
Gynogenesis/androgenesis	○ Not at all ◉ To a minor extent ○ To some extent ○ To a great extent	Induced gynogenesis has been studied in farmed fish (common carp Cyprinus carpio; tench Tinca tinca), see Linhart O, Kvasnička P, Šlechtová V. , Pokorný J., 1986. Induced gynogenesis by retention of the second polar body in the common carp, Cyprinus carpio L., and heterozygosity of gynogenetic progeny in transferrin and Ldh-B1 loci. Aquaculture 54, 1-2: 63-67; Linhart, O., Kvasnička, P., Flajšhans, M., Kasal, A., Ráb, P., Paleček, J., Šlechta, V., Hamáčková, J., Prokeš, M., 1995. Genetic studies with tench, Tinca tinca L.: induced meiotic gynogenesis and sex reversal. Aquaculture, 132: 239 - 251; Lebeda, I., Gazo, I., Flajšhans, M., 2014. Chemical induction of haploid gynogenesis in sterlet, Acipenser ruthenus. Czech Journal of Animal Science 59 (7): 310–318; Lebeda, I., Dzyuba, B., Rodina, M., Flajšhans, M., 2014. Optimization of sperm irradiation protocol for induced gynogenesis in Siberian sturgeon, Acipenser baerii. Aquaculture International 22: 485–495. Studies were carried out under laboratory and/or pilot conditions.

Other **Continue adding row as necessary** Add Row Remove Row		◯ Not at all ◯ To a minor extent ◯ To some extent ◯ To a great extent	

19. Please indicate the ways aquatic genetic resources of the wild relatives of farmed aquatic species have been impacted by drivers that are changing aquatic ecosystems. Please give countermeasures that might be taken to reduce adverse consequences for the aquatic genetic resources that sustain capture fisheries on wild relatives of farmed species.

Drivers that are changing aquatic ecosystems	Effect on AqGR ***mark appropriate box***	Countermeasures and effects
Habitat loss and degradation	○ Strongly positive ○ Positive ○ Negative ◉ Strongly negative ○ No effect ○ Unknown	Revitalization of riverbeds.
Pollution of waters	○ Strongly positive ○ Positive ◉ Negative ○ Strongly negative ○ No effect ○ Unknown	Improvement of wastewater treatment technologies. Reducing the use of pesticides in agriculture and the soil erosion.
Increased frequency of extreme climatic events and long-term climate change	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ○ No effect ◉ Unknown	
Establishment of invasive species	○ Strongly positive ○ Positive ○ Negative ◉ Strongly negative ○ No effect ○ Unknown	Especially cormorant (Phalacrocorax carbo sinensis) - effective elimination of these invasive fish predators.
Introductions of parasites and pathogens	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ◉ No effect ○ Unknown	

Drivers that are changing aquatic ecosystems	Effect on AqGR ***mark appropriate box***	Countermeasures and effects
Impacts of purposeful stocking and escapes from aquaculture	○ Strongly positive ○ Positive ◉ Negative ○ Strongly negative ○ No effect ○ Unknown	There is a potential risk (genetic, social - e.g. due to overstocking) of stocking of non-native strains (and even species) for native populations.
Capture fisheries	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ◉ No effect ○ Unknown	
Other ***Continue listing other driverst*** Angling Add Row / Remove Row	○ Strongly positive ○ Positive ◉ Negative ○ Strongly negative ○ No effect ○ Unknown	Tightening of the rules for angling (increasing of minimal catchable sizes, shortening of the open season, lower limits for a number of taken fish, etc.)

Chapter 3: *In Situ* Conservation of Aquatic Genetic Resources of Farmed Aquatic Species and their wild Relatives within National Jurisdiction

The main objective of Chapter 3 is to review the current status and future prospects for the *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives within national jurisdiction for food and agriculture.

The specific objectives are as follows:

- To review the current and likely future contributions to *in sit*u conservation of aquatic genetic resources of farmed aquatic species and their wild relatives by those who use them in responsible and well managed capture fisheries, aquaculture, and culture-based fisheries.
- To identify and describe any existing and planned aquatic protected areas that are contributing, or will contribute, to *in situ* conservation of aquatic genetic resources of wild relatives of farmed aquatic species.
- To identify and describe any major existing and planned efforts for the *in situ* conservation of threatened or endangered aquatic genetic resources (farmed and wild).
- To review needs and priorities for the future development of *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives.

Overview of the current status and future prospects for the *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives

20. To what extent are responsible and well managed aquaculture and culture-based fisher*ies* contributing to *in situ* conservation of the aquatic genetic resources of farmed aquatic species and their wild relatives.

Please mark appropriate box.

- (•) To a great extent
- ( ) To a limited extent
- ( ) Not at all
- ( ) Not applicable

Please include any additional information

Responsible and well managed aquaculture is a key issue for good functioning of a long-term programme. Under subventions of the present „ National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture“ , altogether 10 Czech and Moravian fish farms and/or institutional fish farming facilities maintain in total 13 live gene banks of common carp with 11 breeds, as well as 23 genetic resources of other species (tench, rainbow trout, wels, brown trout, great maraena, northern whitefish, sterlet and beluga) using a mandatory methodology and under annual control . Mean annual state subventions to the fish farms comprise 46.55% of direct costs for maintenance of live gene banks. See Flajšhans, M., Linhart, O., Šlechtová, V., Šlechta, V., 1999: Genetic resources of commercially important fish species in the Czech Republic: Present state and future strategy. Special edition Genetics in Aquaculture VI, Aquaculture 173: 471 – 483

21. To what extent are existing facilities contributing to *in situ* conservation of aquatic genetic resources of wild relatives of farmed aquatic species?

Please mark appropriate box.

- ○ To a great extent
- ◉ To a limited extent
- ○ Not at all
- ○ Not applicable

Please include any additional information

There are small local hatcheries focused on artificial reproduction of wild salmonids and other esp. riverine fish species and stocking of obtained young fish into the open waters. They are usually managed by the anglers´unions or by national park authorities.

22. Please provide ex*amples* of current or planned activities for the *in situ* conservation of endangered or threatened farmed species and their wild relatives with demonstrated or potential importance for aquaculture, culture-based fisheries, and capture fisheries.

Please describe examples

Conservation of genetic resources of sterlet ,Acipenser ruthenus and beluga Huso huso both in situ and ex situ (National programme of conservation and utilization of farm animal genetic resources; Ministry of Agriculture, Czech Republic, since 1997). The University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters (a member of World Sturgeon Conservation Society) keeps 10 acipenserid species in live gene bank (Acipenser ruthenus, A. baerii, A. gueldenstaedtii, A. stellatus, A. brevirostrum, A. naccarii, A. oxyrinchus, A. transmontanus, Huso huso and Polyodon spathula).
Fundamental research of sturgeon biology for biodiversity conservation, including physiology, reproduction, genetics, manipulation with primordial germ cells, oogonia and spermatogonia , as well as applied research on farming and reproduction of sturgeons for biodiversity conservation is carried out at two universities (University of South Bohemia in České Budějovice, Mendel´s University in Brno).

23. Please rank (from 1 to 10) the importance of the following objectives for *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives in your country.

Objectives of *in situ* conservation	Rank 1=Very Important 10=No importance
Preservation of aquatic genetic diversity	1
Maintain good strains for aquaculture production	1
Meet consumer and market demands	1
To help adapt to impacts of climate change	5
Future breed improvement in aquaculture	1
Please continue listing any other objectives as needed	
Add Row / Remove Row	

Review of the *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives through their use in responsible and well managed aquaculture and culture-based fisheries

24. Is the *in situ* conservation of aquatic genetic resources included in the policy as an objective in the management of aquaculture and/or culture-based fisheries in your country?

Please mark appropriate box

- (•) Yes
- ( ) Not yet, but planned to be included
- ( ) No
- ( ) Unknown

If yes, please give examples

For conservation of fish genetic resources, the present „National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture" has been launched already in 1996 with the goal to keep old, less productive breeds as a part of national heritage and as a source of genes for contemporary breeding (Flajšhans et al., 1999). Nowadays, altogether 10 Czech and Moravian fish farms maintain in total 13 live gene banks of common carp with 11 breeds, as well as 23 genetic resources of other species (tench, rainbow trout, wels, brown trout, great maraena, Northern whitefish, sterlet and beluga). All fish genetic resources have undergone genetic analyses to assess their genetic background, variability and genetic distances of breeds within each species. Mean annual state subventions to the fish farms comprise 46.55% of direct costs for maintenance of live gene banks, i.e. for in situ conservation. See also response to Question 20.

25. To what extent are collectors of wild seed and brood stock for aquaculture and culture-based fisheries contributing to the conservation of aquatic genetic resources by maintaining habitats and/or limiting the quantities collected?

Please mark appropriate box

- ( ) To a great extent
- ( ) To a limited extent
- ( ) Not at all
- (•) Not applicable

Please include any additional details

Review of the *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives through their use in responsible and well managed capture fisheries

26. Is the conservation of aquatic genetic resources of wild relatives of farmed aquatic species included as an objective in the management of any capture fisheries in your country?

Please mark appropriate box

If yes, please give examples

- ○ Yes
- ○ Not yet, but under development
- ◉ No
- ○ Unknown

Capture fisheries de facto does not exist in Czech Republic.

Review of the *in situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives through the establishment and management of aquatic protected areas

27. Please list any aquatic protected areas in your country that are contributing to the *in situ* conservation of aquatic genetic resources of wild relatives of farmed aquatic species and an assessment of effectiveness

Add Row

Aquatic protected area	Effectiveness of conserving Aquatic Genetic Resources	Comments ***provide any additional information***	
Protected spawning areas as a part of some fishing grounds.	○ Very effective ◉ Somewhat effective ○ Not effective ○ Unknown	Protected spawning areas proclaimed on some fishing ground in running waters are to protect spawners before and during natural spawning and/or juveniles for ongrowing, providing them necessary habitats. Angling and wading in these areas is prohibited. In salmonid waters, some capillaries (smallest streams) are proclaimed as protected fish areas for ongrowing of juvenile salmonids. They are managed by the anglers´unions.	X
Nature preserves and general protected areas	○ Very effective ◉ Somewhat effective ○ Not effective ○ Unknown	Large-scale and small-scale protected areas are not primarily focused on fish protection but on nature protection as a whole (4 national parks, 25 protected landscape areas, 14 Ramsar sites, numerous other smaller sites with other categories of nature protection in accordance with Act. No. 114/1992 Coll., on nature and landscape protection).	X

Chapter 4: *Ex Situ* Conservation of Aquatic Genetic Resources of Farmed Aquatic Species and their Wild Relatives within National Jurisdiction

The main objective of Chapter 4 is to review the current status and future prospects for the *ex situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives.

The specific objectives are:

- To review existing *ex situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives in aquaculture facilities, culture collections and gene banks, research facilities, zoos and aquaria;
- To review the contributions that various stakeholders are making to the *ex situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives;
- To review needs and priorities for the future development of *ex situ* conservation of aquatic genetic resources of farmed aquatic species and their wild relatives, including any that are threatened or endangered.

Review of existing and planned collections of live breeding individuals of aquatic genetic resources of farmed aquatic species and their wild relatives

28. Please list your country's existing collections of live breeding aquatic organisms that can be considered as contributing to the *ex situ* conservation of aquatic genetic resources. This includes not only collections of species farmed directly for human use, but also collections of live feed organisms (e.g., bacterial flocs, yeasts, microalgae, rotifers and brine shrimp (*Artemia*)).

Add Row

Species (*include information on subspecies or strain in comments if available*)	Type of use ***Please mark all that apply***	Is the species (or subspecies) threatened or endangered for example in the IUCN Red List, CITES Appendices or national lists? ***Please mark appropriate box***	Comments ***Please list any additional information***	
Acipenseridae	☐ Direct human consumption ☐ Live feed organism ☒ Other	◉ Yes ○ No ○ Unknown	Live specimens of different sturgeon species are kept in few ZOOs and aquaria.	X
Crayfish	☐ Direct human consumption ☐ Live feed organism ☒ Other	◉ Yes ○ No ○ Unknown	Live specimens of different crayfish species (particularly red swamp crayfish Procambarus clarkii and marbled crayfish P. fallax f. virginalis) are kept in home aquaria (including productions for wholesalers)	X

Review of existing *ex situ* conservation activities of aquatic genetic resources of farmed aquatic species and their wild relatives *in vitro.*

29. Please list your country's *in vitro* collections and gene banks of the gametes, embryos, tissues, spores and other quiescent forms of farmed aquatic species and their wild relatives , using cryopreservation or other methods of long-term storage. Describe the major examples, identifying the facilities in which the collections are held. Include examples of any such genetic material from your country that is being kept in *in vitro* collections outside your country on behalf of beneficiaries in your country.

Add Row

Species (include information on subspecies or strain if available in comments)	Users and managers ***List all that apply***	Type of *ex-situ* conservation collection *in vitro* ***mark all that apply***	Facilities where collection is located ***mark all that apply***	Comments ***list all breeds, subspecies of the species and any additional information***	
Cyprinus carpio	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☒ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of South Bohemian Mirror Carp; Pohořelice Mirror Carp; Synthetic Strains C434 and C435; Telč Mirror Carp; Milevsko Mirror Carp; Třeboň Scaly Carp; South Bohemian Scaly Carp C73; Žďár Mirror Carp and Žďár Scaly Carp; Mariánské Lázně Scaly Carp. See Kocour, M., Gela, D., Šlechtová, V., Kopecká, J., Šlechta, V., Rodina, M., Flajšhans, M., 2008. Carp Breeds of the Czech Republic. In: Bogeruk, A.K. (Ed.), Catalogue of Carp Breeds (Cyprinus carpio L.) of the Countries of the Central and Eastern Europe, Ministry of Agriculture of the Russian Federation, Moscow, pp.13-46. Bank of tissues/DNA samples is managed by reference laboratory of Institute of Animal Physiology and Genetics, Czech Academy of Sciences.	X

Species (include information on subspecies or strain if available in comments)	Users and managers ***List all that apply***	Type of *ex-situ* conservation collection *in vitro* ***mark all that apply***	Facilities where collection is located ***mark all that apply***	Comments ***list all breeds, subspecies of the species and any additional information***	
Tinca tinca	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☐ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of strains Velké Meziříčí, Hluboká, Tábor, Mariánské Lázně, Vodňany, Leather ´92, Golden, Blue.	X
Oncorhynchus mykiss	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☒ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of strains PdD75 and PdD66 Kamloops. Bank of tissues/DNA samples is managed by reference laboratory of Institute of Animal Physiology and Genetics, Czech Academy of Sciences.	X
Salmo Trutta	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☐ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of pure population of Šumava brown trout.	X

Species (include information on subspecies or strain if available in comments)	Users and managers ***List all that apply***	Type of *ex-situ* conservation collection *in vitro* ***mark all that apply***	Facilities where collection is located ***mark all that apply***	Comments ***list all breeds, subspecies of the species and any additional information***	
Silurus glanis	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☐ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of strains Hodonín, Vodňany and Albino.	X
Coregonus lavaretus	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☐ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of pure species	X
Coregonus peled	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☐ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of pure species	X

Species (include information on subspecies or strain if available in comments)	Users and managers ***List all that apply***	Type of *ex-situ* conservation collection *in vitro* ***mark all that apply***	Facilities where collection is located ***mark all that apply***	Comments ***list all breeds, subspecies of the species and any additional information***	
Acipenser ruthenus	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☒ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of pure species. In vitro collection of sturgeon tissues/DNA made upon research projects is managed by University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, accessible by the World Sturgeon Conservation Society´s European research network.	X
Huso huso	With state support for sperm cryopreservation of fish genetic resources, the insemination doses are property of the state, with Institute of Animal Science having dispositional rights as a coordinator. The collection is managed and supplemented by the University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters.	☒ In vitro collection of gametes ☐ In vitro collextion of embryos ☒ In vitro collection of tissues ☐ Spores ☐ Other	☐ Aquaculture facilities ☐ Research facilities ☒ Universities ☐ Zoos and aquaria ☐ Other	Cryopreserved insemination doses of pure species. In vitro collection of sturgeon tissues/DNA made upon research projects is managed by University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, accessible by the World Sturgeon Conservation Society´s European research network.	X

30. Please rank (from 1 – 10) the importance of the following objectives for ex situ conservation of aquatic genetic resources of farmed aquatic species and their wild relatives in your country

Objectives of *ex situ* conservation	Rank 1=Very Important 10=No importance
Preservation of aquatic genetic diversity	1
Maintain good strains for aquaculture production	1
Meet consumer and market demands	1
To help adapt to impacts of climate change	5
Future breed improvement in aquaculture	1
Other ***Continue adding row as necessary***	
Add Row / Remove Row	

Chapter 5: Stakeholders with Interests in Aquatic Genetic Resources of Farmed Aquatic Species and their Wild Relatives within National Jurisdiction

The main objective of Chapter 5 is to provide an overview of the perspectives and needs of the principal stakeholders who have interests in aquatic genetic resources of farmed aquatic species and their wild relatives for food and agriculture. Stakeholder groups can be identified from existing institutional knowledge, from sectoral and sub-sectoral consultations conducted during the country reporting process and where necessary from expert opinions. Gender issues pertaining to the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives should be considered, as well as the perspectives and needs of indigenous peoples and local communities.

The specific objectives are:

- To describe the different principal stakeholder groups with interests in aquatic genetic resources of farmed aquatic species and their wild relatives To identify the type(s) of aquatic genetic resources of farmed aquatic species and their wild relatives in which each stakeholder group has interests and why.

- To describe the roles of stakeholder groups and the actions they are taking for the conservation, sustainable use and development of the aquatic genetic resources in which they have interests.

- To describe the further actions that stakeholder groups would like to see taken for the conservation, sustainable use and development of aquatic genetic resources in which they have interests, and the constraints that are hindering those actions, including lack of capacity and perceived threats.

Overview of the principal stakeholder groups who have interests in aquatic genetic resources of farmed aquatic species and their wild relatives

31. Please indicate the principal stakeholder groups who have interests in aquatic genetic resources of farmed aquatic species and their wild relatives including, *inter alia*: fish farmers; fishers in capture fisheries; persons involved in stocking and harvesting in culture-based fisheries; persons employed in postharvest chains; government officials; staff and members of aquaculture associations; managers of aquatic protected areas and others working for the conservation of aquatic ecosystems; researchers; and civil society.

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
Fish Farmers	☒ Conservation ☒ Production ☐ Feed manufactoring ☒ Breeding ☐ Research ☒ Marketing ☒ Processing ☐ Advocacy ☐ Outreach/Extension ☒ Other (**specify**) agrotourism	☐ DNA ☒ Stock, breed or variety ☒ Species ☐ Other	Fish farmers are joined in the Czech Fish Farmers´ Association (CFFA; Rybářské sdružení České republiky; www.cz-ryby.cz). The CFFA is an integrating institution representing interests of its members in the public, at state authorities and also at the EU level.
Fishers	☐ Conservation ☐ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☐ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	Separate capture fisheries de facto does not exist in the Czech Republic.

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
Fish hatchery people	☒ Conservation ☒ Production ☐ Feed manufactoring ☒ Breeding ☐ Research ☒ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☒ Stock, breed or variety ☒ Species ☐ Other	Fish hatcheries are not independent entities but organizational units of either fish farms, or of local angling clubs of anglers´ unions.
People involved in marketing	☐ Conservation ☒ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☒ Marketing ☒ Processing ☐ Advocacy ☒ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☐ Stock, breed or variety ☒ Species ☐ Other	Only indirect effects.
Government resource managers	☒ Conservation ☒ Production ☐ Feed manufactoring ☒ Breeding ☒ Research ☐ Marketing ☐ Processing ☒ Advocacy ☒ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☒ Stock, breed or variety ☒ Species ☒ Other	The decisive authority in fisheries, either for productive aquaculture, angling and management of fishing grounds is the Ministry of Agriculture of the Czech Republic (Ministerstvo zemědělství České republiky, www. eagri.cz). This ministry also covers the veterinary issues of fisheries. The ministry also manages river and/or forestry authority companies including ponds, reservoirs and streams therein. The Ministry of the Environment of the Czech Republic (Ministerstvo životního prostředí České republiky, www. mzp.cz) deals with vulnerable, rare and

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
			endangered species, species under CITES, Natura 2000 areas, national parks, protected natural areas and ponds, reservoirs and streams therein, by means of its authorized organizations. Ponds, reservoirs and streams in military areas are managed by Military forests and estates (also a member of the CFFA) under the Ministry of Defense and Armed Forces of the Czech Republic (Ministerstvo obrany a Armáda České republiky; www.army.cz).
Fishing or aquaculture associations	☒ Conservation ☒ Production ☒ Feed manufactoring ☒ Breeding ☒ Research ☒ Marketing ☒ Processing ☒ Advocacy ☒ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☒ Stock, breed or variety ☒ Species ☒ Other	The Czech Fish Farmers´ Association (CFFA; Rybářské sdružení České republiky; www.cz-ryby.cz), located in České Budějovice, associates fish farmers (producers) and processors, providers of services and producers of gear for fisheries, producers/dealers of fish feeds, both the Czech and Moravian anglers ´unions, river authorities, national park authority, universities and professional secondary schools in the sector. The entire association is also a member of the Federation of European Aquaculture Producers (FEAP), Agrarian Chamber of the Czech Republic, Food Chamber of the Czech Republic and Czech and Moravian Poultry Union . The CFFA is an integrating institution representing interests of its members and promoting ideas and rights of the sector in the public, at state authorities and, as a member of FEAP, also at the EU. Members of the CFFA manage nearly 90 % of pond area and produce about 90 % of all the fish for market in the Czech Republic. The association also maintains

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
			close contact with about 40 farms which are not its members.
Aquatic protected area managers	☐ Conservation ☐ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☐ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
Policy Makers	☒ Conservation ☒ Production ☒ Feed manufactoring ☒ Breeding ☒ Research ☒ Marketing ☒ Processing ☒ Advocacy ☒ Outreach/Extension ☒ Other (**specify**) agrotourism	☐ DNA ☒ Stock, breed or variety ☒ Species ☐ Other	Policy makers, mainly the Ministry of Agriculture of the Czech Republic, deal with legal issues of AqGR, notification of national support mechanisms at the EU, management and distribution of national supports, management of production, conservation and research, its support via European Fisheries Fund, support of marketing and public awareness either on national or international level.
Non-Governmental Organizations	☐ Conservation ☒ Production ☒ Feed manufactoring ☐ Breeding ☐ Research ☒ Marketing ☐ Processing ☒ Advocacy ☒ Outreach/Extension ☐ Other (**specify**)	☒ DNA ☒ Stock, breed or variety ☒ Species ☐ Other	The main non-profit association generally in agriculture is the Agrarian Chamber of the Czech Republic. Its function and role is to support business activities in agriculture, food and forest sectors and promote the interests and needs of its members.

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
Intergovernmental Organizations	☐ Conservation ☐ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☐ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	To the best of our knowledge, intergovernmental organizations are not involved in AqGR.
Donors	☐ Conservation ☐ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☐ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☐ Other (**specify**)	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	To the best of our knowledge, donors are not significantly involved in AqGR.

Stakeholders	Role of stakeholder in regards og AqGR ***mark all that apply***	Genetic resource of main interest ***mark all that apply***	Comments ***Please provide any information or explanation of stakeholders' role***
Consumers	☐ Conservation ☐ Production ☐ Feed manufactoring ☐ Breeding ☐ Research ☐ Marketing ☐ Processing ☐ Advocacy ☐ Outreach/Extension ☒ Other (**specify**) fish as food, angling as hobby, agrotourism	☐ DNA ☐ Stock, breed or variety ☒ Species ☐ Other	According to the annual Situation and outlook reports – Fish - of the Ministry of Agriculture of the Czech Republic, annual consumption of all fish per capita is low (3.7 kg in 2013). From this amount, annual consumption of freshwater fish per capita was about 1.5 kg only and this figure was found stagnating throughout the last decade. Angling is a hobby of 350 000 members of anglers´ unions. Agrotourism, mainly visits of big ponds´ harvesting, school visits to hatcheries or bicycling round contryside pond areas is on the rise.

a) Please indicate the most important role of women in regards to AqGR

Stakeholders in the sector are equal opportunity employers.

b) Please indicate the most important role of indigenous and local communities in regards to AqGR

Chapter 6: National Policies and Legislation for Aquatic Genetic Resources of Farmed Aquatic Species and their Wild Relatives within National Jurisdiction

The main objective of Chapter 6 is to review the status and adequacy of national policies and legislation concerning aquatic genetic resources of farmed aquatic species and their wild relatives including access and benefit sharing.

The specific objectives are as follows:

- To describe the existing national policy and legal framework for the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives.
- To review current national policies and instruments for access to aquatic genetic resources of farmed aquatic species and their wild relatives and the fair and equitable sharing of benefits arising from their utilization.
- To identify any significant gaps in policies and legislation concerning aquatic genetic resources of farmed aquatic species and their wild relatives..

Review of national policies and legislation for Aquatic Genetic Resources of farmed aquatic species and their wild relatives within national jurisdiction

32. Please list national legislation, policies and/or mechanisms that address aquatic genetic resources of farmed species and their wild relatives (see question 47 regarding international agreements).

Add Row

National legislation, policy and/or mechanism	Date established	Scope ***Select all that apply***	Comments ***Please provide any additional information for example whether it has been effective or not; and main sources of information***	
Animal Breeding Act No. 154/2000 Coll.	May 17, 2000	☐ Genes or molecules only ☒ Aquaculture ☐ Capture fisheries ☒ Conservation ☐ Intellectual property protection ☒ Importation ☐ Trade and commerce ☐ Access and benefit sharing ☐ Other	The section dealing with animal genetic resources (paragraph 14) is currently being completely revised. The whole act can be found at: http://www.zakonyprolidi.cz/cs/2000-154	X
Decree No. 447/2006 Coll., animal genetic resources	Sep 1, 2006	☐ Genes or molecules only ☒ Aquaculture ☐ Capture fisheries ☒ Conservation ☐ Intellectual property protection ☐ Importation ☐ Trade and commerce ☐ Access and benefit sharing ☒ Other	The Decree is currently being completely revised. The whole Decree can be found at: http://www.zakonyprolidi.cz/cs/2006-447	X

National legislation, policy and/or mechanism	Date established	Scope ***Select all that apply***	Comments ***Please provide any additional information for example whether it has been effective or not; and main sources of information***	
The National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture	January 1, 1995	☐ Genes or molecules only ☒ Aquaculture ☐ Capture fisheries ☒ Conservation ☒ Intellectual property protection ☐ Importation ☐ Trade and commerce ☒ Access and benefit sharing ☒ Other	The programme has been established by the Ministry of Agriculture already in 1995 and enables the financial support of a number of endangered animal breeds used for food and agriculture in the territory of the Czech Republic.	X
Act No. 99/2004 on fish management	February 10, 2004	☐ Genes or molecules only ☒ Aquaculture ☒ Capture fisheries ☐ Conservation ☐ Intellectual property protection ☐ Importation ☐ Trade and commerce ☒ Access and benefit sharing ☒ Other	This act concerns the area of fish breeding, protection, hunting and angling, fish pond management, sets the rights and obligations of the state administration, and other related topics.	X

Review of the current status and gaps in national policies and legislation for the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives

33. Please list any gaps in the coverage or constraints in implementing national legislation, policies and/or mechanisms in regard to aquatic genetic resources.

National policy for the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species proceeds from the Animal Breeding Act No. 154/2000 Coll. in wording of next amendments. Considering the aquatic species in open waters, this policy proceeds from the Fisheries Act No. 99/2004 Coll. in wording of next amendments.
The section of animal breeding act dealing with animal genetic resources (paragraph 14) is currently being completely revised. The act amendment will bring more clarity on the competences, tasks and responsibilities entrusted to various actors involved in animal genetic resources management – state administration, coordination entity, participants to the National Programme, as well as the genebanks. The overall aim is to make the management more effective, transparent and based on sound legal basis and financial stability.

34. Please indicate any national aquatic genetic resources of farmed aquatic species and their wild relatives for which your country restricts access.

Type of genetic resource (can be species name, DNA, gametes or other descriptor)	Comments ***Please, provide verifiable main sources of information, effectiveness of the restriction, description of type of restriction and for whom does the restriction apply***
DNA	CITES regulations apply to sturgeon DNA samples.
Stock, breed or variety	According to the Animal Breeding Act No. 154/2000 Coll. in wording of next amendments, the export of fish breeds as genetic resources enlisted in the "National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture" is subject to prior approval of the Ministry of Agriculture of the Czech Republic.
Species	According to the Animal Breeding Act No. 154/2000 Coll. in wording of next amendments, the export of pure fish species as genetic resources enlisted in the "National programme of conservation and utilization of genetic resources of farm- and other animals important for nutrition, agriculture and forestry" is subject to prior approval of the Ministry of Agriculture of the Czech Republic. CITES regulations apply to sturgeons. According to Nature and Landscape Conservation Act. No. 114/1992. Coll. in wording of next amendments, any handling with protected crayfish species is prohibited.
Other **Continue adding row as necessary** Add Row | Remove Row	In summary to the answers given above we state that the Czech Republic restricts access to its aquatic genetic resources (species, stocks, samples, DNA, etc.) based on CITES regulations, regulations given within the Animal Breeding Act No. 154/2000 Coll., and Act on Nature and Landscape Protection No. 114/1992 Coll. The Czech Republic does not restrict access to its aquatic genetic resources based on the requirements of the Nagoya Protocol on on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity.

35. Over the past 10 years, indicate the actions your country has taken to maintain or enhance access to aquatic genetic resources of farmed aquatic species and their wild relatives located outside your country; for example, by establishing germplasm acquisition agreements or material transfer agreements.

Add Row

Action taken to enhance access to aquatic genetic resources outside your country	Type of genetic resource ***Mark all that apply***	Comment ***for example other types of genetic resources***	
In 2009, University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, Research Institute of Fish Culture and Hydrobiology was appointed a CITES-registered scientific institution CZ009.	☒ DNA ☐ Genes ☐ Gametes ☒ Tissues ☐ Embryos ☐ Living specimens	To enable rapid exchange of fixed sturgeon samples, tissues and DNA with other CITES-registered scientific institutions within the frame of joint scientific and research activities.	X
In 2014, University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters became the member of the World Sturgeon Conservation Society´s European Sturgeon Research Network (WSCS-ESRN).	☒ DNA ☐ Genes ☒ Gametes ☒ Tissues ☒ Embryos ☒ Living specimens	To enable access to live gene banks, gametes, embryos, tissues and/or DNA for joint scientific and pedagogical activities within the WSCS-ESRN and international projects therein.	X

36. Please indicate any obstacles your country has encountered when trying to access aquatic genetic resources of farmed aquatic species and their wild relatives outside of your country (including access for research purposes).

Obstacles to accessing aquatic genetic resources	Please describe type of genetic resource ***mark all that apply***	Comments ***please include additional information as needed***
Intellectual property protection	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
National laws of your country	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
National laws of donor country	☐ DNA ☐ Stock, breed or variety ☐ Species ☒ Other	Differences in veterinary regulations.
Internationl laws or protocols	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
Too expensive	☐ DNA ☐ Stock, breed or variety ☒ Species ☐ Other	Encountered during attempt to purchase several Asiatic species of sturgeons.
Material transfer agreements required	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
Knowledge gaps	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	
Public perception	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	

Obstacles to accessing aquatic genetic resources	Please describe type of genetic resource ***mark all that apply***	Comments ***please include additional information as needed***
Other **Continue adding row as necessary** Add Row | Remove Row	☐ DNA ☐ Stock, breed or variety ☐ Species ☐ Other	

Chapter 7: Research, Education, Training and Extension on Aquatic Genetic Resources within National Jurisdiction: Coordination, Networking and Information

The main objective of Chapter 7 is to review the status and adequacy of national research, education, training and extension, coordination and networking arrangements and information systems that support the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives for food and agriculture.

The specific objectives are:

- To describe the current status, future plans, gaps, needs and priorities for research, training, extension and education on the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives
- To describe existing or planned national networks for the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives.
- To describe existing or planned information systems for the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives.

Research

37. Does your national research programme support the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives? If yes, give details of current and/or planned research; if no, explain the main reasons why not in box below.

Please mark appropriate box

(•) Yes

( ) No

( ) Unknown

Please provide details

Projects supported by CZ Ministry of Education, Youth and Sports:
LO1205 Sustainability and Excellence of Center of Aquaculture and Biodiversity of Hydrocenoses (01/2014-12/2018, responsible leader prof. Dipl.-Ing. Otomar Linhart, D.Sc.)
Projects of international cooperation – Programme COST
FA 1205 Assessing and improving the quality of aquatic animal gametes to enhance aquatic resources - The need to harmonize and standardize evolving methodologies, and improve transfer from academia to industry (11/2012–11/2016, leader for a part solved at USB FFPW Dipl.-Ing. Martin Pšenička, Ph.D.)
Projects supported by CZ Ministry of Agriculture:
Projects of National Agency for Agricultural Research:
QJ1510077 Increased and more efficient production of salmonids in the CR using their genetic identification (2015-2018, Mendel University in Brno, leader for a part solved at USB FFPW Dipl.- Ing. Vlastimil Stejskal, Ph.D.)
QJ1510117 Optimalization of techniques of controlled and semi-controlled fish reproduction (2015-2018, responsible leader prof. Ing. Jan Kouřil, Ph.D.)
OP Fisheries:
CZ.1.25/3.1.00/13.00466 Optimization and implementation of pikeperch off-season spawning in its intensive culture
(01/2014 - 04/2015, responsible leader Assoc. Prof. Dipl.-Ing. Tomáš Policar, Ph.D.)
CZ.1.25/3.1.00/13.00447 Development of technology for the preservation of pike testicular sperm (02/2014 - 05/2015, responsible leader prof. Dipl.-Ing. Otomar Linhart, D.Sc.)
Other grants supported by the Ministry of Agriculture of the Czech Republic:
National programme for conservation and utilization of genetic resources of farm animals – B.1.16 Maintenance of genetic resources in fish (responsible leader Prof. Dipl.-Ing. Martin Flajšhans, Dr.rer.agr.)
Subsidiary programme 2.A.e.1a): Maintenance and improving of genetic quality of farm animals and plants, Controls of performance – fish (responsible leader Prof. Dipl.-Ing. Martin Flajšhans, Dr.rer.agr.)
Projects supported by the Grant Agency of the Czech Republic:
502/11/0090 Maturation and ageing of fish spermatozoa: A comparative study between teleostean and chondrostean fish species as taxonomically distant models (2011–2015, responsible leader Dipl.-Ing. Marek Rodina, Ph.D.)
P502//12/1973 Characterization of swimming fish sperm flagella: biophysical quantification (2012–2015, responsible leader Jacky Cosson, Ph.D., Dr.h.c.)
P503/12/1834 identification of epigenetic biomarkers of male germ cell disorders linked to adverse environmental factors (2012–2015, Institute of Biotechnology AS CR, leader for a part solved at USB FFPW Dipl.-Ing. Martin Pšenička, Ph.D.)
P502/13/39438P Neuroendocrine regulation of ovulation and spermiation in Cypriniformes (02/2013–12/2015, responsible leader MSc. Peter Podhorec, Ph.D.)
P502/13/26952S Induction of chimerism by transplantation of germ stem cells in critically endangered sturgeons as a tool of their conservation (02/2013–12/2017, responsible leader Dipl.-Ing. Martin Pšenička, Ph.D.)
14-28375P Interspecific competition of sturgeon sperm cells and fertility of the resulting hybrids (2014-2016,

responsible leader Dipl.-Ing. Miloš Havelka, PhD.)
14-0290S Ploidy and hybrid diversity of sturgeons (Acipenseriformes) and its implications for their conservation and farming (2014-2016, responsible leader Prof. Dipl.-Ing. Martin Flajšhans, Dr.rer.agr.)
Projects supported by the Grant Agency of the University of South Bohemia:
114/2013/Z New methods and biotechnological approaches in fish reproduction and genetics (2013-2015, responsible leader Prof. Dipl.-Ing. Otomar Linhart, D.Sc.)
074/2013/Z Optimalization of breeding aspects of the pond and intensive aquaculture (2013-2015, responsible leader Assoc. Prof. Dipl.-Ing. Tomáš Policar, Ph.D.)
126/2015/Z Nuclear transplantation in sturgeon eggs (2015, responsible leader Fatira Effrosyni)
084/2015/Z Ploidy level of perciform fish influenced by post-ovulatory oocytes ageing and high water temperature conditions at the beginning of the embryo development (2015, responsible leader Miroslav Blecha)
059/2015/Z Effect of a deposition of energy reserves in the body of common carp (Cyprinus carpio L.) on fish survival and condition (2015-2016, responsible leader: Martin Prchal)
International Research Projects
Seventh Framework Programme
AQUAEXCEL – Aquaculture infrastructures for excellence for European fish research (2011–2015, leader for a part solved at USB FFPW Prof. Dipl.-Ing. Otomar Linhart, D.Sc.)
613912 TRAFOON - Traditional Food Network to improve the transfer of knowledge for innovation (11/2013 - 10/2016, responsible leader Assoc. Prof. Dipl.-Ing. Tomáš Policar, Ph.D.)
613912 – OrAQUA – European Organic Aquaculture – Science-based recommendations for further development of the EU regulatory framework and to underpin future growth in the sector (1/2014 – 12/2016, responsible leader: Assoc. Prof. Zdeněk Adámek, Ph.D.)
613611 – FishBOOST – Improving European aquaculture by advancing selective breeding to the next level for the six main finfish species (2014 – 2018, responsible leader: Dipl.-Ing. Martin Kocour, Ph.D.)
Seventh Framework Programme and HORIZON 2020
642893 - Improved production strategies for endangered freshwater species, (2015 – 2018, responsible leader: prof. Dipl.-Ing. Otomar Linhart, DrSc.)

38. Please list main institutions, organizations, corporations and other entities in your country that are engaged in field and/or laboratory research related to the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives.

Add Row

Main institutions, organizations, corporations and other entities	Area of research ***Mark all that apply***	Comments ***Please provide any additional information***	
University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Research Institute of Fish Culture and Hydrobiology, Zátiší 728/II, 389 25 Vodňany, Czech Republic	☒ Genetic resource management ☒ Basic knowledge on aquatic genetic resources ☒ Characterization and monitoring of aquatic genetic resources ☒ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☒ Conservation of aquatic genetic resources ☒ Communication on aquatic genetic resources ☒ Access and distribution of aquatic genetic resources ☐ Other	Established in 2009 with the Research Institute of Fish Culture and Hydrobiology in Vodňany as the establishing member part, the faculty is the most complex workplace within Central Europe focused on research and education in fisheries, aquaculture, protection of waters and complex systems. The faculty is a scientific and professional convener of fish genetic resources within the "National programme of conservation and utilization of genetic resources of farm- and other animals important for nutrition, agriculture and forestry" Live gene banks of several fish species and cryopreserved sperm and PGC bank are operated by the faculty.	X
Institute of Animal Physiology and Genetics, Czech Academy of Sciences, v.v.i., Laboratory of Fish Genetics, 277 21 Liběchov, Czech Republic	☐ Genetic resource management ☐ Basic knowledge on aquatic genetic resources ☒ Characterization and monitoring of aquatic genetic resources ☐ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☐ Conservation of aquatic genetic resources ☐ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	Within the Animal Breeding Act No. 152/2000 Coll., the laboratory acts as reference laboratory for analyses of genetic integrity, variability, distance and origin of fish species, strains and pupulations. The laboratory maintains tissue bank of the fish genetic resources.	X

Main institutions, organizations, corporations and other entities	Area of research ***Mark all that apply***	Comments ***Please provide any additional information***	
Czech University of Life Sciences , Faculty of Agrobiology, Food and Natural Resources, Department of Zoology and Fisheries, Kamýcká 129, 165 21 Praha 6 - Suchdol, Czech Republic	☐ Genetic resource management ☒ Basic knowledge on aquatic genetic resources ☒ Characterization and monitoring of aquatic genetic resources ☐ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☐ Conservation of aquatic genetic resources ☒ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	The department is engaged in field research, monitoring of and education on aquatic resources mainly in open waters.	X
Mendel University in Brno, Faculty of Agronomy, Institute of Zoology, Fisheries, Hydrobiology and Apiculture, Zemědělská 1, 61300 Brno, Czech Republic	☐ Genetic resource management ☒ Basic knowledge on aquatic genetic resources ☐ Characterization and monitoring of aquatic genetic resources ☐ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☐ Conservation of aquatic genetic resources ☒ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	The institute is engaged in field-, farm and laboratory research, monitoring of and education on aquatic resources mainly in open waters and rearing and feeding technologies in pond aquaculture.	X

Main institutions, organizations, corporations and other entities	Area of research ***Mark all that apply***	Comments ***Please provide any additional information***	
Institute of Hydrobiology, Biology Centre of the AS CR, v.v.i., Na Sádkách 7, 370 05 České Budějovice, Czech Republic	☐ Genetic resource management ☐ Basic knowledge on aquatic genetic resources ☒ Characterization and monitoring of aquatic genetic resources ☐ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☐ Conservation of aquatic genetic resources ☒ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	The institute is engaged in field research and monitoring of aquatic genetic resources mainly in river dam lakes and other reservoirs, using a wide series of techniques from nets to echosounding.	X
Rybníkářství Pohořelice a.s., Vídeňská 717, 691 23 Pohořelice	☒ Genetic resource management ☐ Basic knowledge on aquatic genetic resources ☐ Characterization and monitoring of aquatic genetic resources ☒ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☒ Conservation of aquatic genetic resources ☐ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	Private fish farm dealing with conservation and own programme of genetic improvement of farmed fish genetic resources (common carp, sturgeons), in cooperation with universities.	X

Main institutions, organizations, corporations and other entities	Area of research ***Mark all that apply***	Comments ***Please provide any additional information***	
Klatovské rybářství a.s., K letišti 442/II , 339 01 Klatovy	☒ Genetic resource management ☐ Basic knowledge on aquatic genetic resources ☐ Characterization and monitoring of aquatic genetic resources ☒ Genetic improvement ☐ Economic valuation of aquatic genetic resources ☒ Conservation of aquatic genetic resources ☐ Communication on aquatic genetic resources ☐ Access and distribution of aquatic genetic resources ☐ Other	Private fish farm dealing with conservation and own programme of genetic improvement of farmed fish genetic resources (rainbow trout, common carp), in cooperation with university.	X

39. What capacity strengthening is needed to improve national research in support of the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives?

Please rank the following in regard to capacity strengthening.

Capacities	Rank 1=Very Important 10=No importance
Improve basic knowledge on aquatic genetic resources	8
Improve capacities for characterization and monitoring of aquatic genetic resources	4
Improve capacities for genetic improvement	8
Improve capacities for genetic resource management	2
Improve capacities for economic valuation of aquatic genetic resources	5
Improve capacities for conservation of aquatic genetic resources	2
Improve communication on aquatic genetic resources	5
Improve access to and distribution of aquatic genetic resources	5
Add other rows as appropriate and rank Add Row Remove Row	

Please describe any other capacity building needs in regards to aquatic genetic resources

Private fish farm dealing with conservation and own programme of genetic improvement of farmed fish genetic resources (rainbow trout, common carp), in cooperation with university.

Education, training and extension

40. Please indicate the extent that education, training and extension in your country covers the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives? List the main institutions involved and the types of courses offered.

Add Row

Institution	Thematic Area	Type of courses **mark all that apply**	Comments	
University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, 389 25 Vodňany, Czech Republic	Genetic resource management	☒ Undergraduate ☒ Post-graduate ☒ Training ☐ Extension	The topic is involved in parts in several subjects of BSc., MSc. and PhD. curricula of Fishery. Training of professional fishery public is provided upon projects from OP Fisheries.	
	Characterization and monitoring of aquatic genetic resources	☒ Undergraduate ☒ Post-graduate ☒ Training ☐ Extension	The topic is involved in parts in several subjects of BSc., MSc. and PhD. curricula of Fishery. Training of professional fishery public is provided upon projects from OP Fisheries.	
	Genetic improvement	☒ Undergraduate ☒ Post-graduate ☒ Training ☐ Extension	The topic is involved in parts in several subjects of BSc., MSc. and PhD. curricula of Fishery. Training of professional fishery public is provided upon projects from OP Fisheries.	X
	Economic valuation of aquatic genetic resources	☒ Undergraduate ☒ Post-graduate ☐ Training ☐ Extension	The topic is involved in parts in several subjects of BSc., MSc. and PhD. curricula of Fishery. Training of professional fishery public is provided upon projects from OP Fisheries.	
	Conservation of aquatic genetic resources	☒ Undergraduate ☒ Post-graduate ☒ Training ☐ Extension	The topic is involved in parts in several subjects of BSc., MSc. and PhD. curricula of Fishery. The FFPW organizes seminars for professional fishery public and lay public as well, including the lifelong learning. Scientific seminars and conferences provide thematic focus, and there are annually a number of excurses and practical demonstrations.	

Coordination and networking

41. Please list any mechanisms within your country responsible for coordinating the aquaculture, culture-based fisheries and capture fisheries subsectors with the other sectors that use watersheds and coastal ecosystems and have impacts on aquatic genetic resources of wild relatives of farmed aquatic species (e.g., agriculture, forestry, mining, tourism, waste management and water resources).

If no mechanism exists check here: ☐

Add Row

Name of mechanism	Description of how mechanism operates	
		X

42. Please indicate how capacity strengthening can be improved in intersectoral coordination in support of the conservation, sustainable use and development of aquatic genetic resources.

Please rank the following in regards to capacity strengthening.

Capacities	Rank 1=Very Important 10=No importance
Increase awareness in institutions	6
Increase technical capacities of institutions	6
Increase information sharing between institutions	8
Add other rows as appropriate and rank Add Row Remove Row	

Please specify in box below

43. Please list any national networks in your country or any international networks your country belongs to that support the conservation, sustainable use and development of aquatic genetic resources.

Add Row

Network	Objectives of the network ***Please mark all that apply*** to your country	Comments	
In frame of the "National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture", there is a network of farm animal genetic resources maintained upon national subsidies. The sub-programme B.1.16 considers Fish genetic resources, which aim is to maintain the genetic resources of fish through the conservation of breading shoals, each consisting at least of 120 specimens of selected fish species, populations and strains enlisted within the above-mentioned National Programme.	☒ Improve basic knowledge on aquatic genetic resources ☒ Improve capacities for characterization and monitoring of aquatic genetic resources ☒ Improve capacities for genetic improvement ☒ Improve capacities for economic valuation of aquatic genetic resources ☒ Improve capacities for conservation of aquatic genetic resources ☒ Improve communication on aquatic genetic resources ☒ Improve access to and distribution of aquatic genetic resources	The network is coordinated by the Institute of Animal Science, v.v.i. in Prague Uhřiněves.	X

Information systems

44. Please list any information systems existing in your country for receiving, managing and communicating information about the conservation, sustainable use and development of aquatic genetic resources of farmed aquatic species and their wild relatives.

Add Row

Name of information system	Type of information stored ***mark all that apply***	Main stakeholders ***mark all that apply***	
Central Breeding Register, transformed into Integrated Agricultural Register, operated via VPN network of the Ministry of Agriculture of the Czech Republic, according to the Animal Breeding Act No. 154/2000 Coll.	☐ DNA sequence ☐ Genes and genotype ☒ Breeds, strains or stocks ☒ Species names ☐ Production figures ☒ Distribution ☐ Level of endangerment ☐ Other	☒ Fish farmers ☐ Fishers in capture fisheries ☒ Fish hatchery people ☐ People involved in marketing ☒ Government resource managers ☒ Fishing or aquaculture associations ☐ Aquatic protected area managers ☐ University and academic people ☐ Non-Governmental Organizations ☐ Intergovernmental Organizations ☒ Policy makers ☐ Donors ☐ Consumers ☐ Politicians **Please list other stakeholders as necessary** Czech Veterinary Authority; Czech Breeding Inspectorate	X

Name of information system	Type of information stored ***mark all that apply***	Main stakeholders ***mark all that apply***	
Breeding books of individual breeds (strains) of farmed fish species, managed by the Czech Fish Farmers´ Association, according to the Animal Breeding Act No. 154/2000 Coll.	☐ DNA sequence ☐ Genes and genotype ☒ Breeds, strains or stocks ☒ Species names ☐ Production figures ☒ Distribution ☐ Level of endangerment ☒ Other	☒ Fish farmers ☐ Fishers in capture fisheries ☒ Fish hatchery people ☐ People involved in marketing ☐ Government resource managers ☒ Fishing or aquaculture associations ☐ Aquatic protected area managers ☒ University and academic people ☐ Non-Governmental Organizations ☐ Intergovernmental Organizations ☐ Policy makers ☐ Donors ☐ Consumers ☐ Politicians **Please list other stakeholders as necessary** Czech Breeding Inspectorate	X

45. What capacity strengthening is needed to improve national information systems to support the conservation, sustainable use and development of aquatic genetic resources?

Please describe what capacities need to be strengthened

The capacity of the current information system is suitable, The communication is ensured through the system established under the National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture.

Please describe any other capacity building needs in regards to information systems for aquatic genetic resources

Chapter 8: International Collaboration on Aquatic Genetic Resources of Farmed Aquatic Species and Their Wild Relatives

The main objective of Chapter 8 is to review the mechanisms and instruments through which your country participates in international collaborations on aquatic genetic resources of farmed aquatic species and their wild relatives.

The specific objectives are:

- To identify your country's current participation in bilateral, sub-regional, regional, other international and global forms of collaboration on aquatic genetic resources. List national memberships, status as a Party and other forms of affiliation in agreements, conventions, treaties, international organizations, international networks and international programmes.
- To identify any other forms of international collaboration on aquatic genetic resources.
- To review the benefits from existing forms of international collaboration on aquatic genetic resources.
- To identify needs and priorities for future international collaboration on aquatic genetic resources

International collaboration includes bilateral arrangements and the sharing of particular waters and stocks of wild relatives of farmed aquatic species.

International, regional or sub-regional agreements, conventions and treaties concerning aquatic genetic resources of farmed aquatic species and their wild relatives

46. Please list the international, regional or sub-regional agreements your country subscribes to that cover aquatic genetic resources of farmed species and their wild relatives, such as the Nagoya Protocol[2] the Convention on Biological Diversity and the Cartagena Protocol and how they have impacted aquatic genetic resources and stakeholders in your country. Examples could include:

[2] http://www.cbd.int/abs/nagoya-protocol/signatories/

- Establishment and management of shared or networked aquatic protected areas as far as wild relatives of farmed aquatic species are concerned
- Aquaculture and culture-based fisheries in transboundary or shared water bodies
- Sharing aquatic genetic material and related information
- Fishing rights, seasons and quotas as far as wild relatives of farmed aquatic species are concerned
- Conservation and sustainable use of shared water bodies and watercourses as far as wild relatives of farmed aquatic species are concerned
- Quarantine procedures for aquatic organisms and for control and notification of aquatic diseases

Add Row

International, Regional, bilateral or Sub-Regional agreement	Year your country ratified or subscribed to the agreement	Impact on aquatic genetic resources	Impact on stakeholders	Comments	
Nagoya Protocol	signature 23.6.2011, CZ is not a Party to Nagoya Protocol, did not ratify or subscribe yet as a country, but bound to EU legislation on ABS;	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ◉ No effect	○ Strongly positive ○ Positive ○ Negative ○ Strongly negative ◉ No effect	The ABS system based on Nagoya Protocol has not been fully functional yet, especially in practice, due to some of the incomplete global, European as well as national elements of the system (ABS CHM, national law).	X

International, Regional, bilateral or Sub-Regional agreement	Year your country ratified or subscribed to the agreement	Impact on aquatic genetic resources	Impact on stakeholders	Comments	
Convention on Biological Diversity	approval 3.12.1993	(•) Strongly positive ( ) Positive ( ) Negative ( ) Strongly negative ( ) No effect	(•) Strongly positive ( ) Positive ( ) Negative ( ) Strongly negative ( ) No effect	Comments: Being a Party to the Convention on Biological Diversity playes direct and important role in shaping and continuation of the National Programme on Conservation and Utilisation of Animal Genetic Resources for Food and Agriculture. The Ministry of Agriculture is now evaluating and reviewing the programme for the period 2017 – 2021 and refers to CBD in many chapters.	X
CITES	1993	( ) Strongly positive (•) Positive ( ) Negative ( ) Strongly negative ( ) No effect	( ) Strongly positive (•) Positive ( ) Negative ( ) Strongly negative ( ) No effect	The Research Institute of Fish Culture and Hydrobiology in Vadňany is engaged in research activities of sturgeon together with other similar research institutions outside of the Czech Republic.	X
The Convention on Wetlands of International Importance (the Ramsar Convention)	1993	( ) Strongly positive (•) Positive ( ) Negative ( ) Strongly negative ( ) No effect	( ) Strongly positive (•) Positive ( ) Negative ( ) Strongly negative ( ) No effect	Up to date 14 Ramsar sites within the territory of the Czech Republic have had an overall positive impact on conservation of aquatic genetic resources and their natural environment.	X

47. Please list the priority needs regarding collaboration on conservation and sustainable use of aquatic genetic resources of farmed aquatic species and their wild relatives. Are they being addressed, i.e. are there any critical gaps?

Collaboration is needed in order to ...	Rank 1=Very Important 10=No importance	To what extent are the needs being met	Comments ***For example any critical gaps***
Improve information technology and database management	5	○ To a great extent ◉ To some extent ○ None ○ Unknown	
Improve basic knowledge on aquatic genetic resources	8	◉ To a great extent ○ To some extent ○ None ○ Unknown	
Improve capacities for characterization and monitoring of aquatic genetic resources	1	○ To a great extent ◉ To some extent ○ None ○ Unknown	Progress in implementing the most up-to-date techniques of genetic analyses is rather slow and species-specific.
Improve capacities for genetic improvement	3	○ To a great extent ◉ To some extent ○ None ○ Unknown	More importance might be put on development of breeding programmes based on selective breeding than on crossbreeding for heterosis effect, e.g. in common carp.
Improve capacities for economic valuation of aquatic genetic resources	6	○ To a great extent ◉ To some extent ○ None ○ Unknown	
Improve capacities for conservation of aquatic genetic resources	8	◉ To a great extent ○ To some extent ○ None ○ Unknown	
Improve communication on aquatic genetic resources	6	◉ To a great extent ○ To some extent ○ None ○ Unknown	

Collaboration is needed in order to ...	Rank 1=Very Important 10=No importance	To what extent are the needs being met	Comments ***For example any critical gaps***
To improve access to and distribution of aquatic genetic resources	8	(•) To a great extent ( ) To some extent ( ) None ( ) Unknown	
Other **Continue adding row as necessary** Add Row Remove Row		( ) To a great extent ( ) To some extent ( ) None ( ) Unknown	

48. Please describe the types of collaboration that have been most beneficial for your country, and why?

Research & aquaculture cooperative projects of the EU Framework programme, such as 7th FP and Horizon 2020 projects, CRAFT projects (Co-operative Research Projects carried out by RTD performers for the benefit of a number of SMEs from different countries on common specific problems or needs), COST projects (European Co-operation in Scientific and Technical Research) with concerted research actions, etc. The most beneficial types of projects involve most complex funding, inculding salaries and research material, not only travel funding for mutual visits.

Bilateral or multilateral cooperation in research and education upon contracts or memoranda of understanding among the particular institutions. This is an essential prerequisite of application for a cooperative research project within programmes of international cooperation in research and development (e.g. Kontakt II of the Ministry of Education, Youth and Sports of the Czech Republic or its other national analogues).

Student and academic mobilities (e.g. education/tutorial, research stay; summer schools, workshops) within the Erasmus, Erasmus Mundus, TEMPUS and CEEPUS programmes, Visegrad Fund, Czech universities´developmental fund and many national funds such as e.g. the French Marie-Curie programme, Alexander von Humboldt fund for mobilities to and research in Germany, Fullbright fund to USA, JSPS fund to Japan and others.

49. Is there a need for your country to expand its collaboration concerning the conservation, sustainable use and development of aquatic genetic resources? If yes, give details, including any requirements for capacity strengthening in box below

○ Yes

◉ No

If yes, please give details

50. Describe important roles that your country performs within its region (and/or sub-region) and globally in terms of being a keeper, user and sharer of aquatic genetic resources.

With its National Programme of Conservation of Farm Animal Genetic Resources launched already in 1994, Czech Republic played a pioneering role in conservation of farmed fish genetic resources in Central European region, as well as a certain advisory or consulting role for neighbouring countries planning to establish or beginning their own programme on the topic .

Czech Republic, through its universities and research institutions, plays in the field of aquatic genetic resources an important role in MSc. and PhD. education and practical training of students from developing countries, as well as in practical implementing the principles of breeding the aquatic genetic resources in their home countries.

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