Empowered lives.
Resilient nations.

TECHNICAL REPORT

BAIKAL BASIN TRANSBOUNDARY DIAGNOSTIC ANALYSIS

INVASIVE SPECIES IN THE BASIN OF THE BAIKAL LAKE

2013

BAIKAL BASIN TRANSBOUNDARY DIAGNOSTIC ANALYSIS – TECHNICAL REPORT

INVASIVE SPECIES IN THE BASIN OF THE BAIKAL LAKE

2013

Support in the preparation of this document was provided by the Project on Integrated Natural Resource Management in the Baikal Basin Transboundary Ecosystem, which is financed by the Global Environment Facility, with support from the United Nations Development Programme.

The Global Environment Facility (GEF) unites 182 member governments – in partnership with international institutions, civil society, and the private sector providing grants to developing countries and countries with economies in transition, linking local, national, and global environmental challenges in order to promote sustainable futures for all. Established in 1991, the GEF is today the largest public funder of projects to improve the global environment investing in over 2,700 projects. www.thegef.org

The United Nations Development Programme (UNDP) partners with people at all levels of society to help build nations that can withstand crisis, and drive and sustain the kind of growth that improves the quality of life for everyone. On the ground in 177 countries and territories, we offer global perspective and local insight to help empower lives and build resilient nations. www.undp.org

CONTENTS

ABBREVIATIONS AND ACRONYMS

IWBM	Integrated Water Basin Management
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
UNDP	United Nations Development Programme
UNOPS	United Nations Office for Project Services

INTRODUCTION

The emergence of alien species in the basin of Lake Baikal is due to two main reasons: introduction and their accidental penetration. In both cases, these processes relate to biological invasion. According to common belief, bio invasions should be considered as the process of spreading and naturalization of alien species and the consequence there immigration --as the biological contamination. The principle difference of biological contamination from chemical, including organic, is that all types of pollution (except Biological) can be stopped by closing the source or its transfer to non-waste technologies.

Introduction of new animal species in the Baikal Lake and its water basin has been carried out since the 30-s of the last century. Immigration of new species of fish has been justified by the desire to enrich the indigenous fauna in the fisheries by species and increasing of fishing catches. The base for immigration was the idea that the Baikal fish productivity is very low and is only 3 kg/ha in 2 times less than in the Ladoga and Onega Lakes.

According to scientists proposals on raising of the fish capacity of the Baikal Lake, it is likely to carry out by the "reconstruction of piscifauna ", namely, on the one hand, the arrival of new, valuable fish species and, on the other hand, to reduce the number of non- commercial species of Baikal endemic species. As new species, it was recommended fish-planktofagov immigration (vendace and Peled) and benthophages (Chir, muksun). In order to reduce the number of non-target kottoidny fishes, it was proposed to immigrate the predatory fish, such as nelma (Misharin, 1949). Just for introductions, it were recommended about 45 species of fishes such as salmon, whitefish, sturgeon and cyprinid fishes, but there were introduced only 12 species: sprat, salmon, ripus, peled, whitefish, bauntovsky cisco, bauntovskaya vendace, grass carp, silver carp, east bream, carp, Amur carp, Amur catfish (Pronin, 1974; 1982; Neronov and others, 2002).

Biological species naturalized in the new locality remains there forever and will continue to modify along with the ecosystem. It is often difficult to predict the results of this evolution.

The result is the release of ecological niches, and large rivers have begun to play the role of transit corridors for the penetration and spread of alien species. One of the main transit routes becomes the Selenga River – the trans-border artery that has become a function of the water corridor, uniting different landscapes and aquatic systems in Russia and Mongolia.

River Selenga belongs to the basin of the Arctic Ocean and it is the home to 30 species of fish, of which 8 (26.7%) are invasive. There are three different ways of spreading of alien fish by water bodies of the Selenga basin. So, six species of fish have been introduced either intentionally which then spontaneously spread on new water reservoirs.

One of species, Chinese sleeper (*Perccottus glenii*) entered the Basin of Selenga River as a result of the accidental introduction. Expansion of the range of dwarf Altai Osman (*Oreoleuciscus a humilis*) probably due to climate change. And in almost of all these cases the Selenga River acts as the transit corridor for spreading of alien species. The result of release of Amur catfish (P*arasilurus asotus*) in 1932 to the Shaksha Lake was the naturalization of this species in the Tola and Orkhon Rivers at the Mongolian part of the Selenga Basin. Amur carp (*Cyprinus carpio haematopterus*) was introduced to the Baikal Lake in the 1940's. Using the transit path of the Selenga River, the species widely spread to the South up to the Tola river and the Ougiy-Nur Lake.

In recent years, the human impact on the Selenga Basin has grown significantly, especially because of the gold mining activities in the South (Mongolian) part. Since the disturbed habitats were more receptive to successful naturalization of alien species than undisturbed, it should be expected in the near future as new invasive species in the Selenga basin. In this regard, the identification of transit routes and vectors of infiltration of alien species, in addition to monitoring changes of their habitats, are more effective than just mechanical destruction of invasive species.

INVASIVE SPECIES IN AQUAS ECOSYSTEMS OF THE BAIKAL LAKE

So far, the representatives of alien fauna species of vertebrates, invertebrates and aquatic plants of flora includes 11 species. Among them, 7 species has been included to the Baikal Lake basin of invasive species on fish, of invertebrates – 3 species and 1 species of higher plants (Dgebuadze, 2003 Matafonov et al., 2006; Bazarova, Pronin, 2007).

1. Fishes, whose invasion has been ended by their naturalization in the Baikal Lake:

- Amur- catfish (*Parasilurus asotus*, Linnaeus, 1758);
- Amur-carp (Amur *Cyprinus carpio haematopterus* Temminck et Schlegel, 1842);
- Eastern bream (*Abramis bramaorientalis* Berg, 1949);
- Char-perccottus glenii (*Perccottus glenii* Dybowski, 1877).

2. Fishes, whose invasion has not been ended normally by their naturalization occupancy or it is questionable:

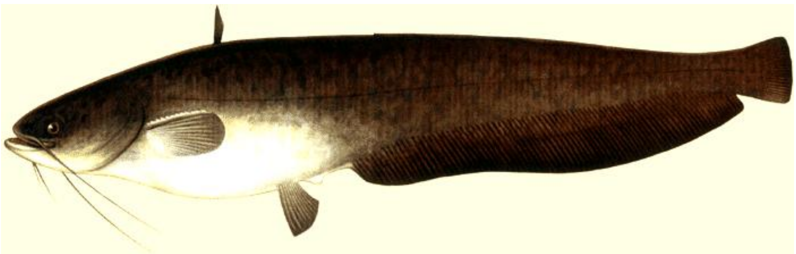
- Peled, Glasiert (*Coregonus peled*, Gmelin, 1789)
- Mikidza or rainbow trout (*Parasalmo mykiss* Walbaum, 1792)
- European whitefish (*Coregonus albula*, Linnaeus, 1758).

3. Fish, whose appearance in the Russian part of Lake Baikal basin is predictable: Altai Osman (*Oreoleuciscus* cf. *humilis)*

1.1. Fish who's invasion has been ended by their naturalization in the Baikal Lake

<u>The naturalized species include only those invasion species, populations of which are capable for self-reproduction in new reservoirs.</u>

Amur- catfish (*Parasilurus asotus*, Linnaeus, 1758)



In 1932, it was settled down in the Shaksha Lake of Transbaikalia district where entered the Selenga river basin, in South Baikal, Angara and Bratsk reservoir, where widely spread (see an annotated catalogue, 1998).

Amur catfish is now firmly entrenched in the local ichthyocoenosis of the basin of Lake Baikal, occupying the particular ecological niche, but its number is small and rarely actually registered in official statistics of the commercial fishery.

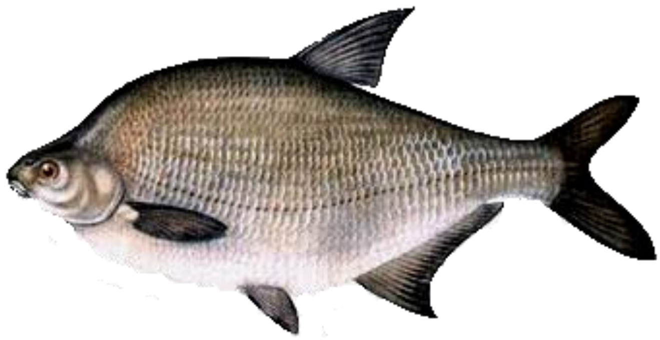
Amur-carp (*Cyprinus carpio haematopterus* Temminck et Schlegel, 1842)

Amur-carp belong to the recent invasive fish of the Baikal Lake. K.N. Panteleev, A.I. Berezovschi, K.I. Misharin, D.N. Taliev suggested to improve the species of fish of Lake Baikal by insert the Amur Carp in the coastal and bathing Lake system. With this aim, it was carried out the study of this fish in its natural habitat in the Onon River (Amur River). In 1934, it was inserted 22 samples of Amur-carp into Lake Shaksha (the Arahlejskaya system of Lakes) and 10 samples of carp - to the Posolsky sor. In 1937, 14 samples of common carp were first released to the Selenga River. In 1944-1945, about 1385 copies of carp were secondary released to the Posolsky sor. Fish was brought from the Petropavlovsk Lake (the basin of the Amur River).
A year later, carp has migrated from Posolsky sor at coastal areas of Lake Baikal and most often occur in the Delta of the Selenga River. In the seventies of the twentieth century, the carp catch was equal from 10 up to 100 tons and since 1978 its catch is prohibited.

The carp caviar is small, 1.0 mm -1.5 mm in diameter, and is glued to the aquatic vegetation. The larvae appear after 8-10 days. The larvae are feed by rotifers and algae, fish fry and planktonic crustaceans. Juvenile of carp found in lacustrine systems of the Selenga and Barguzin rivers; here are the favourable conditions for their growth and development. Adult fish are fed most intensively during the summer by hironomidami, plants, molluscs and air insects.

Amur carp is now common met in the Selenga River, but successful spawning and, accordingly, the most important stock of generation are observed only in occasional years. More favourable conditions for the reproduction of Amur carp found in the floodplain of the Barguzin River. It is in these habitats the carp became the second fishing object after omul of the native population.

Eastern bream (*Abramis bramaorientalis* Berg, 1949)



The bream immigration to reservoirs of Buryatia has started in 1954 and this is an example of rapid acclimatization: basin of the Kama River- the Ubinsky Lake - Lakes of Buryatia. Bream was imported in the Baikal area (the Gousinoe Lake) in November 1954, by 1054 species taken from the Ubinsky Lake beeing at the age of five or six years old and weighing 500-700, the next year it was found that fish have mastered the whole Lake. In 1955, it was imported 1137 breams aged from three to six years to the Bolshoe Eravninskoe Lake. In the same year, in order to carry out experimental work, about 50 units of bream were released into the Okunevoe Lake, located in the Selenga River system. Since 1960, it has begun to meet separate units of bream in the Baikal Lake at the Posolsky Sora district.

Bream keeps by groups in deep places, mostly overgrown by plants, eats molluscs, crustaceans, grass, insects and gammaridami, in summer in its diet is marked detritus. Bream overwinter in deep places.

In recent years there has been observed the self-resettlement of bream in coastal zone of Lake Baikal. The process started by bream migration to the Baikal Lake from the Koto-Kel Lake in the early of the 90 's. From there, it is spread to the South and North of the Turky River. Currently, bream and its hybrids with roach are found in catches at the Istominsky Sor and the Selenginsky shoal. It was observed the bream set to the Selenga River.

Bream is the eco plastic fish of good adaptability to different conditions. It prefers lacustrine environments, but lives in rivers, channels, reservoirs. In large bodies of water feeding areas, breams may reach 40-45 cm in length and more than 3 kg by mass. Bream – typical benthophage having the wide range of typical food.

Rotan (*Perccottus glenii* Dybowski, 1877)

The source center of the Rotan spreading to the reservoirs of the Baikal natural territory (BNT) was formed from a donor-invader populations during its importing into the region (the wagon unloading with unevenly-carp from the Khabarovsky fish farm to the Goosinoe Lake in 1969).

It is necessary to mark the Rotan registration in the paranasal reservoirs of the Barguzin river at 60-65 km from the entry (s. Barguzin) and at the Basin of the Udy River (a tributary of the Selenga) where it is numerous in the sleeves and broadlands of the Bryan River. There is evidence of the Rotan presence at the Verhneangarsky Sor and the Upper Hangar and in the Selenga's tributaries of

Mongolia (Dgebuadze et al., 2003). Currently, the most numerous views of Rotan has become in the ducts of the Selenga Delta and coastal sections of the Selinginsky shoal.

Rotan withstands the partial pond drying and the complete freezing to the bottom in winter. It feels best in standing bodies of water with a well-developed higher aquatic vegetation.

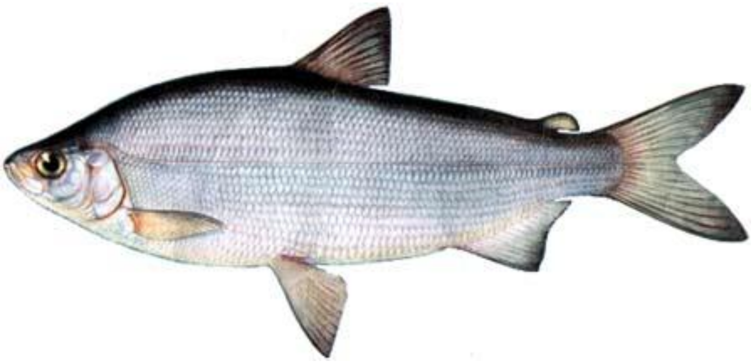
Rotan is a predator. Initially, young fish feed on zooplankton, then small invertebrates, benthos. Rotan adults eat caviar and fish fry, leeches, newts, amphibian larvae (tadpoles). Among Rotan have widespread cannibalism - eating of smaller individuals of their own species. In a small reservoir, it becomes a popular and able to decimate other species of fish. In large reservoirs, the number of Rotan is regulated by other carnivorous fish: Pike, catfish and perch.

Thus, the 20-year-old observations of the Rotan resettlement in the Baikal Basin indicate that it has mastered all of the ponds, the characteristics of which are identical to those in its natural range. If at the first phase of the Rotan expansion in primary vector of BPW, his resettlement was directed downstream of the Selenga River and later in the zone of Lake Baikal to the South and North of the Selenga Delta, currently it is registered the Rotan resettlement up tributaries of the first, second and third orders. In some lakes and streams its value range from 40 to 96 per cent of the total number of fish. Rotan uptake of highly mineralized Lakes shows how its high adaptation ability and genetic programming

1.2. Fishes, whose invasion has not been ended normally by their naturalization occupancy or it is questionable

This group includes those invasion species that are well acclimatized, well developed, but did not find the conditions for natural reproduction in natural conditions. Usually, in catches such species are met from among imported species or grown from larvae collected in artificial reproduction in local hatcheries.

Peled (*Coregonus peled*, Gmelin, 1789)



It reaches in length 40-50 cm, weight 1.5-2 kg. Individuals in the first years after the invasion reached 5 kg. It is mainly the Lake fish, migrates into the water layers following the accumulation of zooplankton organisms. Spawns in streams and lakes.

First, the Peled caviar was imported in the Shchuchye Lake of the Gusino-Ubukunskoj system in 1968, during 1968-1971, in the Shchuchye Lake was released 12.2 million of larvae and 0.23 million of juvenile fish. However, the industrial return on these measures was null and in 1973, it has been received only 0.8 million of spawns from ripe females.

Unplanned Peled releases from the Bolsherechensky Peled fish plant occurred in Lakes of Baikal and Goosinoe. Industrial catches of Peled were registered in the Posolsky Sor in the early of 80-ies, while in catches from the Goosinoe Lake in official statistics Peled was incorporated as omul. It is obvious that all registrations of the Peled catches in the Baikal Lake and its water basin are a consequence of authorized and unauthorized editions of the larvae of the Bolsherechensky plant. Probably, the Peled naturalization in Lake ecosystems of the Baikal and its water basin has not yet to occur.

Mikidza or rainbow trout (*Parasalmo mykiss* Walbaum, 1792)

North America is the native to this species. This species has a very high variability, forming many forms and subspecies, which differ in their biology. Ichthyologists has no agreement on the systematic status, number of forms and subspecies of this species.

In 1992, it were registered the reliably few incidents of catching of two years old rainbow trout's in two different districts of the Irkutsk water reservoir (Shyrobokov, 1993) which young fish might be in its water from the pond of the Barduguzsky forestry and from private fish farms for commercial cultivation of trout. The trout ROE was incubated on the Burduguzsky fish-breeding plant in 1991 (300 thousand roes) and in 1992 (1 million roes). In the following years there were also cases of the trout catch in different districts of the Irkutsk reservoir: the Groznuha Bay, the Uladev Gulf, the Kalay Gulf (Demin, 2001; Sideleva, Telpukhovskij, 2004). These facts may indicate the beginning of the process of naturalization of trout in the Irkutsk reservoir. However, cases of this type of fishing in the waters of the Baikal Lake were not fixed that indirectly can indicate a lack of this invader in the Baikal Lake in the near future.

European whitefish (*Coregonus albula*, Linnaeus, 1758).

For the first time the larvae of vendace (ripus, kilca) from the Ladozhsky Lake after i incubation at the Bolsherechensky fish-breeding plant were imported to the Arakhlei Lake in 1955, then (1956-1957) 3.3 million of the vendace larvae were released in two Lakes: Shchuchye and Okunevoe (of the Gusino-Ubukunsky group). During the flood in August 1971 and 1973, whitefish slid into the Selenga River via a temporary flow in the Ubukun River. In addition, in 1960, 500 thousand of vendace from the Bolsherechensky larvae fish factory "mistakenly" were released in a large River and further to Lake Baikal. It is possible that, along with the pelade, there were the other mistaken releases of vendace. In the following years, the number of instances were in catches of the vendace of the Posolsky Sor and surrounding areas of the South of Lake Baikal. It is clear that naturalization in Baikal vendace has not happened and incorporate it in the number of naturalized species prematurely. At least for the last 20 years are not known reliable cases falling of ripus into the hands of Ichthyologists.

Eats a zooplankton, larvae of insects, small fish. The main food of the vendace mainly consists of small crustaceans (Daphnia, Cyclops, etc), for which vendace often hunts in packs on the shallow depth. Most large forms (like a ripus and kil'ca) are fed not only plankton, but eat the mysids and FRY. European whitefish lives in lakes, although there are Lake-River forms. Typical entrance form is missing. Large whitefish lives in high and cold Lakes, often at a depth of 15 m and below. Prefers clean sand or mud bottom, kept mainly in Lakes on depth, avoiding very hot water.

Spawning occurs in autumn months. Spawning grounds are located on the sand, Sandy-pebbly and rocky areas at depths of 3-20 m. Caviar is small, bottom-dwelling about 1 mm in diameter, light yellow color, progressing from autumn to spring. The larvae are usually appear in the spring, before the ice melting. In the early days Larvae have mixed feeding, two weeks later moving to external supply small grazing and crustaceous.

The area of European vendace covers swimming pools of the Northern, Baltic and the Barents and White seas. In Russia the vendace is especially numerous in the Lakes of Karelia and the Kola peninsula. In recent years, belozersk whitefish descends along the Volga River and meets at the Saratov reservoir. Ripus successfully introduced in many water bodies in the European part of Russia.

1.3 Fish, whose appearance in the Russian part of Lake Baikal basin is predictable

Altai Osman *(Oreoleuciscus* cf. *humilis).* The plant-eating form avoid sites with fast flowing and mostly feed on algae harovymi. Reaches sexual maturity at the age of 7-8 years. Piscivorous form eats like a fish (the Osmans, plenty of Loaches) and vegetation. Matures aged at 8-9 years. The plant-eating form reaches length of 40 cm, weight -1.3 kg and 34 years of age, piscivorous form has length of 100 cm and over 40 years of age, the average adult weight-from 2 up to 4 kg.

Sustained numerous population of the Altai Osman (O*reoleuciscus* cf. *humilis*) have been found on the territory of Mongolia in floodplain waters of middle streams of the Selenga river (Dgebuadze, 2004), and in its major tributaries: the rivers Orhon and Tola (Erdenebat, 2006). Feature of a hydrographic network of Mongolia and adjacent areas of Russia is that it becomes possible to exchange by Ichthyofauna components when border areas, sectors are defined by their physical and geographical rather than environmental factors. In particular, bogging the watersheds of rivers could allow Altai Osman to spread from the Central Asian landlocked basin to the basin of the Ob River, and then in the headstream of the Selenga river.

Naturalized populations of Altai Osman were discovered in 1999 and 2002 in small rivers and lakes in the middle reaches of the Selenga River. It is likely that under certain climatic situations is possible the contact between the headwaters of the Selenga River and water reservoirs of the Central Asian landlocked basin. However, now the Altaic Osmans are not found in the Russian part of the bed of the Selenga River. The Dwarf Altai Osman has penetrated through the Selenga River to small lakes with relatively rich fish population and founded there the two morph types, the population of which is intensively growing.

The cited data and rapid change in the environment as a result of natural and anthropogenic factors show that it can be expected the increased role of the Selenga as invasive corridor. The Organization of the special monitoring is required due to the invasive process in the Basin of the Selenga river which provides quick identification of invasive species, their numbers and impact on native species and ecosystems.

PARASITES – THE COMPANIONS OF ALIEN FISH SPECIES IN THE BASIN OF LAKE BAIKAL

The immediate consequence of acclimatization and introduction works in the Baikal Lake basin is the import of the specific parasites including pathogenic for installed and local fish species. A particularly negative epizootological effect are repeated editions of invasive species. It is known that when the first release of acclimatization species as a result of its low density in the reservoir is the depletion of the parazito fauny of invasive species. In cases of repeated releases of the same species of fish, there are saved specific types of parasites. So, multiple releases of carp from the Khabarovsk region to the Goosinoe Lake have led to the enrichment of this parazitofauny. By results of researches N.M. Pronina (1974), common carp in the Goosinoe Lake and the Selenga Delta after 1961, has purchased the 6 species of peculiar parasites.

When acclimating fish, initially is observed the impoverishment of species loss of the parazitofauny with complex development cycle. However, the repeated fish releases, as a rule, it is observed the general enrich of their parazitofauny by parasites of the local fauna. The Amur catfish, acclimatization of which occurred as a result of repeated importation of producers, according to the authors (Cherepanov, 1962; Zaika, 1965), has 8 species of specific Amur parasites. These are monogenetic flukes and tape worm (*Gangesia parasiluri*).

The parasitology's analysis of invasive species carried out by some authors (Cherepanov, 1962; Voznesenskaya, 1971; Pronin, et al., 1998; Litvinov, 1993) demonstrated the introduction with acclimation of species in the water of the Lake basin of 21 species of parasites.

The most negative effect for fish of the local fauna has the importation of Pygmy (*L. Elegans stenopharyngodontis)* that is dangerous not only for the carps, for which it is specific parasite and often causes the epizootic of carps. Fish was infected with the extensity of 100% and there was observed there death.

In addition to the above parasites of fishes from native acclimatized fishes of Baikal, it was noted a number of parasitic organisms that probably also brought together with invasive. These are related to the flagellate (Tripanosoma amurensis) as well as a number of species such as mixobacillus registered in recent years. The natural habitat of these species is not clear and requires further analysis.

Comparison of the omul parasite fauna in the Goosinoe Lake and the Khoubsugul Lake shows that even with a large diversity of Ichthyofauna, infestations of kinds has the casual character. At the same time, the emergence of a new species of fish could create the conditions for installation in a reservoir of new parasites *(D. dentriticum).*

DISTRIBUTION AND BIOMASS OF THE CANADIAN POND WEED (ELODEA CANADENSIS MICHAUX IN THE BASIN OF THE BAIKAL LAKE)

Among the aquatic invasive species in the Baikal basin as the "leaders" is firmly stands the aquatic plant Elodea canadensis Michaux, 1791 (Hydrocharitaceae), Fig. 2.

Figure 2. Botanical illustration from a book by C. A. M. Lindman «Bilder ur Nordens Flora», 1917—1926

There are large amounts of Elodea Canadensis that fills water basins and violates their economic use, preventing fishing and navigation. At the same time the Green mass of plants can be successfully used for economic purposes (for fertilizer, animal feed, etc.).

Analysis of literary information shows that at the Baikal Siberia Elodea canadensis has appeared for the first time in the 60-ies of XX century.

Probably Elodea canadensis has infiltrated to the Baikal Lake from the Irkutsko-Angarsk source area. It was first registed in the summer of 1980, the opposite the entry of the Selenga Delta (Figure 3).

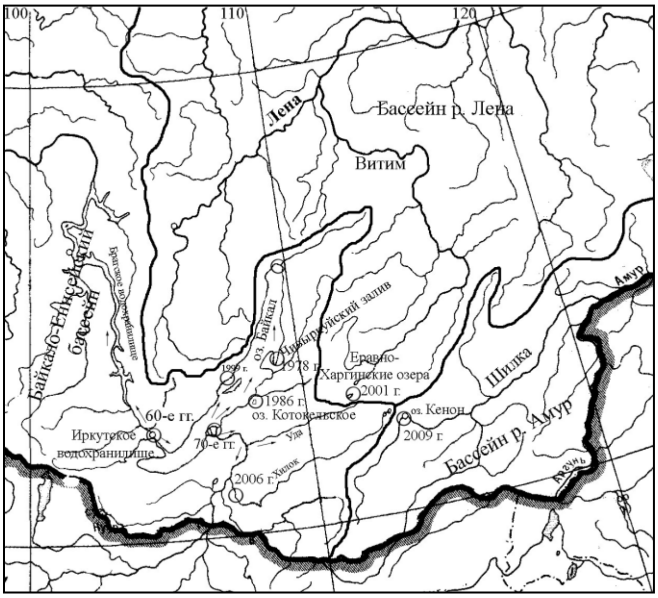


Figure 3. General scheme of the Elodea settling at the Lake Baikal basin and adjacent territories

The main mechanisms of resettlement of foreign species of elodea canadensis in waters of Eurasia were unintentional deliveries (mostly by aquarian) and its self-spreading. Thus, the Angara-Baikal-Selenge Basin became a transboundary invasive strategy corridor. Along this corridor Elodea canadensis widely settled in the basin of the Yenisey river (downstream along the Hangar river), and it became a contributor for its invasion in the Baikal Lake and its Basin.

The spatial distribution in the coastal zone of the Ba*i*kal Lake, as well as in ponds and streams of the Baikal Siberia is determined by a number of environmental factors: temperature conditions, soft silt, chemical composition of the waters, the transparency, the lack of wave-cut mixing.

INVASIVE SPECIES IN TERRESTRIAL ECOSYSTEMS OF LAKE BAIKAL

Dodder (*Cuscuta* sp.) annuals aphyllous parasitic plants which have no roots or leaves, are threaded or have heavily branching stems, being related to the Cuscutaceae family. In the world there are 274 species of flora of the povilik, widespread in all countries of the world. In the basin of Lake Baikal will adversely affect native and cultivated plants that have two kinds of povilik: field dodder (Cuscuta campestris Yunck.) (Fig. 4) and Chinese Dodder (Cuscuta chinensis Lam).

Figure 4. Field dodder (*Cuscuta campestris* Yunck.)

Dodder is not able to adsorb water and nutrients from the soil and synthesize nutrients on light, they live off the host plant. Stems of Dodder envelop the plant, attach themselves to it by special appendages-microscopically. Dodder parasitize mainly on herbaceous plants of the bilobate class. A whole group of so-called thick halm povilik which are adopted to parasitize in trees and bushes. Dodder are not highly specialized parasites, but each species has its own specific infected plants. Some povilik, such as a field, these plants include more than 200 species, others (Cuscuta linen) are parasitic on a small number of species.

Dodder multiply by seeds. Seeds are spread by the wind, with melt water with harvests of agricultural crops. Seed germination rate depends on temperature and soil moisture, as well as the degree of maturity of the seed. Semi-adult and green seeds germinate faster than ripened. The latter do not lose their germination percentage after a long stay in the soil (8-10 years), after passing through the digestive tract of animals. During germination of the seed embryo is straightened, is fixed in the soil through root hairs and the other end of the embryo, is more subtle, comes to the surface of the soil and slowly wrapped around in search of a host plant. In contact with him sprout loses touch with the soil and moves to a parasitic lifestyle (Nikitin, 1983; Moskalenko, 2001).

Dodders not only will reduce the harvest but deteriorate the quality of the products.

Dodders by damaging epithelial tissue of plants, contributed to the defeat of plant pests and diseases. Moreover, they themselves represent very many plant viruses. The dodders contains alkaloids, which obviously are the cause of poisoning of animals with eating of the dodder containing hay.

Dodders are introduced to plant quarantine list, which are limitedly distributed on the territory of the Russian Federation (the list..., 2003), it is banned the import of seed of dodders with seed of crops. To prevent infection and reduce dodders land contamination are carried out prevention interventions and are used agricultural and chemical control measures. Combating with dodders should be carried out before the beginning of flowering. A thorough cleaning of the main crop seeds from dodder seed, destruction of dodders on roadsides, vacant lots, in headlands of village throughout the growing period. In areas severely affected by dodder, it should be 3-4 years to plant such crops which are not growing or weakly poisoned by dodders – cereals, sunflower, hemp, pumpkin and other, as well as crop rotation with clean pairs. To combat the thin stables of povilik also used different herbicides.

Cannabis sativa and wild (Cannabis sativa L., C. ruderalis) Family: Cannabaceae Endl.; genus: Cannabis L.

The annual grassy plant. The stem is erect, 50-180 cm height, covered with appressed hairs. Blossoms in June-July, matures in July-August.

Abundant of wild cannabis are found in Northern Mongolia until the border with Russia. Common along roadside ravines, on zimnikah and livestock barns, on deposits and severely degraded ecotope (Gunin et al, 2002; 2003).

Resinous substance which is recaptured by flowers contains a substance similar to nicotine which is the base of the hashish substance (marijuana).

In Mongolian folk medicine stems are used to treat skin conditions in dental and gastric inflorescence pains, scabies. Plants are poisonous to horses and pigs.

Harmala ordinary (*Peganum harmala*) - longstanding herbaceous plant; habit race of Harmala of zygophyllaceous family (*Zygophyllaceae*).

The plant is also known under the title of *Eastern Imperial Eagle, steppe, Syrian Rue, Ruta bibik, a dog's potion*. It contains significant amounts of alkaloids. Qualitative composition of alkaloids depends heavily on plants growing location. It was found that eating in large quantities of plants and fruits of harmala alkaloids cause poisoning of small livestock and cause miscarriages of sheep and goat females

EVALUATION OF POTENTIAL RISK OF ADVENTIVE PLANTS FOR LANDSCAPES

The most significant way of importing of adventive plants in new regions is anthropogenic. It includes the transportation of contaminated with vegetative production and purposeful introduction of new plant species.

The main stages of adventive plant immigration on the new landscape territories are: skid, settlement in secondary habitats, acclimatization and naturalization. Acclimatization and resettlement processes of plants in the new area are influenced by complex habitats: climatic, phytocoenotic.

The behavior of the adventive habitat at new place is primarily determined by environmental conditions. If they do not meet the requirements, the plant will not be able to complete a full cycle of development and form seeds.

The chance of acclimatization will be high when the similarity of climatic conditions in actual and projected ranges of weeds.

The basic principle of forecasting of the potential environmental range of the adventive undesirable plant should be a systematic approach. It is based on an analysis of data on spreading of species, having similar agro climatic zones in the existing and projected potential range and data for specific climatic requirements. Potential Habitat boundary will be determined on the basis of the principle of limiting factors. The gist of it is that any of the factors, the magnitude of which is beyond the capabilities of type, defines the border range of this species.

Most adventive plant species are having the high seed productivity. The more seeds fell on the area, the more successful its spreading. Breeding strategy is very important from the point of view of competitiveness of adventive plants. Species, combining the vegetative and seed breeding technique, more competitive (Considine, 1986).

Thus, it is evident that potentially hazardous plants shall be characterized by the combination of certain biological indicators.

Expert assessment of each of the adventive species, the probability of skidding which exists as a combination of these properties will conclude its competitiveness and potential opportunities for resettlement in the new territory. Adventive types of weeds that will have high and average levels of the capacity of competitiveness and the potential of harmfulness and the cumulative area potential of which will cover the main areas of cultivation of agricultural crops in Russia and are potentially dangerous (Moskalenko, 2002).

CONSEQUENCES OF BIOLOGICAL INVASIONS IN THE ECOSYSTEM OF LAKE BAIKAL

An objective forecast of positive and negative effects of introduction acclimatizing works in the basin of Lake Baikal climb so far give very difficult. Required comprehensive studies of the dynamics and ecology of invasive species, an integrated environmental-economic assessment and surveys of evolutionary consequences. But even now, two factors are obvious: no lasting positive fisheries effect on the one hand and the presence of biological pollution of Baikal basin on the other. The last most probably not critical for small lakes, but is extremely important for these unique ecosystems, such as Lake Baikal. Thus if pollution from industrial effluents in any case limited in time in connection with the improvement of technology to non-waste, biological pollution of large bodies of water is practically unlimited in time.

Basic provisions on the prevention of biological pollution of Baikal is reflected in the recently adopted Federal Law "On protection of the Baikal Lake ". The spreading of all kinds of exotic invasive species in the Baikal Lake in our view is limited by the coastal area of Lake, basically isobathic line 10 m and the removal of alien species has random character. The spreading boundary is also caused by the ecological valence of invasive species to certain factors (temperature, Elodea and Chinese sleeper, soil - rhothane, rheophil – Amur CARP).

Penetration of Palearctic species of parasitic organisms in deep-water Baikal zone occurs at the expense of development of the Baikal endemic as intermediate, advanced and definitive hosts. Thus, it proceeds the process of co-evolution by complicating of their life cycles.

Undoubtedly, ecosystems in the face of abiotic and biotic factors are resisting to biological invasive. As a rule, in new areas are naturalized not more than 10% of the total number of imported species. However, the more destabilized ecosystem as a result of the impact of pilot ("shock") alien species, then the faster proceeds the naturalization of subsequent invasive species (Mills et al., 1999; Pronin, mills, 2001). There is a kind of "chain reaction" and the number of exotic invasive species increases exponentially. It is obvious that the expansion of invasive species in freshwater ecosystems poses a threat to the biological diversity of biota.

As a result of acclimatization introduction works with multiple import and releases of the 13 species and subspecies of fish (sprat, salmon, ripus, Peled, whitefish, carp, bream, Amur carp, Amur catfish) in Lake Baikal, the naturalization occurred of three kinds of deliberate invasive species: Amur, Amur carp and catfish Eastern bream that partially occupy ecological niches of native species, displacing them. So, Amur carp displace IDE, Amur catfish – burbot, and bream - Roach. In the Lake they are distributed mainly in the coastal zone.

Among all alien species, it was occur the most successful (and dangerous for indigenous species) naturalization and the Baykal Lake has the random (unintentional) invasive species: Rotana-brands and Canadian Pond weed, who have reached the highest number among all the invasive species and obviously have the greatest negative impacts on biodiversity of ecosystems.

The Baikal anthropogenic hearth resettlement of two random and undesirable invasive species (Rotane and pond weed) became one of the East resettlement centers in waters of south of Eastern Siberia, and in the Angara-Baikal-Selenge Basin – a major trans-border corridor of bio-invasive hydro-bionts. Perccottus glenii-char, then the Amur carp and Amur catfish has already entered the Mongolian part of the Selenga River basin. Thus, the major role in spreading and other destinations of Rotan fish – against the stream of the Selenga River and its ducts and in the above flood-plain isolated Lakes.

The main negative consequence of the Rotan spreading consists in the direct impact of this caviar – eating of fish roe and juvenile fishes of native species of fish and impact through food competition and eating of food base. Estimates of damage fisheries in the basin of Lake Baikal that were made by A.V. Litvinov (Litvinov, 1993), were estimated at 220-500 tons of fish products annually. In parts and isolated lakes of the Delta and floodplain of the Selenga River, Rotane, after eating of the native fish, starts to food with its own fish's of young ages, resulting in changes of the age structure of its population - may lack some of the age groups.

It should be noted that the high number of Rotan in reservoirs of the Selenga Delta increases the number of Pikes, which due to its artificial breeding further can become a real regulator of these alien species (Fishes ..., 2007). In addition, Rotan plays an important role in feeding of herring gull, increasing its number and some researchers also attributed it with the Rotan increase.

Settling of the Canadian Pond weed from the Irkutsk reservoir was going through: downstream of the Angarsk reservoirs- spontaneously; on the coastal zone of Lake Baikal – by humans help (coastwise -tourist and fishing vessels); against the flow in the basin of the Selenga and Khilok Rivers – by fishing gear and small scale ships.

As the first negative effects of the overgrowing of the reservoir by Elodea is called obstruction of fisheries (especially subglacial - non-aqueous), up to the complete exclusion of the "clogging" gear. The second implication is the obstacle to navigation, especially of small size fleet. Dense thickets of pond weed are excluded from feeding fish, except for juvenile fish, which in turn is taken in large quantities along with a large amount of biomass in seine nets and perishes. As a result of Elodea overgrowing, changing species composition, structure, abundance and biomass of benthic and light-demanding invertebrate in association of aquatic vegetation (Matafonov et al., 2008). In addition, the feed organisms, even with high numbers are not available for predators due to dense thickets. However, Elodea, replacing Macrophytes certainly plays a certain role in the creation of primary production, brightening water as the substrate for the deposition of seston and as storage of toxic substances, in particular heavy metals.

The Elodea settling was the largest negative consequence on the ecosystem of the Kotokel Lake. Mass development of the invader (up to 92 t/ha of fresh weight in 1992), subsequent and prolonged frozen and then depression of zoobenthos as forage fish led to a catastrophic decrease in the fish capacity of Lake for decades (Fish., 2007).

Expansion of the new range of Canadian Pond weed and its mass development in selected water bodies takes place against the background of declining water levels in the reservoirs in the region that contributes to an optimal temperature and other parameters of ecological niches for heat-loving invader. In 2005-20006. marked by a high level of biological productivity pond weed (up to 8 kg/m^2) in some areas of the Chevyrkujsky Bay and the Karasinoe lake in 2007.

The recent registration of the Altai Osman in the reservoirs of the Selenga River in Mongolia (Dgebuadze and et. al., 2003) may serve as a signal for its expansion to the Russian part of the basin of the Selenga River.

The deliberate (mostly Amur catfish and Amur CARP) and unintentional invasive species in the Baikal Lake were delivered more than 20 alien species of parasites, some of which may cause or has caused epizootics in populations of native fish species. In addition, there are the number of local fish species of parasitic organisms with the unknown (or predominantly Amuro-Chinese) natural habitat which probably also introduced with alien fish.

For the real protection from biological contamination are needed the development, adoption and implementation of regional rules and departmental (industry) regulations including activities on obtaining of biological resources, fish farming, zoo-and phyto-sanitary controls.

It is needed a speedy elaboration and adoption of a legislative act to prevent biological contamination in Mongolia as well as inter-State agreements. The main direction in the prevention of biological pollution, inhibition of the further expansion of alien species, regulating the size and reduce the negative effects of bio-invasion is in ecological education at all stages of education and training. To do this, it is necessary to develop the Program and an Action Plan to test it on the "experienced" sites and begin implementation around the Basin of Lake Baikal.

REFERENCES

1. An annotated catalogue of the round mouth and continental waters fish Russia/Ed. Reshetnikov Y. S./M.: Nauka. 1998.220p.
2. The Atlas of freshwater fish. /Ed. Y.S. Reshetnikov. 2002. Moscow: Nauka. In 2 volumes. 379 p. + 253 il.
3. Bazarova B.B., Pronin N.M. Spatial distribution of *Elodea canadensis* Michx. (Hygrocharitae) Elodea canadensis Michx. (Hygrocharitae) in Chivyrkuiskiy Gulf of Baikal//Biology of inland waters. 2007.-No. 2. -P. 50-54.
4. Berg L.S. 1949. Freshwater fish of the USSR and adjacent countries. M; L.: Az-vo AN SSSR. v. 2. P. 469-925.
5. Gunin P. D., Badha S.N., Miklayeva I.M. Ecological characteristics of the modern settlement of hemp seed (Cannabis sativa l.) in Transbaikalia//Materials of the MC RGO. Biogeography. 2002. vol. 10. Pp. 26-33.
6. Gunin P. D., , Miklayeva I.M., Badha S.N., Ruckova E.A. Ecological characteristics of alkaloid plants with a narcotic effects on example of hemp // Materials of the Russian-American Symposium "Invasion of alien species in Golarktike". Borok. 2003. Pp. 64-75.
7. Dgebuadze Yu. Yu., Dulmaa A., Munhbayar C. About finding of the kind representative of *Oreoleuciscus* (Cyprinidae) family in the Selenga//Questions of Ichthyology. v. 43. No. 3. 2003. p. 420-422.
8. Demin A.I. Introduction of new species of flora and fauna of the Baikal Lake Basin: implications and lessons. 2001. Izd-vo Volna. P. 10-21.

9. Zaika V.E. 1965. The parasite fish fauna of the Baikal Lake. Moscow: Nauka. 106 p.

10. Kozhova O.M., Timopheeva S.S. The role of Canadian Pond weed in the ecosystem of Lake Baikal//Water resources. 1986. N 1. P. 177-178.

11. Litvinov A.G. 1993. Ecology of the Rotana-brands (*Perccotus giehni* Deb.) in the basin of the Baikal Lake. and its impact on commercial fish/Dissertation. -St. Petersburg. 25 p.

12. Matafonov D.V., Itigilova M.C., Kamaltynov P.M. Features of expansion of *Gmdinoides fasciatus* (Stebbing, 1899) reservoirs of East Transbaikalia (on the example of Lake Arakhlei)//The Siberian environmental magazine, 2006, v. 13, No. 5. -P. 595-601.

13. Misharin K. I. 1949. Rights and reproduction of fish in Baikal. Irkutsk. Irkutsk oblast knizhnoe izd-vo,

14. Moskalenko G.P. 2001. Quarantine weeds of Russia. 2001.278 p.

15. Moskalenko G.P. Estimation of damage potential of plants for landscape//Environmental security and invasion of alien species. Proceedings of the round table conference on environmental safety of Russia (4-5 June 2002). Moscow: IPEE named after A.N. Severtsev, IUCN (IUCN), 2002. P. 94-104.

16. Neronov Yu.V., Pronin N.M., Sokolov A.V. 2002. The fish and fisheries of Buryatia. U-Ude. Izd-vo BNC SO RAN. the 1-st Edition. P. 34.

17. Nikitin V.V. Weed plants of the USSR. L.: Nauka. 1983.452.

18. Nicholsky G. V.1956. Fish basin of the Amur. M.: Izd-vo AN USSR. 551 p.

19. List of pests, plant pathogens, weeds that have quarantine significance to the Russian Federation. MSC, 2003.

20. Pronin, N.M., Mills E.L., 2001. Alien species and biological pollution of Lake Baikal and the Great Lakes region: comparative aspects and levels//XII Congress of hydro-biological society RAN (London, 16-23 Sep 2001): proceedings of the Rep. -Kaliningrad, 2001. -V. 1. -P. 26-30.

21. Pronin N. M. 1974. Acclimatization of fish in the Baikal Lake and parasitic factor //Proceedings of the management of meeting activities aimed at accelerating the recovery of fish stocks in the Baikal Lake. – Ulan-Ude, 1974. - P. 111-118.

22. Pronin, N.M., Selgebi D.H., Litvinov A.G. Pronina C.V. 1998. Comparative ecology of fauna of exotic invasive species in the Great Lakes of the world: Rotana-brands (*Perccottus glehni*) in Lake Baikal and Ruffe (*Gymnocephalus cernuus*) in Lake Verhnee//Siberian Ecological Journal. Vol. 5, No. 5. P. 397-406.

23. Pronin, N.M. 1982. On the environmental impact of acclimatization works in the Basin of Lake Baikal//Biological resources and their protection of the Baikal region. -Ulan-Ude, 1982. -P. 3-18.

24. Fish of the Baikal Lake and its basin/Pronin N.M, Matveev A.N., Samusenok V.P., etc. - Ulan-Ude: Publishing House of the BNC SO RAN, 2007. -264 s.

25. Sideleva V.G., Telpukhovskij A.N. 2004. Invasive species of fish in the Lake Baikal and Baikal region. /Biol. invasions in aquatic and terrestrial ecosystems. M.: Izd-vo KVM. P. 171-186.

26. Cherepanov V.V. 1962. The parasite Fauna of amkrskih fish, acclimatized in the basin of Lake

Baikal. //Zool. Magazine. V. 41. Iss. 10. p. 121-124.

27. Erdenebat M. Fish population of the Mongolian part of the Selenga River basin under global climate change and human impacts. Dissertation … Cand. Of Biol. Sciences. Moscow: IPEE RAN, 2006. 22 c.

28. Choi Ki-Chul, Leon Sang-Rin, Kim Ik-Soo, Son Yeong-Mok. Coloured illustrations of Freshwater Fishes of Korea. 1990. 277 p.

29. Considine M.L. Finding a pattern to plant invasions // Ecos., 1986, 46, p.30-31.

30. Dgebuadze Yu.Yu. The Selenga river as invasion pathway for alien species // In: Sciense for Watershed Conservation: Multidisciplinary approaches for Natural Resource Management. Intern. conf. abstrs. Ulan-Ude (Russia)-Ulan-Bator (Mongolia), Sept. 1–8, 2004 Vol. 1. 2004. P. 13–14.

31. Scott W.B., Crossman E.J. 1973. Freshwater fishes of Canada //Bull. Fish. Res. Board Canada. N.184. P.1-966.