Lake Baikal

2025 Conservation Outlook Assessment

SITE INFORMATION

Country: Russian Federation
Inscribed in: 1996
Criteria: (vii) (viii) (ix) (x)

Situated in south-east Siberia, the 3.15-million-ha Lake Baikal is the oldest (25 million years) and deepest (1,700 m) lake in the world. It contains 20% of the world's total unfrozen freshwater reserve. Known as the 'Galapagos of Russia', its age and isolation have produced one of the world's richest and most unusual freshwater faunas, which is of exceptional value to evolutionary science. © UNESCO

SUMMARY

2025 Conservation Outlook

Finalised on 11 Oct 2025

SIGNIFICANT CONCERN

The conservation outlook of Lake Baikal is of concern because of ongoing pollution, as well as new emerging threats, such as large-scale tourism development, poor sewage treatment causing nearshore eutrophication, and climate change. The potential of hydroelectric developments in Mongolia, as well as the current dangerous and harmful practices in water level regulation are also of high concern. The decision to close the Baikalsk Paper and Pulp Mill has been a positive step, but its implementation and mitigation of past negative impacts will require time and significant efforts as well as the remediation of all by-products still stored in the complexes. At the same time, the legal regime of protection and management system of the property remain not fully adequate. The site’s values are still well preserved and largely intact; however, high concerns have emerged in the recent years regarding rapid ecological changes in the coastal zone but not only. The long-term conservation of the property will depend on many factors, including the overall improvement of management effectiveness, improvement of the monitoring system, as well as measures undertaken to address the new emerging threats, particularly nearshore eutrophication and plastic pollution. Of particular concern is the possible further significant weakening of the existing regulatory framework through the recently proposed introduction of amendments to existing laws and regulations (eg. Baikal law and Law on environment, reservoir management rules), which would facilitate development projects, weakening requirements for undertaking environmental impact assessments and logging, and provide for higher possible levels of pollutants discharge to the Lake.

FULL ASSESSMENT

Description of values

Values

World Heritage values

Oldest, deepest and largest (by volume) freshwater ecosystem in the World **Criterion:(vii)**

The Baikal lake and its mountainous surroundings jointly form stunningly beautiful landscapes at an exceptionally large scale. Lake Baikal's transparent water permit views of up to 40 meters below surface, adding to the extraordinary visual experience; scientists attribute it to an exceptional combination of highly active zooplankton, low mineral content, still relatively low levels of contamination and natural processes purifying the lake. The Baikal Lake ecosystem has existed for more than 20 million years. According to V.D. Mats (2010-2011), the geological history of Baikal is subdivided into 3 stages: Archaeo-Baikal (70 – 30-27 mln years), Pre-Baikal (ca 30-27 – 3.5 mln years) and Lake Baikal (3.5 mln years – present). In addition to being the oldest lake, it is also the deepest lake in the world (1,638 m deep) and contains 23,600 km3 of freshwater (ca. 20% of the global unfrozen freshwater reserves) (Kozhov, 1963; UNEP-WCMC, 2011; World Heritage Committee, 1996). It is a globally unique ecosystem with at least 2,640 species of animals (ca. 56% endemic) and 1,000 species of plants (ca. 15% endemic) (Timoshkin, 2001; 2010-2011). Lake Baikal has unique features (e.g. freshwater endemic sponge forests and specialized cryophilic, interstitial and freshwater hydrothermal vent communities), food-webs and system properties (including an exceptional self-purification capacity, high oxygen concentration throughout the water column and exceptionally low particulate matter concentrations) have evolved here. Being the largest by volume, deepest, and oldest lake in the world, the lake itself is a superlative natural phenomenon (UNESCO/IUCN, 2024).

Freshwater invertebrate fauna **Criterion:(x)**

The freshwater invertebrate fauna of Lake Baikal counts ca. 2,640 species, ca. 56% of which are endemic and highly adapted to this cold, deep and oxygen rich freshwater ecosystem. Invertebrate groups with ciliophorans, sponges, flat- and round worms, rotifers, oligochaetes, leeches, polychaetes, snails, amphipods, copepods, and caddisflies (Timoshkin, 2001; 2010-2011; UNEP-WCMC, 2011, UNESCO/IUCN, 2024).

Freshwater vertebrate fauna **Criterion:(x)**

Lake Baikal is among the most biodiverse lakes in the world, with many endemic freshwater species, including the Baikal Seal (Pusa sibirica) and several large fish species such as the Baikal Omul (Coregonus autumnalis migratorius), an endemic sturgeon species (A. baeri baicalensis) and two species of Baikal Oilfish (Comephorus spp.) with completely pelagic life style and endemic deep-water Abyssocottidae sculpins with completely reduced lateral line channel system. A highly iconic vertebrate species of the lake is the endemic Baikal Seal (Pusa sibirica).
61 species of fish, 39 of which are endemic have been recorded in the lake to date (Sideleva, 2003). The most diversified and unique is the Cottoid fish fauna, which includes 33 species and subspecies (45% of the world fauna of freshwater sculpins) (Hunt, DM et al., 1997).

Aquatic flora **Criterion:(x)**

As concluded in the last outlook assessment, the Baikal lake hosts in the order of 1,000 species of aquatic plants, 15% of them endemic to the lake, as well as 560 species of algae, a third of them also endemic (UNEP-WCMC, 2011). Green macrophytes of Draparnaldioides genus, Cladophoraceae and benthonic diatoms are the most diversified and endemic rich groups among floristic biodiversity

(Izhboldina, 2007; Pomazkina Rodionova and, 2014; Boedeker et al., 2016).

The mountains, rivers, forests and steppes surrounding Lake Baikal are an integral part of the catchment area, and provide large habitats for boreal flora and the Selenga Delta is a unique type of wetland that supports as well diverse lakeshore habitats and numerous threatened and endemic flora species (UNESCO/IUCN, 2024).

▶ Geological features

Criterion:(viii)

The Baikal lake is a rift lake, i.e. of tectonic origin, situated in the centre of the still tectonically and seismically active Baikal Rift Zone, creating the deepest lake in the world. The formation of the geological structures in the Baikal rift zone took place during the Palaeozoic, Mesozoic and Cenozoic eras and there are a number of significant geological features (World Heritage Committee, 1996). Continental scale active rift valley system that has been existing since the Mesozoic. There are a wide range of specific geological features associated with this system, including extinct volcanoes, relict landslide circuses, abrasion caverns, hot and mineral springs (World Heritage Committee, 2006).
During the long geological history, Baikal has accumulated ca. 7.5 km thick sediment layers on the bottom (Hutchinson et al., 1992). In combination with the great depth (1,620 m), it makes Baikal the deepest continental rift (depression) on the planet. This deep-reaching and ancient lake sediments offer a unique long-term and high-resolution record of climatic, tectonic and environmental changes in the Earth’s history (World Heritage Committee, 1996).

▶ Freshwater, terrestrial and littoral ecosystems

Criterion:(ix)

The evolution of aquatic life that has taken place over this long period has resulted in an exceptionally unique and endemic fauna and flora, as well as diverse and unique ecosystems (Kozhov, 1964; Timoshkin, 1997; World Heritage Committee, 1996).

Lake Baikal is situated at the intersection of three bio-geological areas: east Siberian Taiga to the North and West, trans-Baikal coniferous forests to the East and Altay-Sayan Mountain forest to the South (UNEP-WCMC, 2011).

This and the considerable altitudinal gradients surrounding the lake (445-2,840 masl) support a wide range of different ecosystem types around the lake, with adapted fauna and flora species, including important wetland ecosystems, such as the Selenga Delta, parts of which is listed on the Ramsar list of wetlands of international importance.

Overall, Lake Baikal boasts is one of the richest and most unusual biodiversity in the world. This has enabled the formation of unique biological communities such as the freshwater sponge reefs and shrimp fauna. Majority of the complex ecosystems are of global importance, and are irreplaceable, both for the study of evolutionary processes and biodiversity conservation.

Other important biodiversity values

▶ Terrestrial flora

The number of plant species present in the Baikal natural territory is estimated at 2,500 species, including more than 200 protected species and 35 species on the Red List of the Russian Federation. In the Irkusk region alone, more than 2,300 species have been recorded, including more than 160 species of vascular plants listed in the region's red data book; more than 2,200 species have been recorded in the Republic of Buryatia, including 126 species present in the natural territory of the Baikal and listed in the Republic's red data book. Lastly, 1,700 species of vascular plants have been recorded in the Trans-Baikal region, including nearly 60 in the Baikal region alone (State Party of the Russian Federation, 2024).

▶ Terrestrial fauna

The terrestrial fauna of the Lake Baikal area is less distinctive than its freshwater fauna, but also significant. Both the southern and the northern shore hosts around 70 species of mammals (Lyamkin,

2004), including a number of globally threatened species such as Musk Deer (Moschus moschiferus, assessed as Vulnerable (VU) in the IUCN Red List of Threatened Species (Nyambayar, B., Mix, H. & Tsytsulina, K., 2015), or near threatened like the Altai Weasel (Mustela altaica) (Abramov, A.V., 2016). 6 species of amphibians, six species of reptiles, more than 400 species of birds and about 90 species of mammals have been recorded in the Irkutsk region alone, including a number of species listed in the region's red data book of threatened species (e. g.: 38 species of birds and 2 species of mammals). The Republic of Buryatia is home to 6 species of amphibians, 7 species of reptiles and over 400 species of birds (Russian Federation, 2024).

The avifauna of both the northern and the southern shore of Lake Baikal numbers over 300 species (Popov, 2004) including globally threatened species such as the Critically Endangered (CR) Siberian Crane (Leucogeranus leucogeranus) (Birdlife International, (2018), the three Endangered (EN) Saker Falcon (Falco cherrug) (BirdLife International. 2021), Swan Goose (Anser cygnoides) (BirdLife International, 2023) and Great Bustard (Otis tarda) (BirdLife International, 2023), as well as the vulnerable species, Eastern Imperial Eagle (Aquila heliaca) (BirdLife International, 2019) and as well as the Near Threatened (NT) Asian Dowitcher (Limnodromus semipalmatus) (BirdLife International, 2016).

Assessment information

Threats

Current Threats

Very High Threat

There is clear scientific evidence of negative impacts of a number of factors rapidly progressing in the coastal zone of Lake Baikal. Several of these are the consequence of increasing eutrophication in combination with changes in the annual water balance. The most harmful is the mass extinction of the main natural biofilters of the coastal zone – endemic Lubomirskiidae sponges – at the scale of the entire Lake. Rapid and mass proliferation of non-typical Spirogyra algae (ca. 30-40-50% of the coastal line), replacing the aborigeneous macrophyte species and suppressing the oxyphilic endemic invertebrates; mass development of cyanoprocaryotes (which have proven ability to produce dangerous toxins) in the near shore zone and on the sponges; giant algal wash-ups; significant changes in the structure and quantitative characteristics of the near-the-settlement planktonic communities; unclear situation with Coregonus migratorius, persistent organic pollutants (POP) bioaccumulation in Baikal seal etc., are all examples of negative trends. Lake water level regulation regime set in 2021 has been continuously violated through derogations, which resulted in serious damage to coastal ecosystems and contributed to shallow-water eutrophication through massive erosion. These facts, in combination with increasing coastal taiga fires, absence of the proper bilge water treatment stations and properly functioning sewage treatment stations, rapid increase in tourism infrastructure and visitor numbers represent high threats to the Lake’s ecosystem.

▶ **Residential Areas, Recreation & Tourism Areas**

(Uncontrolled and irresponsible tourism infrastructure development)

High Threat
Inside site, widespread(15-50%)
Outside site

The tourism sector appears to evolve in two distinct ways within the property: through seemingly coordinated large-scale tourism development initiatives implemented as part of the two "Special Economic Zones for Tourism Development" (SEZs) established in the property, and through rapid emergence of mostly small and medium-scale tourism and recreational facilities in municipalities and settlements (159 in total) located within the property (UNESCO/IUCN, 2024).

The tourism flow inside the national park has increased over the past decade, although gathering accurate visitor numbers have proven difficult. According to some estimates 14,234 people visiting the park in 2012 and 178,854 people in 2023 (UNESCO/IUCN, 2024), however information from accommodation for tourists report that in 2016 Lake Baikal was visited by 1.2-1.3 million visitors in 2016 with the most significant increase in 2000-2012 with more recent increases in visitation not significant (IUCN Consultation, 2025). Nevertheless, an increase in the tourist number has led to rapid construction

of private hotels near the shoreline. Uncontrolled and irresponsible tourism development has had a considerable localized impact on parts of the World Heritage site around the lake's southern shore and particularly Maloe Morye (e.g. construction, including illegal, near the lake's shore, operation of large yachts without appropriate infrastructure), and parts of Olchon Island. Rapid (often – illegal) construction of hotels, guest houses and other types of accommodation without any waste water purification systems and with buildings often located less than 100 m above the shoreline are of particular concern in the settlements on the west coast, such as Listvyanka, Bol. Koty, Bol. Goloustnoe (IUCN Consultation, 2017). In total the environmental prosecutors have registered in the Irkutsk Region 50 court decisions on the demolition and dismantling of 319 illegal buildings between 2018-2023 within the property (UNESCO/IUCN, 2023). Of these, 178 building were legalised, 69 demolished, and in the case of 73 objects, final decision is pending. In the Republic of Buryatia, 33 enforcement proceedings for demolition of 160 unauthorized buildings was ongoing in December 2023.

Not less worrying is the development of SEZ, which were created in Baikalsk and Turka (Buryatia) by weakening protection controls to attract investors. In the case of Turka (SEZ Baikalskaya Havan-Baikal Harbor), the project has led to gradual clearing of several square kilometers of natural vegetation on the lakeshore and development of dykes and marinas at the Turka River mouth (without apparent tangible economic effect) (IUCN Consultation, 2020). The Republic of Buryatia is proposing to expand the Baikal Harbor SEZ (3,283 hectares) and to develop a new lakeshore ski resort at Mamai Mountain, to the west of the Baikalsky Nature Reserve. In 2024, the State Party reports that 29 resident companies were operating in the two SEZ, where more than 48 infrastructure facilities have been built or commissioned with government funds (State Party of the Russian Federation, 2024). The Environmental Impact Assessment and Strategic Environmental Assessment of the development plans for the SEZ, which were repeatedly requested by the World Heritage Committee, have not been carried out (UNESCO/IUCN, 2024). In 2020, the Ministry of Economic Development proposes amendments to the Law on Protection of Lake Baikal to ease conversion of forested lands into land for tourism development in order to facilitate expansion of SEZ in other areas (Ministry of Economic Development, 2020). A major initiative to increase cruise tourism in Lake Baikal is also ongoing, including introduction of new passenger vessels and cruise ships, new tourism and harbour infrastructure for example in Bolshoye Goloustnoye in Pribaikalski National Park, as well as a significant number of hovercrafts (UNESCO/IUCN, 2024).

Overall, the absence of an overall strategic approach and a common vision among stakeholders leads to non-integrated, sometimes unauthorised, territorial development. Nevertheless, there seems to be a slow increase in the interest of environmental friendly tourism offers (IUCN Consultation, 2025).

► Water-borne & other effluent Pollution, Garbage & Solid Waste

Very High Threat
Inside site, widespread(15-50%)

(Pollution from various sources)

The development of unprecedented algal blooms and bacterial pollution (e.g. cyanobacteria), the presence in the water of polluting chemical substances used in everyday consumption (e.g. phthalates, phosphates), increasing plastic pollution, and the decline of certain endemic species that are bio-indicators of the lake health (e.g. sponges) are among the signs of degradation of the lake ecosystem (UNESCO/IUCN, 2024).

This degradation is partly due to industrial and domestic discharges and inadequate wastewater treatment that is poorly adapted to certain forms of pollution (e.g. phosphates, heavy metals, complex molecules), the effects of which are probably influenced by those of climate change. The growth in the number of people (and the corresponding pollutant's runoff) occurred simultaneously with a strong reduction in livestock farming on Baikal. The livestock population was significant, and biogenic nitrogen and phosphorus entered the lake in large quantities. Now these substances have been replaced by others, but other factors like changes in the life cycles of algae and plankton and temperature changes may also be important (IUCN Consultation, 2025).

These factors affect the water quality of the property (criterion vii), as well as its outstanding biodiversity (criteria ix and x). A long-term degradation of this water quality would certainly affect the integrity of the property and therefore compromise its OUV, if it is not urgently stopped and reversed (UNESCO/IUCN,

2024).

► Water-borne & other effluent Pollution

Data Deficient

(Unregulated bilge water disposal and treatment)

Inside site, extent of threat not known
Outside site

The Eastern-Siberian Inland Navigation Company (largest on Baikal) carries out the regular service (trans-Baikalian lines including) on significant areas of the South and Middle basins (Irkutsk Oblast and Buryat Republic) of Lake Baikal. The number of smaller private shipping services is rapidly increasing. Estimation of the total ship numbers varies significantly: from over 2,000 to more than 5,000. According to Kapitalist (2014), 246 ships and about 6,400 small size vessels were registered in Baikal and Irkutsk reservoir area. There are only two bilge water (BW) collection stations: at the northern top (Severobaikalsk city) and Baikal settlement (South basin) accepting the BW for money. According to data from the Limnological Institute, the approximate total BW volume from the ships, registered on Baikal, should not be less than 417 tons per year. The BW stations however, received 12.2 tons only (navigation period of 2014 – 2015). Judging from this information, the length of the Lake (636 km) and the total approximate ship number (more than 2,000) the illegal BW discharge in the Lake should be considered a threat with poorly understood consequences. However, in 2020 specialized new ships to collect bilge water started their operation (IUCN Consultation, 2020).
In the absence of reliable and detailed data, it is not possible to assess the trends observed in this area. It would be important to collect recent data on both the volumes and composition of these discharges, in order to be able to conclude objectively on the significance and effects of this source of pollution on the lake ecosystem, given the potential increase in the shipping traffic in the future.

Additionally, the regulation framework in this area should be reviewed, with a view to improvements in response to the potential increase in this source of pressure, linked in particular to the development of tourist and commercial activities in the property.

► Water-borne & other effluent Pollution

High Threat

(Water pollution from past activities of the Baikalsk Paper and Pulp Mill)

Inside site, localised(<5%)
Outside site

During its operation, the Baikalsk Paper and Pulp Mill (BPPM) dumped a large amount of waste water into the lake (reaching 16-17 km into the lake), causing an increase of key pollutants including phenol and mercury up to 10 times the maximum permissible concentrations (Rosabal & Rao, 2011; Zhelnina, 2019). The Baikalsk Pulp and Paper Mill (BPPM) was definitively closed in 2013 (State Party of the Russian Federation, 2014). The elimination of the polluting substances (e.g. black liquors) stored on the industrial site has started and general remediation of the site is also underway (State Party of the Russian Federation, 2024). However, the final detailed rehabilitation concept and precise timetable for its implementation in all affected sites have not yet been determined, and not all EIAs have been submitted in response to Committee’s repeated requests (World Heritage Committee, 2023).
While it is positive that the State Party is finally taking important measures to resolve this issue, the property is still facing major environmental risks as long as the waste remains stored on the lake shores, prone to flooding, mudslides and other external events (Zhelnina, 2019; Petley, 2019; Williams, 2019; The Siberian Times, 2019; Bellona 2021). .

► Water-borne & other effluent Pollution

High Threat

(Pollution by heavy metals)

Inside site, extent of threat not known

The presence of heavy metals in the waters of the lake and its tributaries (eg: Selenge river) has been confirmed since the last outlook assessment, contributing to a continuing degradation of the lake's ecosystems to the detriment of the property's integrity (UNESCO/IUCN, 2024). This form of pollution is partly due to industrial and domestic discharges and inadequate wastewater treatment that is poorly adapted to this form of pollution, among others. (e.g. phosphates, complex molecules), the effects of which are likely influenced by those of climate change.

These factors affect the water quality of the property (criterion vii), as well as its outstanding biodiversity (criteria ix and x). A long-term degradation of this water quality would certainly affect further its integrity and therefore compromise its OUV, if it is not urgently stopped and reversed.

► Fishing, Harvesting & Controlling Aquatic Species

Data Deficient
Inside site, extent of threat not known

(Overfishing of Baikal omul and decrease in available fish-stock)

Other targeted species names

Coregonus migratorius

The decline in omul populations observed in the past and reported in the previous outlook assessment appears to have been halted, according to the most recent information (UNESCO/IUCN, 2024; State Party of the Russian Federation, 2021, 2023, 2024), likely and partly thanks to the ban of commercial fishing of this species adopted in 2018 (Kork, 2017). However, the population of omul remains significantly lower than in the past. However, the total number of omul entering spawning rivers was almost a third lower in 2022 than in 2021 and more than half lower than the mean annual abundance (State Party of the Russian Federation, 2024). Some scientists attribute this decline to unfavourable ecological and climatic conditions for its reproduction (Anoshko et al. 2020), also potentially linked with the water regime caused by the Irkutsk hydropower plant affecting the littoral zone and the most important food sources of the omul (Jaguś, A. et al. 2015). Authorities indicate that the Baikal seal and cormorants cause decimation of fish stocks and propose culling. Artificial breeding and expansion of nurseries for commercial fish has been the main direction of investments by which the state is trying to cure the problem (Simonov et al. 2022). The effectiveness of this approach and its impacts on integrity of the Lake Baikal ecosystem has not been properly assessed. Further work is certainly needed to have a more reliable and detailed view on the omul population tendencies.

► Invasive / Other Problematic Species, Genes & Pathogens, Invasive Non-Native/ Alien Species

High Threat
Inside site, extent of threat not known
Outside site

(Invasive species)

Invasive/problematic species

Elodea canadensis

Perccottus glenii

Other invasive species names

Spirogyra spp.

The presence of invasive species in Lake Baikal and its watershed has been documented for many years (Anon, 2013). The most widely distributed invasive macrophyte species is Elodea canadensis, first found in Baikal at the end of 1970s. At present, elodea is known from many localities with maximum abundance in bays (Chyvyrkuy, Barguzin) and gulfs. Another group of alien species – green filamentous alga – spirogyra – became widely distributed in benthos of the coastal zone of Baikal since ca 2010. According to Timoshkin et al. (2016), the distribution area of Spirogyra spp. covered over 30% of the coastal zone of the Lake. The problem of Spirogyra penetration in Baikal and its natural history (whether the Spirogyra is an invasive species or not) is under debate. The distribution of both water plants is limited to shallow water zones. Five introduced fish species (their parasitofauna included) have been found in Baikal; of them Perccottus glenii is becoming the most widespread one, successfully occupying coastal communities (Pronin et al., 1998). Recent studies have shown that many endemic species are now being replaced by trivial common species of freshwater organisms, which previously were abundant in tributaries but not in the Lake (IUCN Consultation, 2020).
It is possible that global changes in recent years are influencing the presence of such species; however, the subject needs additional work in order to assess further this type of threat and the tendencies.

► Logging, Harvesting & Controlling Trees

High Threat
Inside site, extent of threat not known
Outside site

(Intensification of wood production in the catchment area of the Lake)

Current intensification of the wood production in the catchment area of the Lake needs to be considered as one of the potentially serious threats for the Baikal ecosystem (increase in erosion resulting in further eutrophication, decrease of tributaries water balance, etc.). Some sources note attempts to modify the federal Law on Baikal regarding the wood harvesting around the Lake (Nodelman, 2017). Ta Decree of

the Government of the Russian Federation (N° 2399 dated December 31st, 2020 as amended on January 26th,2023) “On approval of the list of activities prohibited in the CEZ of the Baikal natural territory” has amended the list of prohibited activities in this zone, authorising sanitary cutting of forests, amongst other uses and activities. Such clear cuts, whatever the purposes, including for sanitary purposes, if they were to be authorised within the CEZ, may have negative effects on the property’s OUV, and threaten its functional integrity (UNESCO/IUCN, 2024). Potentially this may lead to illegal tree-felling and further deforestation of not only burned, but also untouched areas around Baikal. Rapid deforestation of the central ecological zone of the Lake will negatively influence the annual water balance of the tributaries and may affect the structure of the coastal communities. Wood production may also be exacerbated by the development of energy production facilities to replace coal-burning ones.

► Fire & Fire Management

Very High Threat

(Coastal forest fires)

Inside site, extent of threat not known
Outside site

Increasing intensity of coastal forest fires within the last decade (SCANEX, n.d.), affecting not only the continental parts, but also the isles (ca. 70% of the forest on unique Bolschoy Ushkaniy Island – North Basin – suffered from strong fire in 2015) should be considered as a significant threat for the Baikal ecosystem. However, normal undisturbed taiga represents a mosaic of forest areas of post-fire succession at different stages - from black burnt forest to primary forests aged 200-300 years. Such complex ecosystems have the highest biodiversity and optimal productivity. Therefore, it is necessary to carefully manage fires to ensure the mosaic is maintained while preventing catastrophic fires that pose a threat of destruction to the protected area ecosystems (IUCN Consultation, 2025).

2,676 fires were recorded in the Baikal Natural Territory in 2015, on a total area of more than 1 million ha, representing almost a quarter of all fires occurred during the same year in the whole Russian Federation. During 2018-2023, more than 3 000 fires occurred in the forests of the territory. They affected a total of 510 000 ha, spreading over the territories of the Republic of Buryatia (57,1%), Irkutsk Oblast (28,5%) and Zabaikalsky Krai (14,4%). Fire incidents were reported in the buffer ecological zone (60%), in the CEZ (12%) and in the atmospheric influence zone (28%) of the property. According to the State Party, these wildfires are generally caused by lightning, the anthropogenic factors considered as a less important source. However, some experts claimed, that part of fires in Buryatia are result of arson, which paves way to "salvage operations" in burned forest resulting in appropriation of commercially valuable wood (Rivers without Boundaries, 2025).

It is known that forest fires have effects on trees and plants, and they may also affect the air (Khodzher T. V. et al. 2022), the soils (Shcherbov B.L. 2011) and the water biotic balance (Belan S.V., Rybalova O.V. not dated), increase the degradation of organic matter, and may aggravate and accelerate soil erosion, especially in coastal zones. Based on the results of the research efforts undertaken in the Baikal region in recent years, it was not possible to conclude on the effects of fire on the property. Overall, it appears that fire incidents would not have significantly affected the aquatic part of the property - the Lake Baikal - which would have shown resilience to fire and climate change effects (Pinardi, M et al. 2023); however, this conclusion must be interpreted carefully as affluent after fires on Ushkany Islands caused significant eutrophication in coastal waters and the same should be expected in the aftermath of larger-scale coastal fires as indicated in several papers summarised in Simonov, E. et al (2022). Depite request of the World Heritage Comittee Russian Federation failed to report the results of specific studies of linkage between fires and eutrophication of coastal waters, likel because no such studies have been commissioned.

The State Party has significantly improved its capacity in fire prevention and control at the regional level (State Party of the Russian Federation, 2024). A series of measures were also taken to restore the forest ecosystem such as tree plantations and improvement of technical equipment; fire control plans were consolidated, and specific intervention plans were elaborated for each forest area. These measures were supported by the federal Project “Forest conservation” of national Project “Ecology” and they sought to: ensure fire protection of forest in priority in the CEZ; improve proactive interventions and coordination between all stakeholders; set up a comprehensive and efficient information, communication and fire control system, involving the various forces and capacities; strengthen and improve the intervention

technical capabilities; increase the level of protection of forest within the Baikal nature area. However, relative decrease in frequency and area of fires in 2022-2024 is best explained by less dry conditions during recent fire seasons.

The State Party was urged by the WH Committee to pursue its efforts on forest fire management; its was also urged to elaborate and implement a clear and comprehensive plan and programme of activities for fire management and forest ecosystem restoration throughout the property, using methods and techniques that preserve the integrity of the forest ecosystem and fully compatible with the natural features of the original forests located in the property (UNESCO/IUCN, 2024, World Heritage Committee, 2024).

► Renewable Energy

High Threat
Inside site, throughout(>50%)
Outside site

(Water level fluctuations due to dam operations)

Since the last outlook assessment, and in application of Article 7 of the Baikal Law, the State Party has repeatedly derogated from the initial rules fixing the maximum and minimum limits of the water level of Lake Baikal (456.00-457.00 m) during a year, as implemented since 2001. This derogation was repeated once again in 2023. The negative environmental consequences of the lake water level regulation had also raised the attention of the scientific community, appealing for the return to regulating the water level of Lake Baikal in the set meter range (Open Letter to the Members of the Interdepartmental Council on Lake Baikal of the Ministry of Natural Resources and Environment of the Russian Federation, the Scientific Council of the Siberian Branch of the Russian Academy of Sciences on the Problems of Lake Baikal and the Public, https://www.baikal-daily.ru/news/16/400687/).

A study was carried out from December 2021 to December 2023, with the participation of the Siberian branch of the Academy of Sciences, the government and 13 specialist agencies (e.g., Rosshydromet and Rosrybolovstvo), involving more than 170 experts, in order to prepare proposals for minimising environmental and socio-economic risks and potential damage when regulating the level of Lake Baikal.

Overall, the study confirms that regulating the water level of Lake Baikal is a very complex issue, from both environmental and socio-economic points of view, and that it is closely interconnected with not only the water flow and regime, but also the quality of water.

However, those difficulties should not lead to delaying the establishment of clear permanent regulations that meet the immediate requirements of preserving the OUV of the property, in the context of deteriorating integrity linked in part to the weak water management system applied for nearly 10 years by the State Party (UNESCO/IUCN, 2024).

To conclude, the World Heritage Committee (Decision 46 COM 7B.52
Lake Baikal (Russian Federation) (N 754)) urged the State Party to elaborate by the end of 2024, detailed proposals to develop water level regulations of Lake Baikal to be compatible with the protection of the property’s OUV and to submit these proposals to the World Heritage Centre for review by IUCN.

► Roads, Trails & Railroads, Utility & Service Lines, Shipping Lanes

High Threat
Inside site, widespread(15-50%)
Outside site

(Development of "main infrastructure", which entails forest clearing and a waiver of EIA requirement)

The construction of large linear infrastructures within or in the immediate vicinity of the property's territory remains a significant threat to the preservation of its OUV, particularly in connection with the development of mass tourism. This threat cannot be separated from the construction of other large infrastructure, as planned in the two economic zones (SEZ) established to date in the immediate vicinity of the property (Gates of Baikal and Baikal Harbour).

With regard to this global infrastructure development, the World Heritage Committee has urged the

State Party to conduct a Strategic Environmental Assessment in each SEZ and, based on the assessments, to develop and implement an environmental management plan for each SEZ to avoid any adverse impact on the property's OUV.

Added to this threat is the development of several hundred illegal constructions, linked also to the socioeconomic development and currently under judicial and administrative review, in a general context marked by the absence of a global and coordinated strategic vision between the actors, in terms of territorial planning and urbanization on the scale of the Lake Baikal basin (UNESCO/IUCN, 2024)

in spite of the repeated requests form the World Heritage Committee to the State Party to develop an integrated management plan for the property that would foster coordination between all federal, regional and local stakeholders. Although coordination among stakeholders appears to have been improved over time, there is still a lack of strategic vision for the integrated management and socioeconomic development in the property. Further legal reinforcement are also needed in key areas, such as control of water pollution, wastewater discharges and treatment.

To conclude, the situation has not significantly improved since the last outlook assessment and the threat is still very high coming from construction of large infrastructures, whatever they are, including linear infrastructures but not only, that may affect the property's OUV.

► Recreational Activities

High Threat
Inside site, extent of threat not known

(Increasing number of visitors)

The most popular tourist/recreation areas are Maloe More strait and Olkhon Island (Middle basin); bays of the western coast of South basin, particularly Listvyanka, Bolshye Koty, Bolshoe Goloustnoe settlements and Aya Bay. Lake Baikal became the most popular recreation destination among the Russian World Heritage sites in 2017 (Tourism Agency of Irkutsk Region, 2017). The number of visitors in 2016 increased by about 45 per cent in comparison with the 2015 level (Baikal Info, 2016). The tourism flow inside the national park has increased over the past decade, although gathering accurate visitor numbers have proven difficult. According to some estimates 14,234 people visiting the park in 2012 and 178,854 people in 2023 (UNESCO/IUCN, 2024), however information from accommodation for tourists report that in 2016 Lake Baikal was visited by 1.2-1.3 million visitors in 2016 with the most significant increase in 2000-2012 with more recent increases in visitation not significant (IUCN Consultation, 2025). Direct anthropogenic impacts are reported from uncontrolled land and water transport and violation of the established environmental regime, such as illegal harvesting, hunting and fishing.

► Changes in Physical & Chemical Regimes, Changes in Temperature Regimes, Changes in Precipitation & Hydrological Regime

High Threat
Inside site, throughout(>50%)
Outside site

(Climate change)

Water temperature and ice cover have been responding strongly to climate change in the recent past, with a trend towards warmer and wetter winters. This is likely to have multiple consequences on ecosystem dynamics, the extent of which at this stage is difficult to predict (Moore et al., 2009). An increase in lake water temperature has been documented in the offshore pelagic zone of Lake Baikal by various scientists (Shimaraev et al., 2002; Troitskaya et al., 2003; Hampton et al., 2008; Katz et al., 2011; Sizova et al., 2013; Shimaraev and Domysheva, 2013). Additionally, some researchers established a positive relationship between surface water temperatures in May-October and the biomass of Baikal phyto- and zooplankton (Shimaraev et al., 1994; Afanasyeva and Shimaraev, 2006). Subsequently, others have suggested that warmer waters may have contributed to an increase in thermophilic zooplankton in the pelagic zone of Lake Baikal (Afanasyeva and Shimaraev, 2006; Hampton et al., 2008; Moore et al., 2009; Izmest'eva et al., 2016; Silow et al., 2016), and created a welcoming environment for invasive species causing problems for endemics (Dye et al., 2019). On the other hand, no correlation was found between the surface water temperature increase and the mass development of Spirogyra (Timoshkin, 2016; Timoshkin et al., 2016, 2017). Over the last two decades, Lake Baikal has also been influenced by prolonged droughts, culminating in 2014 when the Selenge River only brought half the

water volume it normally supplies to the lake and water levels were gradually declining (Dye et al., 2019). In a recent sensitivity analysis of the response of Lake Baikal to climate change, Piccolroaz and Toffolon (2018) showed that the lake is sensitive to climate change to an extent that its ecosystem and water quality may undergo profound disturbances and that the deep ventilation mechanism, whereby large amounts of oxygenated surface water sink to the bottom of the lake, is particularly sensitive to changes in wind speed.

Potential Threats

High Threat

The planned extensive additional tourism developments (both in terms of new areas included and envisaged visitor numbers) pose a significant potential threat to the site's values. The potential of hydroelectric developments on the Selenga and Orkhon Rivers in Mongolia remains of very high concern. If water level regulation regime proposed in the conclusions of the government-sponsored "study" is approved without major amendments and incorporated in the Irkutsk reservoir operation rules, then significant destruction of coastal ecosystems will become a norm in water-abundant and water-deficient years as the Lake will be used as flood-control structure for Irkutsk City and drought-control structure for industrial facilities in water-deficient years. The World Heritage Committee has repeatedly requested the States Parties of Mongolia and the Russian Federation to jointly develop a Strategic Environmental Assessment for any future hydropower and water management projects, which could potentially affect the World Heritage site, taking into account any existing and planned projects on the territory of both countries. However, no progress has been achieved in this regard so far. On the contrary, the Russian Federation increased allowed fluctuations in lake water level by 2.3 times and proposed to allow such regulation by hydropower in perpetuity, without having completed an EIA. In addition, as long as the 6.5 million tons toxic waste from the closed Baikalsk Paper and Pulp Mill remain untreated and stored in ponds along the lakeshore, this will also remain a very high potential threat to the lake ecosystem as the area is prone to floods, high seismic activity and mudslides, which could cause disastrous outbursts of the toxic waste to the lake.

► Dams & Water Management/Use

High Threat

Inside site, localised(<5%)

(Hydropower projects and proposed construction of dams and reservoirs on the Selenga, Eg and Orkhon Rivers)

The proposed development of hydropower projects in Mongolia has been discussed for a number of years now and the World Heritage Committee expressed its concerns about potential impacts on Lake Baikal in several Decisions (World Heritage Committee, 2017, 2018). The projects included the Egiin Gol project, the Shuren hydropower project and the Orkhon River project.

Since then, the Mongolian State Party has taken the decision to abandon two of the initially planned three hydropower projects, and to pursue solely the development of the "Egiin Gol Hydropower Plant project" (letter from the Minister of Environment and Tourism of Mongolia n°01/506 dated 30 January 2024 to the World Heritage Centre). It is not clear however what will be the final contents of this project and whether it will contain a regulation reservoir downstream or not (UNESCO/IUCN, 2024). Besides, current mid-term plan of Mongolian Government for strategic development projects also includes Orkhon-Onggi long-distance water transfer project (which was previously called Orkhon-Gobi Project in UNESCO documents), therefore claim that other dams in the Selenge basin have been removed from planning is likely incorrect (UFE 2024, Nomin 2024).

There is also a need for clarification on the characteristics and exact location and potential impacts of all infrastructures on the Selenge and downstream on the property, as well as on the detailed measures that would be taken to minimize those impacts, especially on the river delta's ecological functioning throughout the year, that is part of the property. The World Heritage Committee noted the State Party of Mongolia's progress to assess those potential impacts, and all parties are still waiting for the conclusions and recommendations of the updated EIA of the project in accordance with the WH and international standards on EIA.

The Committee also requested the States Parties of the Russian Federation and Mongolia to continue

cooperate on the sustainable management of the shared Lake Baikal watershed (World Heritage Committee, 2024) .

► Water-borne & other effluent Pollution

High Threat

(Potential threat from the synergetic effect of pollutants)

Inside site, extent of threat not known

Fortunately, present concentrations of organochlorine contaminants in the water of the pelagic zone of Lake Baikal are below international regulatory standards. However, this masks an important problem. Experts who test the toxicity of chemicals extracted from aquatic environments normally focus on concentrations of separate, individual contaminants. Yet in nature, organisms are exposed to a “cocktail of contaminants,” where a mixture of organochlorine compounds, for example, consisting of individual chemicals (in particular, pesticides) at low, allowable concentrations, significantly harms aquatic communities (Kortenkamp, 2008; Relyea, 2009; Servan-Schreiber, 2014). Although the synergistic effect of multiple contaminants on freshwater ecosystems is beginning to receive scrutiny, it has never been examined for the unique and potentially sensitive communities of Lake Baikal. Therefore, the discharge of an “organochlorine cocktail” into the littoral zone of Northern Baikal via the failed wastewater treatment plant and from aerosols may potentially be very dangerous for sensitive biota of the oligotrophic and endemic biota (Timoshkin et al., 2016).

► Mining & Quarrying

Low Threat

(Mining)

Inside site, extent of threat not known

The context has not changed since 2020.

The license of the LLC “Invest-Euro-Company” for the Kholodninskoye gold deposit was suspended and the application was officially withdrawn by the company (UNESCO, 2016). Therefore, this potential threat is currently assessed as very low. At the same time accelerated development of roads, municipal infrastructure and recreational construction incentivises extraction of gravel, sand and other poorly regulated construction materials, which have to be mined close to the construction sites. If amendments to the Law "on Protection of Lake Baikal" are passed in second and third hearings in 2025, this will be a serious issue due to multitude of proposed construction projects (Rivers without Boundaries 2025).

► Geological Events

High Threat

(Avalanches/landslides especially in combination with an earthquake in some localities)

Inside site, extent of threat not known

At the former Baikalsk Paper and Pulp Mill, there are still many old ponds filled by poisonous sludge from the production years. Earthquakes in the vicinities of Baikalsk city could set off avalanches and landslides (which happened in 1930 and 1970 in the area), overflowing and destroying the sludge ponds. This is of serious concern, as the sludge may be extremely hazardous for the Baikal ecosystem (Timoshkin, 2014).

Overall assessment of threats

High Threat

There is clear scientific evidence of negative impacts of a number of factors rapidly progressing in the coastal zone of Lake Baikal but not only, including mass proliferation of non-typical Spirogyra algae and significant changes in the structure of the near-the-settlement planktonic communities. The eutrophication of the coastal waters should be considered as an important threat to the oligotrophic and unique freshwater ecosystem of Lake Baikal. In combination with increasing forest fires, absence of proper water treatment and properly functioning sewage treatment stations, rapid increase in tourism infrastructure and visitor numbers, represent all together a very high threat to the Lake’s ecosystem. The toxic by-products of ca. 60-years long functioning of the Baikalsk Paper and Pulp Mill still represents also one of the most significant potential threats as long as the remediation process is not fully completed. Tendency to value hydropower generation and flood control in Irkutsk over integrity of Lake Baikal coastal ecosystems de-facto legitimized unsafe water level regulation resulting in coastal erosion and other negative impacts. Presently proposed new lake level regulation schemes

may significantly increase those already detrimental impacts on near-shore ecosystems and local communities. The development of hydroelectric projects in Mongolia is another potential threat although decreasing since the last assessment, as well as water level management by hydropower operations at the Irkutsk Dam in Russia.

Protection and management

Assessing Protection and Management

▶ **Involvement of stakeholders and rightsholders, including indigenous peoples and local communities, in decision-making processes** — **Some Concern**

No specific measures have been taken to involve local people in the management of the World Heritage site (State Party of the Russian Federation, 2006). There is also a conflict of interest between the development priorities of local and regional governments and the protection of the OUV of the site. In 2019, the degree of public interest and concern about the state of the Lake Baikal grew dramatically. All the visible signs of deterioration (tons of waste and rotting algae on the shores, increasing media reports on the poor state of Baikal water, new industrial projects, skyrocketing tourism and poor infrastructure, etc.) heated the locals' dissatisfaction and public protests grew to the scale unknown ever before. In March 2019, the illegal construction of the Chinese water bottling plant in the unique area of Talovskie wetlands sparked massive protests related to the poor management and environmental, with about 1,000,000 participants in 43 cities of the Russian Federation. An Appeal with 30,000 signatures was sent to all relevant national and regional authorities, including requirements to ensure public participation in environmental decision-making, the safe rehabilitation of the former Baikalsk Paper and Pulp Mill's (BPPM) toxic waste ponds, and to eliminate illegally constructed hotels, stimulate eco-tourism, improve waste water treatment and strengthen control of logging and construction in unaffected natural areas (Simonov and Kreindlin, 2020). However, there is growing anti-conservation sentiment as well. Active opposition of local house owners to existing strict land ownership regulations is exacerbated by poor administrative and enforcement practices. Businessmen and owners of thousands of illegally acquired plots are actively lobbying Irkutsk Oblast authorities, the Republic of Buryatia and the State Duma of the Russian Federation to exclude settlements from the territory of protected areas and the Central Ecological Zone of the BNT, as well as to soften regulations on "prohibited activities" (IUCN Consultation, 2020).

▶ **Legal framework** — **Serious Concern**

The legal protection of the property is defined by the federal law "On the Protection of Lake Baikal" , modified 18 times since its adoption. This law provides the legal basis for the protection and management of the Baikal Natural Territory and Lake Baikal, also as a World Heritage property.

The Baikal Natural territory includes three main zones, (the central ecological zone (CEZ) the boundaries of which coincide with those of the World Heritage property, which includes Lake Baikal and its islands, the water protection zone as well as the specially protected natural areas adjacent to the lake, a buffer ecological zone located outside the CEZ and including the Russian part of the catchment area of Lake Baikal, the ecological zone of atmospheric influence that covers the area outside the catchment area of Lake Baikal within the territory of the Russian Federation, a 200 km wide territory to the west and northwest outside the catchment area), the boundaries of which and the legal regime of activities were established by law.

The Baikal Natural Territory overlaps with three administrative regions in the Russian Federation: Irkutsk oblast (region), the Republic of Buryatia, and Zabaikalsky Krai (Transbaikal Territory), the third region having no overlap with the CEZ and hence the World Heritage property. In addition, 159 settlements are included within the CEZ (77 in Irkutsk region and 82 in Buryat side).

The Baikal Law also fixes the main principles for utilization of natural resources, including wildlife and water, in each of the three zones listed here above, as well as the legal regimes of traditional uses, recreational and tourism activities, and regulation on waste. Various other federal laws, legal acts and regional and local regulations determine the protection and management of the property compiled under the government monitoring portal for Lake Baikal. In accordance with the law on environmental protection, the Baikal Law imposes also a registration of objects that may have negative impact on the property, as well as various rules for economic activities and facilities, information and monitoring, federal programmes targeted on protection of the lake and related to the law enforcement and liability. This law details as well provisions on specific activities that are allowed for a limited period (e.g., modernization and expansion of railways facilities within the CEZ

The property is governed also by the federal law 33-FZ dated March 14th, 1995 “On specially protected natural areas” which provides the basis for protected areas and activities permitted in their territories. This autonomous legislation lists diverse types of protected areas such as, at the federal (strict nature reserves, national parks, wildlife reserves and nature monuments) and regional levels (nature parks, nature reserves and nature monuments); it also regulates the organization and the management regime of those areas and is applicable to the protected areas located within the property.

The incomplete application, high instability and weaknesses of the Law “On the Protection of Lake Baikal” (Baikal Law) was raised several times in the past and since the last outlook assessment, including in the report of the last reactive monitoring mission (UNESCO/IUCN, 2024). The absence of certain implementing texts and the frequent and numerous legal amendments have reduced the predictability, consistency and security of the legal framework dedicated to the protection of the property and the draft amendment on Article 25 of the law on protection of Lake Baikal as adopted on first reading by the Federal Assembly of the Russian Federation in June 2023 could further weaken the legal protection of the property if it were to be definitively voted in the proposed form, constituting a potential threat to the preservation of the OUV of the property (UNESCO/IUCN). The World Heritage Committee adopted also in 2024 a series of measures with regard to the legal protection of the property (Decision 46 COM 7B.52 Lake Baikal (Russian Federation) N 754).

The amendments prepared by February 2025 for 2nd and 3rd hearings propose further weakening of the Baikal Law by potentially permitting clearing of woody vegetation of land plots in settlements, while expansion of municipal lands of each settlement is not restricted by the law, permitting “sanitary cutting” of forests to fight pests and diseases, excluding from “forest fund” land plots (listed in annexes to the bill) earmarked for construction and reconstruction of priority roads, wastewater treatment facilities, engineering structures to confront geological hazards, and water infrastructure, etc. The bill received a preliminary blessing from the president of Russia and may be passed in 2025 (IUCN Consultation, 2025).

► Governance arrangements — Serious Concern

The protection of Lake Baikal is under the responsibility of the federal government, coordinated by the Government Commission for the Protection of Lake Baikal established to ensure concerted action by federal executive bodies, and the executive bodies of the Republic of Buryatia, the Trans-Baikal Territory and the Irkutsk Region.

The Ministry of Natural Resources and Environment of the Russian Federation has the responsibility for the oversight of the protection of the property, determining the executive bodies in charge of specific monitoring, protection and management activities according to their competencies.

The legal protection of the property if overseen by the Federal Prosecutor’s Office

The lack of strategic vision for the integrated management and socioeconomic development in the property was raised by the last monitoring mission (UNESCO/IUCN, 2024)

Although coordination among stakeholders appears to have been improved over time, further legal

reinforcement may be needed in key areas, such as control of water pollution, tourism development, and land use planning.

The World Heritage Committee has also repeatedly requested overtime the State Party to develop an integrated management plan for the property that would foster coordination between federal, regional and local stakeholders. As urged by the Committee, this plan should be elaborated after public mandatory consultation and scientific review. It should also lead to the adoption of a retrospective statement of OUV for the property with a clear and high definition of the property's boundaries.

► Integration into local, regional and national planning systems (including sea/landscape connectivity) — Serious Concern

The insufficient integration of public policies carried out at different levels, federal, regional and local, has been highlighted on several occasions by the World Heritage Committee and, again, recently in the report of the last reactive monitoring mission (UNESCO/IUCN, 2024).

This lack of integration was, for example, mentioned on the occasion of the Baikalsk Master Plan regarding which the World Heritage Committee requested that a SEA of this plan be conducted ensuring full compatibility with World Heritage requirements and, more generally, that an integrated management plan for the property be developed.

► Boundaries — Some Concern

The boundaries of the World Heritage site, and particularly of its central ecological zone, appear to have been poorly defined and/or documented. Following years of disputing, the boundaries were only recently fully (or partially) legitimized by registration in the National Land Cadaster (Register). Boundaries have until now been contested by various authorities and only in 2020 did the Republic of Buryatia revoke its claim that the boundaries of the World Heritage site coincide with those of the water-protection zone. However, many economic and political actors still hope to change those boundaries and in the current legislative disorder, it cannot be ruled out (IUCN Consultation, 2020). The State Party has still to submit a map delimiting the property boundaries to the World Heritage Centre for the Committee’s approval (Retrospective Inventory of boundaries).

► Overlapping international designations — Some Concern

The property overlaps with one Ramsar site (Selenga Delta Ramsar site) and two biosphere reserves (The Baikalsky biosphere reserve and the Barguzinskyi Biosphere Reserve). There is no information available on the effectiveness of collaboration between the different designations, however considering the lack of coordinated regional planning and the overall unregulated and increasing tourism development in the region the management effectiveness of the overlapping designations remains concerning.

► Implementation of World Heritage Committee decisions and recommendations — Serious Concern

The property has been the subject of numerous decisions by the World Heritage Committee since its inscription.

Since the previous outlook assessment, the Committee has reiterated three times a series of concerns on a series of questions previously posed, in relation to the preservation of the property and the maintenance of its integrity (World Heritage Committee 2024, 2023).

Many of these questions and expectations of the Committee have still not found clear, precise and fully satisfactory responses to date, several of them directly questioning the inscription of the property on the list of world heritage properties in danger.

► Climate action — Serious Concern

The question of climate change is central in the preservation of the property's OUV (Lyubov R. Izmest'eva, L.R. 2016); Moore, M.V et al. 2009). The property is affected by significant and growing anthropogenic threats which, combined with the effects of climate change, may have a direct negative impact on its OUV and degrade its integrity.

There is also a risk that fires will reoccur in the future, despite the measures taken to prevent such natural hazards, particularly in the face of climate change. The report of the last reactive monitoring mission concludes that specific efforts should also be made to increase knowledge on direct and indirect effects of climate change on the water quality of the lake and its tributaries, and flows in Lake Baikal (UNESCO/IUCN, 2024).

In summary, it is admitted that climate change will likely further exacerbate the environmental risks within the property in the future and that there is a strong need to strengthen monitoring of its current and potential impacts on its functional integrity that is part of the property's OUV. There is tendency to use the lake as an element of engineering measures for climate adaptation (e.g. increasingly as the flood-control reservoir), rather than designing nature-based solutions to protect lake ecosystems in the course of climate adaptation (Rivers without Boundaries 2024).

As requested several times by the World Heritage Committee, these conclusions call for further studies and research aiming to improve knowledge on the effects of climate change on the property's OUV, although the Baikal lake may have shown to date resilience to it according to some scientists.

► Management plan and overall management system — Serious Concern

As repeatedly requested by the World Heritage Committee and in compliance with the Operational Guidelines, the State Party was urged several times to develop an integrated management plan for the property involving all Government entities and other stakeholders; this plan should be elaborated after mandatory public consultation and scientific review, and it should address all current and future major development initiatives that could affect the property and its OUV.

► Law enforcement — Some Concern

With the establishment of the Unified Baikal Prosecutor's Office around 2017, the work to reveal and rectify violations of environmental law has intensified significantly. According to the prosecutor's office, in just the two years between January 1, 2017 and January 1, 2019, the persecutors revealed that administration of the Olkhonsky District allocated 369 plots on a leasehold basis and 19 for permanent unlimited use. A significant part of these plots are located within the boundaries of the Pribaikalsky National Park and has been allocated in violation of the established restrictions on land sales. The prosecutor's office has filed a series of lawsuits to stop the illegal use of or demolish illegally constructed buildings, including tourist facilities. The Baikal Prosecutors' Office also started enforcement of many previously idle provisions of the Law on Conservation of Lake Baikal, and that evoked a lot of criticism from local people who routinely conducted activities in violation of the conservation laws. This in turn increased pressure to soften the laws to allow local economy functioning (IUCN Consultation, 2020).

► Sustainable finance — Data Deficient

According to the most recent data provided by the State Party, the level of funding dedicated to the management of the property would be stable, secure in the medium and long term and satisfactory; however, it could be improved (State Party of the Russian Federation, 2024b).

However, no precise information is available on the financial volumes committed, nor on the sources and distribution of available funds, between the authorities responsible for managing the various components of the property, and between the activities carried out in the property.

This lack of data does not allow to draw a more robust conclusion on this topic.

► Staff capacity, training and development — Data Deficient

According to the most recent data provided by the State Party, the human capacities dedicated to the protection and management of the property would be satisfactory regardless of the types of needs; the same applies to training activities whatever the areas of expertise (conservation, environmental sustainability, community participation and inclusion, risk preparedness, capacity development and education, administration, research and monitoring, raising awareness and public information/communication, marketing and promotion, interpretation, visitor management/tourism and enforcement (custodians, police)) (State Party of the Russian Federation, 2024 b).

However, no precise information is available on the resources committed nor on their allocation and distribution in the different areas of intervention. Since 2020 capacities of independent civil society organisations working on protecting the Lake Baikal ecosystem have been diminished both in Russia and Mongolia due to various reasons (Simonov 2023, Simonov 2024).

► Education and interpretation programmes — Data Deficient

The data provided by the State Party nor the various reports and other documents on the state of conservation of the property do not allow a proper assessment of the educational and interpretation activities carried out in the property; the information available is general and limited to certain components of the property; they concern often the entire natural territory of Baikal, only part of which is located within the property.

Under these conditions, it is not possible to draw a precise conclusion on the educational and interpretation efforts carried out in the property.

► Tourism and visitation management — Serious Concern

The data provided by the State Party and the reports and other documents on the state of conservation of the property do not allow a thorough assessment of the number of tourists visiting the property as a whole, or its impacts, with the exception of certain components:
- Pribaskalye strict nature reserve (Zapovednoye Pribaikaliye - a Joint Directorate of 4 Nature Protected Areas: Pribaikalsky National Park, Baikal-Lena Nature Reserve, Tofalarsky and Krasnyy Yar Nature Refuges. Here you can see a visit to all 4 territories, and almost all of them are visitors to the Pribaikalsky Park) (almost 160,000 visitors in, 2022);
- Podlemorye strict nature reserve (Podlemorye is a Joint Directorate of 2 Nature Protected Areas – Zabaikalsky National Park and Barguzin Nature Reserve. The most number of visitors are of the National Park) (almost 52,000 visitors in 2022);
- Baikal State nature biosphere reserve (45,000 visitors in 2022);
- Jerginsky State natural reserve (836 visitors in 2022);
- Sokhondinsky State natural reserve (almost 1,500 visitors in 2022).

According to the State Party, the tourism pressure seems relatively stable and fairly well managed, but its negative effects on the property are increasing (Russian Federation, 2024b).

However, the latest reactive monitoring mission (UNESCO/IUCN, 2024) concluded that the development of tourism in the property is clearly a threat to the preservation of its OUV, in the absence of a common strategic vision among federal, regional and local stakeholders, particularly in relation to the development of these activities in the 2 economic zones set up for this purpose on the shore of the Lake and in the absence of an overall management system for the whole property.

These weaknesses have been highlighted on several occasions in recent years by the World Heritage Committee which has expressed its utmost concern with the significant ascertained and potential threats faced by the property due to, among other reasons, persistent and increasing anthropogenic pressures, notably related to tourism development.

► Sustainable use — Serious Concern

As the property's legal protection regime stands, the sustainable use of natural resources is not a major issue for the preservation of the property's OUV, with the exception of the use of timber and fish resources.

- Logging and all silvicultural management practices are a matter of concern for the preservation of the property's OUV. Should they become allowed in the future, in the property and in its vicinity, large scale and clear-cut logging,including sanitary cuts, as well as artificial plantations following mechanical soil works within the property, may affect the preservation of the values and attributes that convey the property's OUV, The amendment to the article 25 of the Baikal law, as drafted at the time of the last reactive monitoring mission (UNESCO/IUCN, 2024), may threaten the property's OUV if adopted in the form of this draft;
- In the past, fishing activities in the lake led to a drastic reduction in omul populations; restrictions on fishing and restocking efforts have enabled the conservation status of this species to be stabilised at a level of abundance that is still lower than the population levels known in the past. Although the threats to this species appear to have been reduced, all the risks of a deterioration in its conservation status cannot yet be fully ruled out.

► Monitoring — Some Concern

The State Party’s has made efforts to set up a comprehensive framework for monitoring the property and to provide open access to information and data on the Lake Baikal Ecological Portal. According to the last reactive monitoring mission, this framework should be strengthened this monitoring, including in demersal and coastal zones of the lake that are not properly covered currently. Coordination should also be improved between the diverse public agencies and academic bodies, with a view to ensuring that monitoring guides management decisions and enables the State Party to deliver timely, reliable and public annual reports on the overall state of conservation of the property.

This monitoring framework should form part of the integrated management plan requested several timers by the World Heritage Committee and be based on the most up-to-date knowledge and reliable data collected by both administrative and scientific stakeholders (UNESCO/IUCN, 2024). In practice, so far monitoring data is not widely used to inform management, while monitoring programs are often disjunct from conservation needs. The Academy of Sciences has been calling to establish comprehensive monitoring of shallow-water ecosystems (Simonov et al 2022). However, most recent study on allowable water level regulation had very little relevant data available on water regime impacts on shallow-water and coastal ecosystems and indicator species (Institute of Systems Dynamics 2024).

► Research — Some Concern

Historically and for long, Lake Baikal has been the subject of many studies and research works on the various topics of preservation of its natural values, as shown by the scientific publications available, only a small proportion of which are referenced in this assessment, particularly those published since the previous outlook assessment. Hundreds of scientific publications are issued every year on Baikal, in all fields of expertise.

These publications are generally of high scientific quality and they covers the main themes of preservation of the property's environmental values, which led to its inscription under criteria (ix) and (x).

The complexity of the functioning of the lake ecosystem and the surrounding terrestrial ecosystems, which have an influence on the preservation of the property, requires a high level of research in a very large number of fields of expertise, requiring the use of often sophisticated means and a very long-term work.

It is therefore important for the State Party to continue its research efforts and to strengthen it on the

strongest external constraints as well as on cross-cutting issues, such as climate change, which are likely to influence more and more the functional integrity of the property and therefore the preservation of its OUV. Public unavailability of the results of government-sponsored research has been an increasing problem. Cooperation between Russian and foreign scientists and joint publications are constrained due to geopolitical tensions which may further impact the capacity for research in the site.

▶ **Effectiveness of management system and governance in addressing threats outside the site** — **Serious Concern**

The management system and governance is not addressing threats outside the site. Furthermore, this system is lacking coordination between the various stakeholders, at federal, regional and local levels; Nor is it based on a shared strategic vision of management for the whole property, as called for by the World Heritage Committee in several decisions since the last outlook assessment (UNESCO/IUCN, 2024).

This is also the opinion of the latest reactive monitoring mission, which concludes on the need to strengthen the strategic approach to this management and to formulate it in a global management plan drawn up in an inclusive manner with all categories of stakeholders.

▶ **Effectiveness of management system and governance in addressing threats inside the site** — **Serious Concern**

The current management system is lacking coordination between the various stakeholders, at federal, regional and local levels; Nor is it based on a shared strategic vision of management for the whole property, as called for by the World Heritage Committee in several decisions since the last outlook assessment.

This is also the opinion of the latest reactive monitoring mission, which concludes on the need to strengthen the strategic approach to this management and to formulate it in a global management plan drawn up in an inclusive manner with all categories of stakeholders (UNESCO/IUCN, 2024).

Overall assessment of protection and management — **Serious Concern**

The current protection and management regime of the property is not fully effective and not implemented fully, in relation to the main current and emerging threats (eg. water pollution and flows, tourism development and potentially unsustainable use of natural resources). This context is primarily caused by the fragmented and complicated institutional management framework, the lack of coordination between the stakeholders as well as a inadequate monitoring programme and, likely, not sufficient resources capacities in the various components that make up the property. Of particular concern is the possible further significant weakening of the existing regulatory framework through the recently proposed introduction of amendments to the existing laws and regulations (eg. Baikal law and Law on environment), which would facilitate development projects, weakening requirements for using natural resources, undertaking environmental impact assessments, and providing for higher possible levels of pollutants discharge to the Lake.

State and trend of values

Assessing the current state and trend of values

World Heritage values

▶ **Oldest, deepest and largest (by volume) freshwater ecosystem in the World** — **Low Concern** **Trend:Stable**

Lake Baikal remains the oldest and largest freshwater body in the world; however, its ecosystem is becoming increasingly threatened by a number of negative factors (see below).

▶ Freshwater invertebrate fauna

High Concern
Trend:Deteriorating

There is a clear scientific evidence of worrying ecological processes, rapidly progressing within the coastal zone.

The most harmful is the mass extinction of the main natural biofilters of the coastal zone – endemic Lubomirskiidae sponges – at the scale of the entire Lake.

Rapid and mass proliferation of the Spirogyra algae (observed along ca. 30-40-50% of the coastal line); mass development of cyanoprocaryotes (with proven ability to produce dangerous toxins) in the near shore zone and on the sponges; giant algal wash-ups; significant changes in the structure and quantitative characteristics of the near-the-settlement planktonic communities, are some examples showing the deep and rapid ecological degradation of the coastal zone, as observed since the last ten years (Timoshkin, et al., 2015, 2018; Timoshkin, 2016; Khanaev et al., 2018; Namsaraev et al., 2018).

▶ Freshwater vertebrate fauna

High Concern
Trend:Deteriorating

Fishing deficiency is evident at present and was confirmed in the last few years, although the state of conservation of the omul population seems to have stabilized, likely thanks to the ban of commercial fishing in 2018, but at a level that is lower than in the past.

Baikal omul, sturgeon and other endemic fish are likely still threatened due to mostly illegal fishing, deterioration of the water quality and flows, structural changes in the lake ecosystem, development of invasive species, as well as degradation of the Selenge River. Future reproductive success of the Selenge omul may be threatened by new water infrastructure, including dams planned in Mongolia (Bazov et al. 2024).

▶ Aquatic flora

Data Deficient
Trend:Data Deficient

Due to the lack of recent and reliable information and data, it is not possible to conclude about the state and trends of the state of conservation of freshwater flora. However, based on a review of current research (Timoshkin, 2019), many endemic and typical Baikal species are being replaced by ubiquitous Siberian aquatic organisms (including species of flora). Coastal plants, including endemics are also threatened both by tourist development and increasing frequency of high fluctuations of lake level (Alymbaeva et al. 2025).

▶ Geological features

Good
Trend:Stable

As concluded in the last outlook assessment, there is no evidence that values associated with the rift valley system are affected by anthropogenic pressures.

▶ Freshwater, terrestrial and littoral ecosystems

High Concern
Trend:Deteriorating

Most terrestrial ecosystems within the property have so far been preserved, but they are under growing pressure of uncontrolled and mass tourism development along an increasing part of the shoreline (IUCN, 2012a, Rosabal & Debonnet, 2005, Rosabal & Rao, 2011), fire events and not sustainable use of forest resources in the property’s vicinity.

Furthermore, the overall condition and water quality of Lake Baikal in its central and deep zones is deteriorating as shown by a growing eutrophication. The most harmful is the mass extinction of the main

natural biofilters of the whole coastal zone (eg.: endemic Lubomirskiidae sponges), a rapid and mass proliferation of the Spirogyra algae (observed along ca. 30-40-50% of the coastal line), the mass development of cyanoprocaryotes (with proven ability to produce dangerous toxins) in the near shore zone and on the sponges, giant algal wash-ups as well as significant changes in the structure and quantitative characteristics of the near-the-settlement planktonic communities (Timoshkin, et al., 2015, 2018; Timoshkin, 2016; Khanaev et al., 2018; Namsaraev et al., 2018).

Summary of the Values

▶ **Assessment of the current state and trend of World Heritage values**

High Concern
Trend: Deteriorating

The property still includes large areas of untouched wilderness and natural landscapes but the water quality of the lake is deteriorating and the effects of the water management regime are also a matter of concern for the preservation of the natural processes which partly motivated the property’s inscription on World Heritage. The most evident signs of the deep and rapid ecological degradation of the property which became evident in the last decade, are the mass extinction of the main natural biofilters of the coastal zone – endemic Lubomirskiidae sponges – at the scale of entire Lake, the rapid and mass proliferation of the Spirogyra algae, the mass development of cyanoprocaryotes in the near shore zone and on the sponges, the giant algal wash-ups as well as the significant changes in the structure and quantitative characteristics of the near-the-settlement planktonic communities.

▶ **Assessment of the current state and trend of other important biodiversity values**

High Concern
Trend: Deteriorating

Flora and fauna species and ecosystems are inferred to be increasingly negatively affected by growing anthropogenic pressures, such as uncontrolled and mass tourism development, coupled with other negative impact factors (eg.: water pollution and water management, forest fires, expansion of major infrastructures, unwise use of forest resources). Several terrestrial species of the World Heritage site are globally threatened (IUCN, 2012b, Birdlife international, 2016, 2019, 2021 and 2023 ; Russian Federation, 2023, 2024).

Additional information

Benefits

Understanding Benefits

▶ **Legal subsistence hunting of wild game, Fishing areas and conservation of fish stocks**

Fishing in the lake and its tributaires, hunting of wild game in the taiga around it are traditional ways of life in the whole region for the local population and communities.

Commercial fishing of omul was proihibited in 2018, reducing the impacts of this activity on the state of conservation of this species

▶ **Collection of wild plants and mushrooms**

Collection of wild plants (medical grass, wild berries) and mushrooms around the Lake is practiced by local communities.

To date, this activity has not been reported as threatening the property's values ; however, there is no data available on the species and their volumes collected usually.

▶ **Commercial wells**

Several private companies are producing bottled Baikal water ; the water is pumped about 1500 m from the shoreline, to a depth of 500 m. Lake Baikal needs approximately 400 years to completely substitute its waters from its tributaries. The age of Baikal water at a depth of over 250 m changes from 7.2 to 11.1 years in different years and different areas. The age was determined with the help of chemical tracers, such as dissolved atmospheric freon and tritium/helium (for References, see Khodzher et al., 2006). Therefore the water, taken for bottling from the depth of 500 m is significantly older and, therefore (at least, theoretically), less influenced by the current negative processes (pollution).

Factors negatively affecting provision of this benefit :
- Overexploitation Impact level - Low

► History and tradition

Lake Baikal area is full of archeological enigmas and is the real center of archeological investigations (Karnyshev, 2010).
There are many historical memorials such as ancient (ca. 2500 years old) rock paintings in Aya, Sagan-Zaba and other bays (human bodies, fish, different animals etc.).

A map of the main archeological sites, monuments and excavations includes 61 separate stations; their short description is given by Gryunova (2012).

No new data and information since the last outlook assessment

► Sacred natural sites or landscapes

There are very many sacred natural sites and landscapes in the property and its surroundings, mostly associated with Buddhism tradition.

One of the most famous ones is Shamany Cape on Olkhon Island.

Factors negatively affecting provision of this benefit :
- Habitat change Impact level - Low, Trend - Continuing

No new data and information since the last outlook assessment

► Sacred or symbolic plants or animals

Historically, many local species have been considered as sacred by local people (buryats, evenks and others). These species include the Baikal seal and the brown bear.

No new data and information since the last outlook assessment

► Outdoor recreation and tourism

Baikal provides excellent and exciting possibilities for outdoor recreation and tourism for different types of visitors.

Factors negatively affecting provision of this benefit :
- Pollution Impact level - Moderate, Trend - Increasing
- Overexploitation Impact level - Moderate, Trend - Increasing
- Invasive species Impact level - Moderate
- Habitat change Impact level - High, Trend - Increasing

See above the assessmernt of mass tourism development nearby the property, for example in the two economic zones, and the growing pressure on its values.

► Importance for research, Contribution to education, Collection of genetic material

Due to unique biological and geological features, the property is inspiring and an admired destination of scientists and students around the world.

Many geological features of the Lake and biological peculiarities (rare and endemic species) are similar

with oceanic ecosystems. It is commonly accepted that Baikal lake is a natural laboratory for research and stuides of riftogenesis, general questions of evolution, speciation and other natural processes.

It is also an important flora and fauna endemism area, offering a rich genetic material.

► **Carbon sequestration,**
Water provision (importance for water quantity and quality)

The area around the Lake is very sparsely populated; the giant regions of the Lake's catchment area are covered by wild forests with high capability for carbon sequestration.

The lake itself is the largest fresh water reservoir in the world and its quality of its water is still very much appreciated although deteriorating

Factors negatively affecting provision of this benefit :
- Pollution Impact level - Moderate, Trend - Increasing
- Habitat change Impact level - Low, Trend - Increasing

Deforestation and taiga fires are the most dangerous negative factors affecting the provision of this benefit.

Summary of benefits

Generally, Lake Baikal provides an extremely wide range of rich and partly as yet unutilized benefits which – provided it is managed in a sustainable way – may contribute significantly to the livelihoods, economy, science and spiritual well-being of local inhabitants, the citizens of the Russian Federation and humankind. Lake Baikal harbors an enormous quantity of pure drinking water and an unusual diversity of endemic life forms (Kozhov, 1963; Timoshkin, 2001). Specifically, Baikal contains one fifth of the total amount of unfrozen freshwaters of the globe. Lake Baikal is first among lakes in terms of its exceptional taxonomic diversity; more than 2660 animal and more than 1000 plant species and subspecies have been described, with ca. 60% of the animal species being endemic (Timoshkin, 2010-2011). Therefore, the lake is an ideal natural laboratory for investigating questions regarding evolution and processes of endemic speciation. Many endemic invertebrates (sponges, for instance) should be considered as potential sources for new biologically active substances and medicines (for example - antibiotics).

REFERENCES

№	References
1	AYURZHANAEV ,A. et al. MODELING OF SHORELINE CHANGES AND ASSESSMENT OF THE INFLUENCE OF LAKE BAIKAL WATER LEVEL FLUCTUATIONS ON SETTLEMENTS ALONG THE EASTERN COAST. Pp.54-63 in Journal of Geography and Natural Resources.2022 #5 DOI: 10.15372/GIPR20220506
2	Abramov, A.V. (2016). Mustela altaica. The IUCN Red List of Threatened Species: e.T41653A45213647. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T41653A45213…
3	Activatica (2016). Forest fires in Baikal natural territory. Activatica, 26 April 2016. http://activatica.org/problems/view/id/511/version/622
4	Afanasyeva, E.L., Shimaraev, M.N. (2006). Long-term zooplankton variations in the pelagial of Lake Baikal under global warming. In: Alimov, A.F., Bul'on, V.V. (Eds.), Aquatic ecology at the dawn of the XXI century. KMK Scientific Press Ltd., Moscow, pp. 253–265.
5	Alymbaeva, Z. et al.(2025) Impact of High Water Levels in Lake Baikal on Rare Plant Species in the Coastal Zone. Appl. Sci. 2025, 15, 2131. https://doi.org/10.3390/app15042131
6	Anon (2013). Invasive species in the basin of the lake Baikal, technical report, Baikal basin transboundary diagnostic analysis, UNOPS/UNDP/GEF (https://archive.iwlearn.net/baikal.iwlearn.org/baikal.iwlea…)
7	Anon (2023). Open Letter to the Members of the Interdepartmental Council on Lake Baikal of the Ministry of Natural Resources and Environment of the Russian Federation, the Scientific Council of the Siberian Branch of the Russian Academy of Sciences on the Problems of Lake Baikal and the Public (https://www.baikal-daily.ru/news/16/400687/)
8	Anon, (2022). Scientific Council of the Siberian Branch of the Russian Academy of Sciences on the problems of Lake Baikal in 2022 (new.ras.ru) (https://new.ras.ru/activities/news/nauchnyy-sovet-so-ran-po…)
9	Anoshko et al. (2020) - Restriction on the catch of the Baikal omul Coregonus migratorius (Georgi, 1775) and probable ecological consequences. South of Russia: ecology, development. T.15. No 3. P.132-143. 10.18470/1992-1098-2020-3-132-143
10	Baikal Info (2016). The number of tourists in the Irkutsk region increased by 45%. Baikal Info, 27/09/2016. http://baikal-info.ru/kolichestvo-turistov-v-irkutskoy-obla…
11	Baikal Report (2013). ON THE STATE OF LAKE BAIKAL AND MEASURES FOR ITS PROTECTION IN 2013. https://yadi.sk/i/A42INjmibvKGX
12	Baikal Water (n.d.). Water quality Lake Baikal. http://www.baikal.ru/ru/baikal/faqs/baikal_info_water.html
13	Baturina, M.A. & Kononova, O.N., (2021) - Impact of Wastewater from the Pulp and Paper Industry on Aquatic Zoocenoses: A Review of the Literature. Contemporary Problems of Ecology, Vol. 14, No. 6, pp. 579–587. https://link.springer.com/article/10.1134/S1995425521060044
14	Bazov,A. et al. (2024) A. V. Bazov, N. V. Bazova, and N. L. Frolova. Distance of the Spawning Migration of Baikal Omul Coregonus migratorius (Salmonidae: Coregoninae) in the Selenga River (Lake Baikal Basin). Journal of Ichthyology, 2024, Vol. 64, No. 3, pp. 480–495. Pleiades Publishing, Ltd., 2024.
15	Bazov,A. et al. (2024) A. V. Bazov, N. V. Bazova, and N. L. Frolova. Distance of the Spawning Migration of Baikal Omul Coregonus migratorius (Salmonidae: Coregoninae) in the Selenga River (Lake Baikal Basin). Journal of Ichthyology, 2024, Vol. 64, No. 3, pp. 480–495. Pleiades Publishing, Ltd., 2024.

№	References
16	Belan S.V., Rybalova O.V. (not dated). Analysis of the influence of forest fires on the ecological state of water bodies. Electronic resource. – cyberleninka.ru.article.
17	Bell, P. R. F., Elmetri I., and Lapointe B. E. (2014). Evidence of large-scale chronic eutrophication in the Great Barrier Reef: quantification of chlorophyll “a” thresholds for sustaining coral reef communities // AMBIO. 2014. Vol. 43. pp. 361–376.
18	Bellona (2021). Kolotov, A. et al. Baikal Pulp and Paper Mill - Accumulated Environmental Damage. April 2021. (in Russian) https://bellona.ru/publication/2021-bcbk/
19	Bellona (2021). Kolotov, A. et al. Baikal Pulp and Paper Mill - Accumulated Environmental Damage. Report of Bellona “Ecology and Law” Center. April 2021. (in Russian) https://bellona.ru/publication/2021-bcbk/
20	BirdLife International (2016). Limnodromus semipalmatus. The IUCN Red List of Threatened Species T22693351A93397892. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22693351A93….
21	BirdLife International (2018). Leucogeranus leucogeranus. The IUCN Red List of Threatened Species : T22692053A134180990. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22692053A13….
22	BirdLife International (2019) Aquila heliaca (amended version of 2017 assessment). The IUCN Red List of Threatened Species T22696048A155464885. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22696048A15…
23	BirdLife International (2021). Falco cherrug. The IUCN Red List of Threatened Species T22696495A204182473. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22696495A20…
24	BirdLife International (2023). Anser cygnoid. The IUCN Red List of Threatened Species T22679869A228564177. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T22679869A22…
25	BirdLife International (2023). Otis tarda. The IUCN Red List of Threatened Species.T22691900A226280431. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T22691900A22….
26	Boedeker Ch., Leliaert F., Zuccarello G. (2016). Molecular phylogeny of the CLADOPHORACEAE (CLADOPHORALES, ULVOPHYCEAE), with the resurrection of Acrocladus naegeli and Willeella Boergesen and the description of Lubrica gen. nov. and Preudorhizoclonium gen. nov. // J. Phycol. DOI: 10.1111/jpy.12457
27	Bondarenko N.A., Malnik V.V., Vishnyakov V.S., Rozhkova N.A., Sinyukovich V.N., Gorshkova A.S., Timoshkin O.A., Matveev A.N. (2015). Current ecological condition of Selenga River delta biota (Baikal Lake basin) under the conditions of unstable hydrological regime. 1. Microbial community and algae // Hydrobiological journal, Vol. 51, No 5, pp. 17 – 28.
28	Bondarenko N.A., and al. (2021) - Dolichospermum lemmermannii (Nostocales) bloom in world’s deepest Lake Baikal (East Siberia): abundance, toxicity and factors influencing growth (http://limnolfwbiol.com/index.php/LFWB/article/view/773)
29	Brown, K.P. et al. (2021) - Human impact and ecosystemic health at Lake Baikal. Wires Water, Volume8, Issue 4, July/August 2021, 36 p. (https://wires.onlinelibrary.wiley.com/doi/abs/10.1002/wat2…)
30	Domysheva, V.M. and al, (2020) - Dynamics of nutrients in the water of the pelagic zone of Lake Baikal (https://www.researchgate.net/publication/344791016_Dynamics…)
31	Dye, B.J., Simonov, E., Lafitte, G., Bennett, K., Scarry, D., Lepcha, T., Lepcha, G., Wagh, S., Kemman, A. and Eyler, B. (2019). Heritage Dammed: Water Infrastructure Impacts on World Heritage Sites and Free Flowing Rivers; Rivers without Boundaries, World Heritage Watch: Moscow, Russia, 2019 (p. 132). DOI: 10.13140/RG.2.2.33037.38883.

№	References
32	Eletskaya, E.V.and Tomberg, I.V. (2020) - The concentration of mineral and total phosphorus in the coastal water of southeast coast of Lake Baikal. Limnol. Freshw. Biol. 2020, 4, 896–898.
33	Fanatbaikala (n.d). Medicinal Herbs Baikal. http://fanatbaikala.ru/celebnye-travy-bajjkala/
34	Gomboev, B.O., Tsybikova, A.B., Ul'zetueva, I.D. et al. (2020) - Assessing the Anthropogenically Caused Pollution of Water Bodies Within the Selenga River Basin on the Territory of Mongolia and Russia. Geogr. Nat. Resour. 41, 372–380 (2020). https://doi.org/10.1134/S1875372841040083
35	Gorshkov A.G., Kustova O.V., Dzyuba E.V., Sakharova Yu.M., Shishlyannikov S.M., Khutoryansky V.A. (2017). Polychlorinated Biphenils in water ecosystem of Lake Baikal // Khimiya v interesakh ustoichivogo rasvitiya (Chemistry for the benefit of sustainable development), Vol. 25, pp. 269 – 278.
36	Goryunova O.I. Ancient man and archeological monuments on Baikal coasts. . In: Baikalogy, Chapter 8.1, Rusinek O.T., Takhteev V.V., Gladkochub D.P., Khodzher T.V., Budenev N.M. (Eds.), pp. 880-897.
37	Grachev M.A. (2002). On current condition of ecological system of Lake Baikal. Novosibirsk, SD RAS Publ., 156 p.
38	Gusev O.K. (2016). Phalacrocorax carbo on Baikal // Russian Ornithological Journal, Vol. 25, express issue1274, pp. 1372-1387.
39	Hampton, S.E., Izmest'eva, L. R., Moore, M. V., Katz, S. L., Dennis, B. and Silow, E. A. (2008). `Sixty years of environmental change in the world's largest freshwater lake – Lake Baikal, Siberia`. Global Change Biology 14: 1947-1958.
40	Hunt DM, Fitzgibbon J, Slobodyanyuk SJ, Bowmaker JK, Dulai KS (1997). Molecular evolution of the cottoid fish endemic to Lake Baikal deduced from nuclear DNA evidence. Mol Phylogenet Evol. (1997) Dec;8(3):415-22. doi: 10.1006/mpev.1997.0428. PMID: 9417898.
41	Hutchinson D. R., Golmshtok A. Ya., Zonenshain L. P. et al. (1992). Depositional and tectonic framework of the rift basins of Lake Baikal from multichannel seismic data // Geology, Vol. 20, p. 589-592.
42	IUCN (2012a). 'WHC-12/36.COM/7B.Add: State of Conservation of World Heritage properties inscribed on the World Heritage List'. [Electronic reference] << http://whc.unesco.org/en/sessions/36COM/documents/>>. Accessed 10 July 2012.
43	IUCN (2012a). 'WHC-12/36.COM/7B.Add: State of Conservation of World Heritage properties inscribed on the World Heritage List'. [Electronic reference] >. Accessed 10 July 2012.
44	IUCN (2012b). 'The IUCN Red List of Threatened Species'. [Electronic reference] http://www.iucnredlist.org/. Accessed 10 July 2012.
45	Il'ina, O.V. et al. (2021) - Plastic pollution of the coastal surface water in the middle and southern Baikal. Water Resour 48, 56–64 (https://doi.org/10.1134/S0097807821010188)
46	Institute of System Dynamics (2023) Institute of System Dynamics and Management Theory. Siberian Branch of Russian Academy of Science. Final Report on Study "Impact of changes in the water level in Lake Baikal on the state of the lake ecosystem, determination of damage to economic and infrastructure facilities of the coastal territory of the Republic of Buryatia, Irkutsk region depending on the lake levels and discharges of the Irkutsk HPP". December 2023. http://idstu.irk.ru/ru/content/nacionalnyy-proekt-ekologiya…
47	Interfax (2020). Liquidator of chemical waste dumps in the Volga region will deal with waste of Baikal CBK. Interfax, 23 March 2020. https://www.interfax.ru/russia/700452
48	Irkutsk Media (2017). Rosgeology will deal with waste disposal of Baikal CBK. Irkutsk Media 29 August 2017. http://irkutskmedia.ru/news/617883/

№	References
49	Izhboldina L.A. (2007). Guide and Key to benthonic and periphyton algae of Lake Baikal (meio- and macrophytes) with short notes on their ecology. Novosibirsk, Nauka-Center Publ., 248 p.
50	Izmest'eva, L.R., Moore, M.V., Hampton, S.E., Ferwerda, C.J., Gray, D.K., Woo, K.H., Pislegina, H.F., Krashchuk, L.S., Shimaraeva, S.V., Silow, E.A. (2016). Lake-wide physical and biological trends associated with warming in Lake Baikal. J. Great Lakes Res. 42, 6–17.
51	Kapitalist (2014). Baikal fleet: At the start of commercial navigation. No. 3 (74), by Yaroslav Knyazev. http://www.kapitalpress.ru/kapitalist/archive/2014/74/2112/
52	Karnyshev A.D. (2010). Baikal many-sided (literally – having many faces), mysterious, multilingual. Third edition. (http://irkipedia.ru/content/arheologiya_baykalskoy_prirodno…)
53	Katz, S.L., Hampton, S.E., Izmest'eva, L.R., Moore, M.V. (2011). Influence of long-distance climate teleconnection on seasonality of water temperature in the world's largest lake - Lake Baikal, Siberia. PLoS ONE. URL: https://doi.org/10.1371/journal.pone.0014688
54	Khanaev, I. V., Kravtsova, L. S., Maikova, O. O., Bukshuk, N. A., Sakirko, M. V., Kulakova, N. V., Butina, T.V., Nebesnykh, I.A. & Belikov, S. I. (2018). Current state of the sponge fauna (Porifera: Lubomirskiidae) of Lake Baikal: Sponge disease and the problem of conservation of diversity. Journal of Great Lakes Research, 44(1), pp.77-85.
55	Khodzher T. V. et al. (2022) - Monitoring and assessment of hazardous natural phenomena (forest fires) and anthropogenic sources on the quality of the atmosphere in the Baikal region based on complex remote and ground-based local measurements, and mathematical modelling. Monitoring-and-assessment-of-hazardous-natural-phenomena.pdf (bscnet.ru) (https://www.researchgate.net/publication/363482818_MONITORI…)
56	Khodzher T.V., Domysheva V.M., Sorokovikova L.M., Golobokova L.P. (2016). Methods for monitoring the chemical composition of Lake Baikal water // In: Novel methods for monitoring and managing land and water resources in Siberia, Mueller L., Sheudshen A.K., Eulenstein F. (Eds.). Springer, pp. 113–132.
57	Kolobov R.Y. & Dietsevich Y.B. (2021) - Problems of International Legal Protection of Lake Baikal: Results of the 44th Session of the World Heritage Committee International law. International law. № 3. S. 26-39. DOI: 10.25136/2644-5514.2021.3.36699 URL (https://nbpublish.com/library_read_article.php?id=36699)
58	Komarova V. (2017). Construction of the hydroelectric power stations in Mongolia can become unpredictable factor for Baikal // Vostochno-Sibirskaya Pravda. May 3, 2017. http://www.vsp.ru/2017/05/03/stroitelstvo-ges-v-mnr-mozhet-…
59	Kork, B. (2017). There's nothing to catch! The ban on omul fishing will not affect amateur fishermen. vsp.ru, 4 July 2017. http://www.vsp.ru/2017/07/04/nechego-lovit/
60	Kortenkamp A., (2008). Breast Cancer and Exposure to Hormonally Active Chemicals: An Appraisal of the Scientific Evidence. Chemical Health Monitor Alliance, London.
61	Kozhov M.M. (1964). Lake Baikal and its life. Dr W Junk Publ., the Hague, 344 p.
62	Kozhova O. and Pavlov B. (1995) Ecological consequences of the water level rise in Lake Baikal due to the Irkutsk hydroelectric station (HES) construction. Proceedings of the Ecological Problems International Science Conference dedicated to the memory of Prof.M.Kozhov. Volume II. pp145-149. Science Publishers. Novosibirsk 1995
63	Kremlin (2017). List of instructions following the meeting on the environmental development of the Baikal Natural Territory. The President of the Russian Federation, Kremlin, 14 August 2017. http://kremlin.ru/acts/assignments/orders/55355

№	References
64	Kremlin (2019). Instructions following verification of compliance with law on Lake Baikal’s conservation and environmental rehabilitation. The President of the Russian Federation, Kremlin, 12 September 2019. http://en.kremlin.ru/acts/news/61526
65	Lenta (2016). Baikal Reservation: How residents of Buryatia were restricted in their rights in the fight for the environment. Lenta.Ru 23 March 2016. https://lenta.ru/articles/2016/03/23/baikal/
66	Levi K.G., Zadonina N.V. (2012). Tatural hazards Baikal region. In: Baikalogy, Chapter 9, Rusinek O.T., Takhteev V.V., Gladkochub D.P., Khodzher T.V., Budenev N.M. (Eds.), pp. 1019 – 1070.
67	Li Yu (2017). Human footprint. Abundant Spirogyra alga blooms in coastal zone of Lake Baikal related to anthropogenic activity // Vostochno-Sibirskaya Pravda, No 18; May 9, 2017. http://www.vsp.ru/sp-issue-print/149969/
68	Lyamkin V.F. (2004). Mammals (Mammalia) // Index of Animal Species Inhabiting Lake Baikal and Its Catchment Area. Vol. 1, Book 2, Novosibirsk, Nauka Publ., pp. 1199-1251.
69	Lyubov R. Izmest'eva, L.R. (2016) - Lake-wide physical and biological trends associated with warming in Lake Baikal. Journal of Great Lakes Research. Vol. 42, Issue 1, p. 6-17
70	Mamontova E.A., Tarasova E.N., Mamontov A.A. (2017). PCBs and OCPs in human milk in Eastern Siberia, Russia: Levels, temporal trends and infant exposure assessment // Chemosphere, Vol. 178, pp. 239-248.
71	Marinaite I.I. et al. (2022). Oil Products in Lake Baikal and Its Tributaries. Water Resource 49, 458–466 (https://doi.org/10.1134/S0097807822030101)
72	Masrukho S. (2017). Baikal crisis: the most pure lake became hostage to diplomatic gamesmanship (https://openrussia.org/mobile/notes/706219/)
73	Mats V.D. (2010-2011). Geological factors in the formation of unique biodiversity in Baikal ecosystem // Index of Animal Species Inhabiting Lake Baikal and Its Catchment Area. Vol. 2, Book 2, Novosibirsk, Nauka Publ., pp. 1406-1419.
74	Ministry of Natural Resources and Ecology of Russian Federation (n.d., a). On amending the Russian Government's resolution of February 29, 2000 No. 176 https://regulation.gov.ru/projects#npa=8810
75	Ministry of Natural Resources and Ecology of Russian Federation (n.d., b). On the approval of the list of activities prohibited in the central ecological zone of the Baikal natural territory. https://regulation.gov.ru/projects/List/AdvancedSearch#depa…
76	Moore, M. V., Hampton, S. E., Izmest’eva, L.- R., Silow, E. A., Peshkova, E. V. and Pavlov, B. K. (2009). ‘Climate change and the world’s “Sacred Sea” – Lake Baikal, Siberia’. BioScience 59: 405-417.
77	Moore, M.V. et al. (2021) - Lake-wide assessment of microplastics in the surface waters of Lake Baikal, Siberia. Limnology 23, 265–274 (https://doi.org/10.1007/s10201-021-00677-9)
78	Namsaraev, Z., Melnikova, A., Ivanov, V., Komova, A., & Teslyuk, A. (2018, February). Cyanobacterial bloom in the world largest freshwater lake Baikal. In IOP Conference Series: Earth and Environmental Science (Vol. 121, No. 3, p. 032039). IOP Publishing.
79	Narangarvuu, D. and al (2023) - Mining and urbanization affect river chemical water quality and macroinvertebrate communities in the upper Selenga River Basin, Mongolia. Environ Monit Assess (2023) 195:1500 (https://doi.org/10.1007/s10661-023-12022-x)
80	Nikitina, E.P. et al. (2023) - Phthalates in Bottom Sediments of Lakes on the Eastern Coast of Baikal. Dokl. Earth Sc. 513, 1417–1421 (https://www.researchgate.net/publication/374298547_Phthalat…)
81	Nodelman, V. (2017). The Ministry of Natural Resources has proposed to allow continuous logging near Baikal. IZ, 28 August 2017. https://iz.ru/636384/valeriia-nodelman/minprirody-predlozhi…

№	References
82	Nyambayar, B., Mix, H. & Tsytsulina, K. (2015). Moschus moschiferus. The IUCN Red List of Threatened Species 2015: e.T13897A61977573. https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T13897A61977...
83	Ogawa N., Yoshii K., Melnik N.G., Bondarenko N.A., Timoshkin O.A., Smirnova-Zalumi N.S., Smirnov V.V., Wada E. (2000). Carbon and nitrogen isotope studies of the pelagic ecosystem and environmental fluctuations of Lake Baikal. Lake Baikal. A Mirror in Time and Space for Understanding Global Change Processes. Minoura (ed.), Elsevier Publ., pp. 262-272.
84	Ozersky T., Pastukhov M.V., Poste A.E., Deng X.Y., Moore M.V. (2017). Long-Term and Ontogenetic Patterns of Heavy Metal Contamination in Lake Baikal Seals (Pusa sibirica) // Environ. Sci. Technol., DOI: 10.1021/acs.est.7b00995
85	Ozersky, T., Volkova, E. A., Bondarenko, N. A., Timoshkin, O. A., Malnik, V. V., Domysheva, V. M., & Hampton, S. E. (2018). Nutrient limitation of benthic algae in Lake Baikal, Russia. Freshwater Science, 37(3), pp.472-482.
86	Petley, D. (2019). Baikalsk: a horrifying example of a high risk waste storage facility in Russia. American Geophysical Union [online blog], 30 July 2019. Available at: https://blogs.agu.org/landslideblog/2019/07/30/baikalsk-1/ (Accessed July 2020)
87	Piccolroaz, S., and Toffolon, M. (2018). The fate of Lake Baikal: how climate change may alter deep ventilation in the largest lake on Earth. Climatic change, 150(3-4), pp.181-194
88	Pinardi, M et al. (2023) - Assessing the impact of wildfires on water quality using satellite remote sensing: the Lake Baikal - case study. Front. Remote Sens. 4:1107275. doi: 10.3389/frsen.2023.1107275 (https://www.researchgate.net/publication/369056756_Assessin...)
89	Pomazkina G.V., Rodionova E.V. (2014). Diatoms of Cymbellaceae family from Lake Baikal. Novosibirsk, Nauka Publ., 241 p.
90	Popov V.V. (2004). Birds (Aves) // Index of Animal Species Inhabiting Lake Baikal and Its Catchment Area. Vol. 1, Book 2, Novosibirsk, Nauka Publ., pp. 1062-1198.
91	Popovskaya G.I., Tashlikova N.A. (2008). Phytoplankton. The Selenga River delta as a natural biofilter and indicator of the condition of Lake Baikal. Vol. 15, pp. 88 – 101.
92	Poste, A. E., Pastukhov, M. V., Braaten, H. F. V., Ozersky, T., & Moore, M. (2018). Past and present mercury accumulation in the Lake Baikal seal: Temporal trends, effects of life history, and toxicological implications. Environmental toxicology and chemistry, 37(5), pp.1476-1486.
93	Pronin N.M., Selgebi D., Litvinov A.G., Pronina S.V. Comparative ecology and parasitic fauna of exotic invaders into great lakes of the world: rotan (Perccottus glehni) into the Lake Baikal and the ruffe (Gymnocephalus cernuus) into the Lake Superior]. Sibirskiy ekologicheskiy zhurnal [Siberian Journal of Ecology], 1998, no. 5, pp. 397–406.
94	Relyea R.A. (2009). A cocktail of contaminants: how mixtures of pesticides at low concentrations affect aquatic communities. Oecologia 159, 363–376.
95	Rivers without Boundaries (2024). Rivers without Boundaries International Coalition. Water level regulations for Lake Baikal. 9 September 2024. Submission to the UNESCO World Heritage Center.
96	Rivers without Boundaries (2025). Rivers without Boundaries International Coalition. New Information on Lake Baikal and SoC Critique. 17 March 2025. Submission to the UNESCO World Heritage Center.
97	Romanov M. (2014). Omul – at the bottom of the “demographic pit”? // Mir Baikala, Vol. 1(41), pp. 70-73. (http://www.baikal-center.ru/books/element.php?ID=99561)
98	Rosabal, P. and Debonnet, G. (2005). ‘Mission Report: Reactive Monitoring Mission to Lake Baikal (Russian Federation) 21-31 October 2005’. [Electronic reference] < http://whc.unesco.org/en/list/754/documents/>. Accessed 10 July 2012

№	References
99	Rosabal, P. and Rao, K. (2011). ‘Mission Report: High Level Mission lake Baikal (Russian Federation) 10-15 July 2011’. [Electronic reference] <http://whc.unesco.org/en/list/754/documents/>. Accessed 10 July 2012.
100	Rosprirodnadzor (2020). Rosprirodnadzor wins in legal disputes with GazEnergoStroy-Environmental Technologies LLC. Rosprirodnadzor Press Office, 11 March 2020. https://rpn.gov.ru/news/rosprirodnadzor_vyigral_v_sudebnykh…
101	Rudykh, L. & Shilova, O. 2020. Tourism Investment Development of The Baikal Region: Basic Issues, Challenges And Prospects. The European Proceedings of Social and Behavioural Sciences. DOI: 10.15405/epsbs.2020.12.68 (https://www.europeanproceedings.com/article/10.15405/epsbs…)
102	Ryabtsev V. (2017). Forests around Baikal face the destruction. http://activatica.org/blogs/view/id/3858/title/lesam-baykal…
103	Ryabtsev V.V. (2017). Let’s begin to kill Phalacrocorax carbo on Baikal? (http://irk-pal.ru/nachnem-mochit-baklanov-na-bajkale/)
104	SCANEX (n.d.). Map of fires. http://fires.ru
105	Semenov, M.Y. et al. (2024) - Revealing the Sources of Nutrients in the Surface Waters of the Selenga River Watershed Using Hydrochemical and Geospatial Data. Water 16(5):630. DOI: 10.3390/w16050630 (https://www.researchgate.net/publication/378355159_Revealin…)
106	Servan-Schreiber D. (2014). Anticancer. A new way of life. RIPOL classic, Moscow.
107	Shcherbov B.L. (2011) - Forest fires as a geochemical threat. Journal "Science first hand", p. 120–127. Electronic resource. – cyberleninka.ru.article
108	Shimaraev, M., Sinyukovich, V., Sizova, L., Troitskaya, E., Kuimova, L. (2015). Ice-thermal and water regime of Lake Baikal during 1950–2014. Abstract Book of the 9th Symposium of European Freshwater Sciences. Unimail, Geneva. URL: http://www.freshwatersciences.eu/files/Abstract_book_SEFS9…
109	Shimaraev, M.N., Domysheva, V.M. (2013). Trends in hydrological and hydrochemical processes in Lake Baikal under conditions of modern climate change. In: Goldman, C.R. et al. (Eds.), Climatic Change and Global Warming of Inland Waters. John Wiley and Sons, Ltd., Chichester, pp. 43–66.
110	Shimaraev, M.N., Kuimova, L.N., Sinyukovich, V.N., Tsekhanovskii, V.V. (2002). Manifestation of global climatic changes in Lake Baikal during the 20th century. Dokl. Earth Sci. 383A, 288–291.
111	Shimaraev, M.N., Starygina, L.N. (2010). Zonal air circulation, climate and hydrological processes on Baikal (1968–2007). Geography and Natural Resources 3, 62–68.
112	Shimaraev, M.N., Verbolov, V.I., Granin, N.G., Sherstyankin, P.P. (1994). Physical limnology of Lake Baikal: a review 2. Irkutsk–Okayama, p. 81.
113	Sideleva V.G. (2003). The endemic fishes of Lake Baikal. Backhuys Publ., Leiden, 270 p.
114	Silow, E. A., 2013. The present state of human impact on Lake Baikal // Journal of Siberian Federal University. Biology Vol. 4 (6), pp. 388 – 404.
115	Silow, E.A., Krashchuk, L.S., Onuchin, K.A., Pislegina, H.V., Rusanovskaya, O.O., Shimaraeva, S.V. (2016). Some recent trends regarding Lake Baikal phytoplankton and zooplankton. Lakes Reservoirs Res. Manage. 21, 40–44.
116	Simonov and Kreyndlin (2020). Why the Lake Baikal May Be Inscribed on the Danger List in 2021? Report to UNESCO compiled by Rivers without Boundaries International Coalition (RwB) and Greenpeace Russia. 10.13140/RG.2.2.16607.61603. https://www.researchgate.net/publication/340444005

№	References
117	Simonov, E. et al (2022). Simonov, E., Kreyndlin, M., Ivanov, A., Panteleeva, I., 2022. Lake Baikal in Crisis. In: DellaSala, D.A., Goldstein, M.I. (Eds.), Imperiled: The Encyclopedia of Conservation, vol. 2. Elsevier, pp. 389–408. https://dx.doi.org/10.1016/B978-0-12-821139-7.00055-6.
118	Simonov. E. (2022) Eugene Simonov, Rivers without Boundaries International Coalition. Damage From Water Level Manipulation Severely Affects Lake Baikal, pp 56-59 in World Heritage Watch Report 2022. Berlin 2022, ISBN 978-3-00-073805-0. https://world-heritage-watch.org/content/wp-content/uploads...
119	Simonov. E. (2023) Eugene Simonov, Rivers without Boundaries International Coalition. Lake Baikal as a Casualty of War. p191 in World Heritage Watch: World Heritage Watch Report 2023. Berlin 2023
120	Simonov. E. (2024) Eugene Simonov, Chronic Mismanagement and Weakened Protection of Lake Baikal Rivers without Boundaries. pp.200-202 in World Heritage Watch: World Heritage Watch Report 2024. Berlin 2024.228 pages Published by World Heritage Watch e.V. ISBN 978-3-00-079183-3
121	Sizova, L.N., Kuimova, L.N., Shimaraev, M.N. (2013). Air circulation influence on ice-thermal processes in Baikal in 1950–2010. Geography and Natural Resources 2, 74–83.
122	State Party of Russia (2014). Report of the State Party to the World Heritage Committee on the state of conservation of Lake Baikal (Russian Federation). [online] Russian Federation, pp.1-8. Available at: <https://whc.unesco.org/document/127565> [Accessed August 2020].
123	State Party of Russia (2016). Report of the State Party to the World Heritage Committee on the state of conservation of Lake Baikal (Russian Federation). [online] Russian Federation, pp.1-8. Available at: <https://whc.unesco.org/document/156136> [Accessed August 2020].
124	State Party of Russia (2017). Report of the State Party to the World Heritage Committee on the state of conservation of Lake Baikal (Russian Federation). [online] Russian Federation, pp.1-9. Available at: <https://whc.unesco.org/document/165638> [Accessed August 2020].
125	State Party of Russia (2018). Report of the State Party to the World Heritage Committee on the state of conservation of Lake Baikal (Russian Federation). [online] Russian Federation, pp.1-20. Available at: <https://whc.unesco.org/document/180703> [Accessed August 2020].
126	State Party of the Russian Federation (2021). State of conservation report by the State Party in 2021: Lake Baikal, Russian Federation. [online] Available at: https://whc.unesco.org/document/191672 [Accessed 10 March 2025]
127	State Party of the Russian Federation (2023). State of conservation report by the State Party: Lake Baikal, Russian Federation. [online] Available at: https://whc.unesco.org/document/198559 [Accessed 10 March 2025]
128	State Party of the Russian Federation (2024). State of conservation report by the State Party: Lake Baikal, Russian Federation. [online] Available at: https://whc.unesco.org/document/205395 [Accessed 10 March 2025]
129	State Party of the Russian Federation (2024b). Periodic Reporting Cycle 3, Section II: Lake Baikal, Russian Federation. [online] Available at: https://whc.unesco.org/document/217215 [Accessed 10 March 2025]
130	Stepanenko V.N. (2014-2016). Phalacrocorax carbo on Baikal // Official site of Zapovednoe Pribaikalye Natural Reserve (http://baikal-1.ru/nature/fauna/aves/aves-150605-phalacroco...)
131	Strategy (2001) Ministry of Natural Resources of Russia, GEF project "Biodiversity conservation in Russia" (TF028315), Lake Baikal Ecosystem Biodiversity Conservation Strategy. 48 pages. "POO Oikumena" Publishers. Approved by Ministry of Natural Resources on June 6, 2001; Approved by the governments of three provinces 01.11.2000; (in Russian: Стратегия сохранения биоразнообразия экосистемы озера Байкал. https://zakon-region2.ru/4/168171/ Accesed on September 20, 2020).

№	References
132	Sukhgerel, D. &Simonov, E. (2021) E.Simonov and D.Sukhgerel. Consequences of Lake Baikal water level regulation and other water management issues in 2021. Report from the Rivers without Boundaries to the UNESCO World Heritage Centre. December 2021 DOI: 10.13140/RG.2.2.24296.60160
133	The Siberian Times (2019). Pure waters of Lake Baikal in danger from 6.5 million tons of toxic waste. The Siberian Times [online], 5 August 2019. Available at: https://siberiantimes.com/ecology/casestudy/features/pure-w… (Accessed July 2020)
134	The United Nations World Water Development Report, 2015. Water for a Sustainable World. UNESCO, Paris (URL:http://unesdoc.unesco.org/images/0023/002318/231823E.pdf).
135	Timoshkin D.O. (2014). http://baikal-info.ru/sel-mozhet-razrushit-hranilishcha-yad…
136	Timoshkin O. A., Bondarenko N. A., Volkova Ye. A., Tomberg I. V., Vishnyakov V. S., Malnik V. V. (2014). Mass Development of Green Filamentous Algae of the Genera Spirogyra and Stigeoclonium (Chlorophyta) in the Littoral Zone of the Southern Part of Lake Baikal // Hydrobiological Journal. Vol. 50 (№ 5). – p. 15–26.
137	Timoshkin O. A., Sakirko M.V., Annenkov V.V., Chebykin E., Nepokrytykh A.V., Zaytseva E.P., Sheveleva N.G., Malnik V.V., Luhnev A.G., Ivanov E.A., Korotkoruchko V.A. Baikal: Coastal zone ecology. Limnological Institute reports on emergency in Severobaikalsk vicinities (2014a). Arguments of the week (Argumenty nedeli), East Siberia, No 9 (401).
138	Timoshkin O.A. (1997). Biodiversity of Baikal fauna: state-of-the-art // New Scope on Boreal Ecosystems in East Siberia: Proc. of the Intern. Workshop, Kyoto, Jap; 23-25 nov.1994 (DIWPA Ser.). Wada E. et al. eds. Novosibirsk: Russ. Akad. of Sci. Siberian Branch; 1997; Vol. 2, pp. 35-76.
139	Timoshkin O.A. (2001). Lake Baikal: Diversity of Fauna, Problems of its immiscibility and origin, ecology and “exotic” communities // Index of Animal Species Inhabiting Lake Baikal and Its Catchment Area. Vol. 1, Book 1, Novosibirsk, Nauka Publ., pp. 16-73.
140	Timoshkin O.A. (2010-2011). Main tendencies in research of ancient lakes biodiversity; most interesting recent discoveries in biodiversity of Lake Baikal // Index of Animal Species Inhabiting Lake Baikal and Its Catchment Area. Vol. 2, Book 2, Novosibirsk, Nauka Publ., pp. 1423-1428.
141	Timoshkin O.A. (2016). Ecological crisis in coastal zone of lake Baikal (East Siberia): short description and reasoning // Third International Symposium of Benthological Society of Asia. Dalnauka Publ., Vladivostok, Russian Federation, August 24-27, 2016; pp. 157–160.
142	Timoshkin O.A., Samsonov D.P., Yamamuro M., Moore M.V., Belykh O.I., Malnik V.V., Sakirko M.V., Shirokaya A.A., Bondarenko N.A., Domysheva V.M., Fedorova G.A., Kochetkov A.I., Kuzmin A.V., Luhnev A.G., Medvezhonkova O.V., Nepokrytykh A.V., Pasynkova E.M., Poberezhnaya A.E., Potapskaya N.V., Rozhkova N.A., Sheveleva N.G., Tikhonova I.V., Timoshkina E.M., Tomberg I.V., Volkova E.A., Zaytseva E.P., Zvereva Yu.M., Kupchinskiy A.B., Bukshuk N.A. (2016) / RAPID ECOLOGICAL CHANGE IN THE COASTAL ZONE OF LAKE BAIKAL (EAST SIBERIA): IS THE SITE OF THE WORLD’S GREATEST FRESHWATER BIODIVERSITY IN DANGER? /Journal of Great Lakes Research 42, pp. 487-497.
143	Timoshkin, O. A., Moore, M. V., Kulikova, N. N., Tomberg, I. V., Malnik, V. V., Shimaraev, M. N., Troitskaya, E.S., Shirokaya, A.A., Sinyukovich, V.N., Zaitseva, E.P., Domysheva, V.M., Yamamuro, M., Poberezhnaya, A.E. & Domysheva, V. M. (2018). Groundwater contamination by sewage causes benthic algal outbreaks in the littoral zone of Lake Baikal (East Siberia). Journal of Great Lakes Research, 44(2), 230-244.
144	Timoshkin, O.A., Bondarenko, N.A., Kulikova, N.N., Lukhnev, A.G., Maximova, N.V., Malnik, V.V., Moore, M.V., Nepokrytykh, A.V., Obolkina, L.A., Rozhkova, N.A. and Shirokaya, A.A. (2019). Protection of Lake Baikal requires more stringent, not more lenient, environmental regulation. Journal of Great Lakes Research, 45(3), pp.401-402.

№	References
145	Timoshkin, O.A., Malnik, V.V., Sakirko, M.V., Boedeker Ch. (2015). Ecological crisis on Lake Baikal: Diagnosed by scientists // Science First Hand. – No 2 (41). – P. 25–41.
146	Tourism Agency of Irkutsk Region. (2017). Tourist flow statistics. http://irkobl.ru/sites/tour/topical/page.php
147	Troitskaya, E.S., Shimaraev, M.N., Tsekhanovskiy, V.V. (2003). Many year changes of surface water temperature in Baikal. Geography and Natural Resources 2, 47–50.
148	UFE 2024 .Mongolia's 14 mega project, 2024-2028. 2024-12-12 https://ufeckmd.org/ko-mong-news/?mod=document&uid=82. Or Nomin, J. (2024) What does the joint government plan to do in the next 4 years? 2024-08-13 https://www.graph.mn/news/863
149	UNEP-WCMC (2011). Lake Baikal, Russian Federation. UNEP-WCMC World Heritage Information Sheets. [Electronic reference] <http://www.unep-wcmc.org/medialibrary/2011/06/10/1bb7740b/L...; accessed 20 June 2012.
150	UNESCO (2016). Report on the State of Conservation of Lake Baikal, Russian Federation. State of Conservation Information System of the World Heritage Centre. [online] Paris, France: UNESCO World Heritage Centre, pp.2. Available at: <https://whc.unesco.org/en/soc/3473> [Accessed August 2020].
151	UNESCO (2017). Report on the State of Conservation of Lake Baikal, Russian Federation. State of Conservation Information System of the World Heritage Centre. [online] Paris, France: UNESCO World Heritage Centre, pp.2. Available at: <https://whc.unesco.org/en/soc/3618> [Accessed August 2020].
152	UNESCO (2018). Report on the State of Conservation of Lake Baikal, Russian Federation. State of Conservation Information System of the World Heritage Centre. [online] Paris, France: UNESCO World Heritage Centre, pp.2. Available at: < https://whc.unesco.org/en/soc/3756> [Accessed August 2020].
153	UNESCO/IUCN (2024). Report of the World Heritage Centre/IUCN Monitoring Mission to Lake Baikal (Russian Federation), 12-16 December 2023 (file:///C:/Users/herve/Downloads/Russian%20Fed.-Lake%20Baikal-RM%20mission%20WHC-IUCN-16DEC23-4.pdf)
154	Valerii V. Malnik et al. (2021) - Lacustrine, wastewater, interstitial and fluvial water quality in the Southern Lake Baikal Region 2021. Journal of Water and Health Vol 00 No 0, 1 doi: 10.2166/wh.2021.064 (https://iwaponline.com/jwh/article/20/1/23/85838/Lacustrine...)
155	Vedomosti (2017). Putin instructed to eliminate the consequences of the activities of the Baikal CBK. Vedomosti, 17 August 2017. https://m.vedomosti.ru/business/news/2017/08/17/729950-puti...
156	Vladimirovich, N.S. (2018). The National Audit Agency notes the risks of failure to achieve the expected results of the FTP "Protection of Lake Baikal". The National Audit Agency, [Press release in Russian], 29 November 2018. Available at: https://ach.gov.ru/news/schetnaya-palata-otmechaet-riski-ne... (Accessed: August 2020)
157	WHC-UNESCO (2021). Lake Baikal, Russian Federation, State of conservation report in 2021 (https://whc.unesco.org/en/soc/4156)
158	WHC-UNESCO (2021). Lake Baikal, Russian Federation, State of conservation report in 2021 (https://whc.unesco.org/en/soc/4156)
159	WHC-UNESCO (2024). Lake Baikal, Russian Federation, State of conservation report in 2024 (https://whc.unesco.org/en/soc/4630)
160	WHC-UNESCO(2023). Lake Baikal, Russian Federation, State of conservation report in 2023 (https://whc.unesco.org/en/soc/4340)

№	References
161	Williams, D. (2019). Pure Waters of Lake Baikal in Danger From 6.5 million Tons of Toxic Waste. Outdoor Revival [online news], 6 September 2019. Available at: https://www.outdoorrevival.com/news/lake-baikal.html (Accessed July 2020)
162	World Heritage Committee (2014). 38 COM 7B.76. Lake Baikal (Russian Federation). In: Report of decisions of the 38th session of the World Heritage Committee (Doha, 2014). [online] Paris, France: UNESCO World Heritage Centre. Available at: < https://whc.unesco.org/en/decisions/6062> [Accessed August 2020].
163	World Heritage Committee (2015). 39 COM 7B.22. Lake Baikal (Russian Federation). In: Report of decisions of the 39th session of the World Heritage Committee (Bonn, 2015). [online] Paris, France: UNESCO World Heritage Centre. Available at: <https://whc.unesco.org/en/decisions/6279> [Accessed August 2020].
164	World Heritage Committee (2016). 40 COM 7B.97. Lake Baikal (Russian Federation). In: Report of decisions of the 40th session of the World Heritage Committee (Istanbul, 2016). [online] Paris, France: UNESCO World Heritage Centre. Available at: <https://whc.unesco.org/en/decisions/6760> [Accessed August 2020].
165	World Heritage Committee (2017). 41 COM 7B.6. Lake Baikal (Russian Federation). In: Report of decisions of the 41st session of the World Heritage Committee (Krakow, 2017). [online] Paris, France: UNESCO World Heritage Centre. Available at: <https://whc.unesco.org/en/decisions/7006> [Accessed August 2020].
166	World Heritage Committee (2018). Decision : 42 COM 7B.76. Lake Baikal (Russian Federation). In: Report of decisions of the 42nd session of the World Heritage Committee (Manama, 2018). [online] Paris, France: UNESCO World Heritage Centre. Available at: < https://whc.unesco.org/en/decisions/7305> [Accessed August 2020].
167	World Heritage Committee (2021). Decision 44 COM 7B.107 Lake Baikal (Russian Federation) (N 754) (https://whc.unesco.org/en/decisions/7823/)
168	World Heritage Committee (2023). Decision 45 COM 7B.24 Lake Baikal (Russian Federation) (N 754) (https://whc.unesco.org/en/decisions/8298)
169	World Heritage Committee (2024). Decision 46 COM 7B.52, Lake Baikal (Russian Federation) (N 754) (https://whc.unesco.org/en/decisions/8578)
170	Zhelnina, D. (2019). 6 mln tons of toxic wastes on bank of Lake Baikal: closed Baikal pulp and paper mill threatens lake. Foundation MERIDIAN Dobra [online article], 10.01.2019. Available at: https://meridiandobra.ru/en/6-mln-tons-of-toxic-wastes-on-b… (Accessed July 2020).
171	Zvereva et al. (2022) - Industrial site of out-of-operation Baikalsk Pulp and Paper Mill as a potential source of pollution in Lake Baikal coastal zone. Limnology and Freshwater Biology 5(5):1630-1638. DOI:10.31951/2658-3518-2022-A-5-1630 (https://www.researchgate.net/publication/365360806_Industri…)